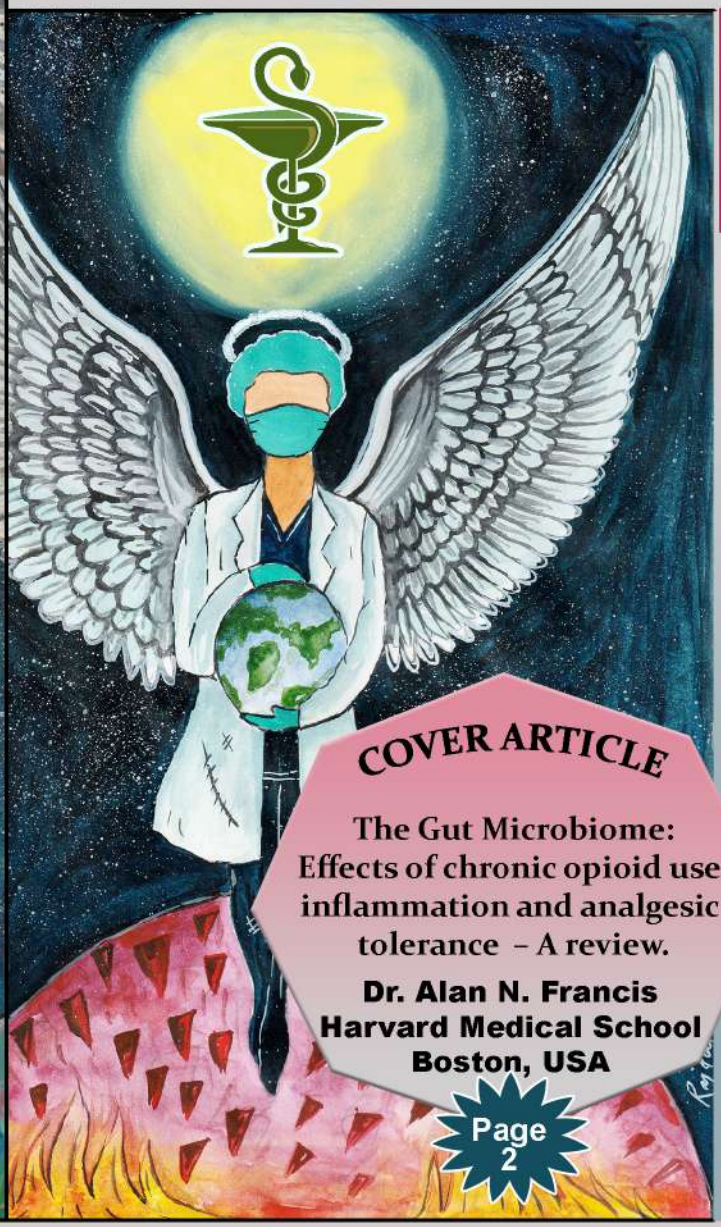
Rxplore
The Newsletter

Volume 2 | Issue 1

January 2021

An Official Biannual Publication of the Central Drug Research Centre, NETES Institute of Pharmaceutical Science, NEMCARE Group of Institutions, Mirza, Assam



COVER ARTICLE

The Gut Microbiome: Effects of chronic opioid use, inflammation and analgesic tolerance – A review.

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ARTICLES IN FOCUS

EDITORIAL MESSAGE

With the successful release of the first issue of Rxplore-The Newsletter, we are extremely delighted to see the release of the second issue dedicated to current scenario of COVID-19. We have no grain of doubt to mention that this issue is also going to add another feather to the achievement of NIPS Mirza. With a boosted amount of confidence, we can say that the publication of this newsletter at regular intervals will benefit the entire fraternity of healthcare workers and students. Therefore, we want to congratulate all the individuals involved in the development of Rxplore-The Newsletter. We also want to thank all the authors who have contributed their remarkable articles and shared their knowledge and expertise with us enabling us to fit this newsletter into the frame of reality. We would also like to thank all the readers of the newsletter for their readership, support and appreciations. Along with the experts in the field of healthcare; we have also managed to reach out to the commoners through this newsletter and hope it unifies the students, scholars and healthcare professionals hailing from diverse backgrounds.

Regards
Editorial Team
Rxplore-The Newsletter

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To submit your articles for the upcoming issue

(Volume 2, Issue 2); you may e-mail your articles, short reviews or commentary to the Editor-in-Chief at

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The Gut Microbiome: Effects of Chronic Opioid Use, Inflammation and Analgesic Tolerance – A Review

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Abstract
Addiction to opioids has become a deadly epidemic that has reached global significance (Severino et. al., 2018). One of the potentially severe side effects viz opioid-induced gut dysbiosis and neuroinflammation could exacerbate the psychological withdrawal symptoms of opioid addiction, compounding the profound negative reinforcement that underlies the high relapse rate (O'Sullivan et. al., 2019). A review of the literature revealed that both chronic and intermittent opioid use cause proinflammatory shifts in the gut microbiota, which lead to increased blood-brain barrier permeability, neuroinflammation, and analgesic tolerance (Table 1). Opioid-induced inflammation and analgesic tolerance were reversed through modulation of the gut microbiome, and administration of the opioid antagonist naltrexone (Meng et. al., 2015; Wang et. al., 2018). Opioid withdrawal symptoms such as anxiety were improved through anti-inflammatory treatments and dietary supplements (Cooper et. al., 2016; Hakimian et. al., 2019). Future treatments may involve a microbiome-centered approach in the way health practitioners treat opioid addiction.

Introduction

The extant opioid epidemic

Pain management is a very important component of medical care and is critical for increasing quality of life (Severino et. al., 2018). In 2001 self-reported pain was classified as the fifth vital sign by The Joint Commission (Wiss et. al. 2019). Prescription opioid analgesics for pain management are highly effective in treating both chronic and acute pain (Wiss et. al., 2019). Opioids act as agonists at the endogenous G protein-coupled opioid receptors μ, κ, and δ, and work to reduce neuronal firing, inhibit the release of pain neurotransmitters, and create a general sense of well-being (Cussotto et. al., 2019; Wiss et. al., 2019).

One of the first prescription opioids available in the United States was OxyContin, which was aggressively marketed as being non-addictive (Severino et. al., 2018). Based on its purported safety, many clinicians began prescribing OxyContin, and other prescription opioids, frequently to their patients for pain management (Severino et. al., 2018). This led to increased use and diversion of these prescriptions for recreational use (Severino et. al., 2018).

The appeal of opioids stems from their ability to relieve not only physical pain, but also unresolved emotional pain by inducing a state of euphoria (Wiss et. al., 2019). Emotional pain has its source in several psychosocial factors and adversity: traumatic childhood experiences, underlying mental illnesses, stress, and PTSD which can lead to self-medicating behaviors (Wiss et. al., 2019).

Addiction to opioids has increased dramatically in recent years and has become a deadly epidemic of global proportions (Severino et. al., 2018). In the United States alone, 128 people die every day from opioid overdose, with an estimated economic cost of 78.5 billion dollars each year (National Institute on Drug Abuse, 2020). The number of people currently addicted to opioids in the United States is three times greater than the current treatment capacity (Wiss et. al., 2019). Drug-seeking in opioid addiction is largely due to the severe dysphoria associated with withdrawal, with a relapse rate of over 90% (Hakimian et. al., 2019; O'Sullivan et. al., 2019).

The abuse of opioids has led to a rise in a variety of gastrointestinal side effects, termed opioid-induced bowel dysfunction (Thapa et. al., 2019; Wang et. al., 2018). Opioid induced bowel

dysfunction is notoriously difficult to manage, and is characterized by persistent constipation, nausea, vomiting, bloating and abdominal pain (Akbarali et. al., 2017; Thapa et. al., 2019; Wang et. al., 2018). The rise of these gastrointestinal symptoms in the context of the opioid epidemic indicate that the gut microbiome may play an important role in opioid addiction (Wiss et. al., 2019).

Gut Microbiome

The human gut contains trillions of microorganisms, including diverse species of bacteria, which work together in an internal ecosystem called the gut microbiome (Luczynski et. al., 2017). A healthy gut microbiome assists the host in extracting nutrients from food, modulating immunological responses, and mood regulation (Cussotto et. al., 2019; O'Sullivan et. al., 2019). Illness, antibiotic treatment, dietary changes, and drug use can all cause shifts in the gut microbiome diversity and function, a condition called gut dysbiosis (Cussotto et. al., 2019; O'Sullivan et. al., 2019).

Opioid receptors are highly expressed within enteric neurons in the gut and digestive tract (Akbarali et. al., 2017; Lee et. al., 2018). During opioid use, activation of μ-opioid receptors inhibits pathways in the nervous system that reduce gastric motility, causing constipation (Wiss et. al., 2019). This stagnancy negatively impacts the population dynamics in the gut through the accumulation of toxins, increased growth of harmful bacteria, and increased inflammation (Lee et. al., 2018; Wiss et. al., 2019). During withdrawal, gut motility increases, causing symptoms of diarrhea (Lee et. al., 2018).

Recent studies have proposed that the gut and the brain communicate with each other through vagus nerve circuits that connect the gut to the nucleus tractus solitarius, conveying the status of the gut to the limbic system in the brain (O'Sullivan et. al., 2019). Changes in the gut microbiota composition are linked to the development and exacerbation of psychological disorders, including depression and anxiety (Lee et. al., 2018). Opioid-induced changes in the gut microbiota may work to compound the negative emotions experienced during withdrawal, contributing to the high rate of relapse (O'Sullivan et. al., 2019). This review will explore the role of bacterial population dynamics in the gut in opioid-induced inflammation, analgesic tolerance, and withdrawal, with hope to shed light on possible safe, effective, and targeted therapies for opioid addicts (Ren et. al., 2020).

Methods

Article search relating to the gut microbiome and opioid addiction was performed using Pubmed.gov and the Harvard University Library search engine HOLLIS. Initial search terms included "opioids and the gut microbiome", "opioid addiction and gut dysbiosis", "opioid addiction and probiotics", and "healthy gut microbiome", which yielded 1,681 results. From this the publication numbers were narrowed down by selecting peer-reviewed articles published in English where the full text was available to view. Publications were further excluded based on comorbidities, and a publication date earlier than 2015.

A subset of publications was selected that specifically addressed the gut microbiota population dynamics during opioid exposure at the genus and species level. After careful consideration of the common themes, findings were classified into four broad categories: background, opioids and gut dysbiosis, inflammation and analgesic tolerance during opioid use, and anti-inflammatory treatments. The final core sample size consisted of 21 publications.

Results and Trends

Chronic opioid use affects the gut microbiome creating a neuroinflammatory phenotype in mice

A study by Meng et. al., 2015 evaluated fecal bacterial populations from mice that were chronically exposed to morphine or methadone. In this study, they discovered that both morphine and methadone promote the growth and dissemination of pathogenic bacteria such as Staphylococcus and Enterococcus species (Meng et. al., 2015; Table 1). These bacteria activate inflammatory pathways in the gut leading to increased upregulation of the proinflammatory cytokine IL-17A (Meng et. al., 2015). IL-17A broadly compromises tight junction connections between endothelial cells, promoting blood-brain barrier disruption and increased systemic and neuroinflammation (Meng et. al., 2015). Interestingly, alterations in gut bacterial populations were reversed after the administration of the opioid antagonist naltrexone, implicating that the bacterial population shifts were opioid-induced (Meng et. al., 2015).

In support of these findings, Banerjee et. al., 2016 also observed that chronic exposure to

morphine induces the net expansion of inflammatory Staphylococcus and Enterococcus species (Banerjee et. al., 2016). They observed a decrease in the Firmicutes to Bacteroides ratio, skewing the gut microbiome toward an inflammatory phenotype (Banerjee et. al., 2016). Chronic exposure to morphine has been shown to compromise the mucosal barrier in the gut, compounding the neuroinflammatory aspects of opioid use (Banerjee et. al., 2016). Interestingly, bacterial dysbiosis was ameliorated when the mice were given fecal transplants from morphine-naïve mice (Banerjee et. al., 2016).

To further investigate the effect of opioid use on the gut microbiota, O'Sullivan et. al., 2019 exposed mice to morphine over a six-day period. Fecal analysis revealed a 4-fold increase in the abundance of bacteria in the genus Bacteroides following morphine exposure (O'Sullivan et. al., 2019). In addition, there were significant decreases of bacteria in the Clostridium, Bifidobacterium, Faecalibacterium, and Butyricoccus genera, members of the firmicutes phylum that have been implicated in a healthy gut microbiome (O'Sullivan et. al., 2019; Rinninella et. al., 2019). The authors were able to bolster the findings of Banerjee et. al., 2016, showing that opioid withdrawal also decreases the Firmicutes to Bacteroides ratio in the gut, an established biomarker of gut dysbiosis (O'Sullivan et. al., 2019). During opioid withdrawal, cytokine analysis showed significant upregulation of the proinflammatory cytokine tumor necrosis factor (TNF) in neurons, microglia, and astrocytes, implicating broad neuroinflammation in support of the findings of Meng et. al., 2015.

The gut microbiome plays a key role in opioid analgesic tolerance

It is well established that prolonged exposure to opioids results in tolerance to their pain-relieving properties (Wiss et. al., 2019; Zhang et. al., 2019). Many lines of evidence have shown that the gut microbiota play a key role in the sensory processing of visceral pain through the gut-brain-axis, though the exact mechanism remains unknown (Luczynski et. al., 2017). In mice, disruption of the gut microbiome can have lasting effects on pain processing, which are ameliorated by the administration of probiotics (Luczynski et. al., 2017). In context, a dysfunctional gut microbiome may be linked to the development of opioid tolerance due to disruptions in pain processing (Luczynski et. al., 2017).

In a study by Zhang et. al., 2019, both conventional and germ-free mice were subjected to an opioid tolerance regimen where they were treated with escalating doses of morphine over an eight-day period (Zhang et. al., 2019). The mice were then assessed for analgesic tolerance in both hot plate and tail flick tests (Zhang et. al., 2019). Germ free mice were used in this study because they lack a gut microbiome (Zhang et. al., 2019). Strikingly, germ free mice that received morphine displayed less analgesic tolerance in both tail flick and hot plate tests than the conventional mice (Zhang et. al., 2019). They then gave the conventional mice a panel of antibiotics to eliminate their gut microbiota (Zhang et. al., 2019). Morphine analgesic tolerance also decreased in the antibiotic-treated mice (Zhang et. al., 2019).

In addition, germ-free mice given fecal microbiota from morphine-naïve mice regained analgesic tolerance (Zhang et. al., 2019). After analyzing the composition of the fecal microbiota, the researchers found that this tolerance was associated with the depletion of Bifidobacterium and Lactobacillus species (Zhang et. al., 2019). Probiotics containing these bacterial communities decreased analgesic tolerance in morphine-treated mice, highlighting the importance of the gut microbiota in opioid analgesic tolerance (Zhang et. al, 2019). Similarly, in a study by Khang et. al., 2017, mice were chronically exposed to morphine over a 10-day period while simultaneously receiving a panel of antibiotics to eliminate their gut microbiota. Antibiotic treatment prevented the development of analgesic tolerance to chronic morphine exposure in both the tail immersion and acetic acid stretch assays (Khang et. al., 2017).

Wang et. al., 2018, chronically administered morphine to mice over a 6-day period through subcutaneous implants, and relative abundances of bacterial populations were analyzed from fecal samples. Abundances of pathogenic Enterococcus species increased significantly after only one day of morphine exposure (Wang et. al., 2018; Table 1). Wang et. al., 2018 were able to distinguish microbiome differences at the species level that translated to phenotypes in analgesic tolerance. Morphine-exposed mice with high levels of Enterococcus faecalis showed increased analgesic tolerance compared to mice with lower levels of Enterococcus faecalis in a tail flick test (Wang et. al., 2018). In context, E. faecalis could be used as a specific biomarker for morphine-induced changes in

the gut that could be linked to analgesic tolerance (Wang et. al., 2018).

Based on these results, scientists posit that morphine induces changes in the gut microbiome that lead to local gut inflammation (Zhang et. al., 2019). This inflammation leads to the induction of a cocktail of proinflammatory cytokines which irritate the gut even more, leading to increased gut and blood-brain barrier permeability, more inflammation, and sustained morphine tolerance (Zhang et. al., 2019). It has been proposed that opioid-induced dysbiosis contributes to analgesic tolerance due to decreased hepatic recirculation of morphine in the body, resulting in lower bioavailability of morphine over time (Wang et. al., 2018).

Opioid-induced gut dysbiosis causes dysfunction in reward seeking behavior in mice

Studies have shown that opioid use contributes to the development of impaired reward processing, which is driven by inflammation and hypodopaminergia (Lee et. al., 2018). To explore this in the context of the gut microbiome, Lee et. al., 2018 exposed mice to multiple opioid withdrawals after intermittent exposure to morphine (Lee et. al., 2018). Withdrawal significantly decreased populations of Lactobacillus and increased populations of Ruminococcus (Lee et. al., 2018). Ruminococcus species are known to produce an inflammatory polysaccharide that is associated with Crohn's disease (Henke et. al., 2019). These findings are in support of a gut dysbiosis-driven model of inflammation, which occurs both during chronic use and during withdrawal (Lee et. al., 2018, Table 1).

Morphine-naïve mice were then transplanted with microbiota from morphine-exposed mice (Lee et. al., 2018). Results from the conditioned place preference test (CPP) showed impaired reward behavior in mice transplanted with microbiota from morphine-exposed mice (Lee et. al., 2018). In contrast, morphine-exposed mice that were treated with antibiotics and then transplanted with microbiota from morphine-naïve mice had restored normal reward behavior by CPP (Lee et. al., 2018). This suggests that a proinflammatory shift in gut microbiota following morphine exposure is detrimental to normal reward processing (Lee et. al., 2018). Multiple exposures and withdrawals from opioids could potentiate the inflammatory cycle and impair reward-seeking behavior, contributing to the negative consequences of opioid abuse (Lee et. al., 2018).

Gut microbiome restoration prevents opioid relapse

The evidence presented above suggests that reducing inflammation in individuals with opioid addiction could lead to better clinical outcomes (Cooper et. al., 2016). A study by Haikimian et. al., 2019 suggests that dietary interventions, such as omega-3 polyunsaturated fatty acids could reduce inflammation, opioid-seeking behaviors, and anxiety during withdrawal (Hakimian et. al., 2019). In this mouse model of opioid use, mice were directed to self-administer remifentanil over a 3-day period and were then maintained on oxycodone for 10 days (Hakimian et. al., 2019). This schedule was followed by 5 days of extinction in which withdrawal was induced (Hakimian et. al., 2019). After extinction, oxycodone use was reinstated using the same cues and environment as before (Hakimian et. al., 2019). In this self-directed intake model of opioid abuse, the researchers found that mice supplemented with omega-3 polyunsaturated fatty acids showed decreased opioid-seeking behaviors, and reduced anxiety symptoms as shown by light-dark assay (Hakimian et. al., 2019). Microbiome characterization revealed that supplementation with omega-3 polyunsaturated fatty acids decreased levels of pathogenic bacteria (e.g. *Akkermansia* and *Bacteroides* species), and increased levels of beneficial bacteria such as Lactobacillus and Bifidobacterium (Hakimian et. al., 2019; Rinninella et. al., 2019; Table 1).

To further investigate the inflammatory component of opioid tolerance and withdrawal, Hakimian et. al., 2019 evaluated the basal activation state of microglia in the striatum. The authors found that omega-3 polyunsaturated fatty acid supplementation reduced the basal activation state of microglia, indicating a reduction in inflammation (Hakimian et. al., 2019). These data suggest that omega-3 polyunsaturated fatty acid supplementation could be used as a potential treatment to decrease inflammation and alleviate anxiety symptoms during withdrawal (Hakimian et. al., 2019).

Therapeutic Interventions for Opioid Addiction and Withdrawal

In humans, there is clinical evidence suggesting that reducing inflammation through administration of the glial activation inhibitor ibudilast improves withdrawal symptoms in heroin-dependent subjects (Cooper et. al., 2016). Individuals who received ibudilast had significantly decreased Subjective Opioid Withdrawal Scale (SOWS) ratings compared to placebo recipients (Cooper et. al.,

2016). Though the clinical findings of Cooper et. al., 2016 are encouraging, dietary supplements and probiotics may be more financially accessible to opioid users by reducing inflammation for significantly less cost (Wiss et. al., 2019). Enriching bacteria that contribute to decreased anxiety could help individuals who are in withdrawal from opioids by stabilizing their mood (Wiss et. al., 2019).

Naltrexone may be an especially effective treatment for opioid addiction because it blocks opioids at the receptor level and appears to ameliorate opioid-induced gut dysbiosis (Meng et. al., 2015; Wang et. al., 2018). However, treatment for opioid addiction should be cross-disciplinary and take a "whole patient" approach which includes nutrition education and counseling (Wiss et. al., 2019). During active opioid use, many individuals report little interest in food, defaulting to cheap convenience foods with little fiber (Wiss et. al., 2019). During early withdrawal, users report a high preference for sugar-laden foods and binge eating (Wiss et. al., 2019). Taken together, nutritional counseling could help individuals develop healthy eating habits that will increase the diversity of their gut microbiota, decrease inflammation, and improve recovery outcomes (Wiss et. al., 2019).

Discussion

These studies demonstrated that both chronic and intermittent opioid use cause proinflammatory shifts in the gut microbiota, which lead to increased blood-brain barrier permeability, neuroinflammation, and analgesic tolerance (Banerjee et. al., 2016; Khang et. al., 2017; Zhang et. al., 2019, Table 1). Neuroinflammation in chronic opioid users may exacerbate the psychological withdrawal symptoms of opioid addiction, compounding the profound negative reinforcement that underlies the high relapse rate (O'Sullivan et. al., 2019).

O'Sullivan et. al., 2019 showed that Bacteroides species were increased in opioid users. Abundance of Bacteroides has been shown to be positively correlated with anxiety severity (Chen et. al., 2019). In contrast, several studies have shown significant decreases in Bifidobacterium, a known GABA producer (Barengolts et. al., 2018). A decrease in species from this genus could lead to anxiety symptoms due to a net decrease in GABA production (Barengolts et. al., 2018). In other studies, opioid-induced inflammation and analgesic tolerance were ameliorated through modulation of the gut microbiome, and administration of the opioid antagonist naltrexone (Meng et. al., 2015; Wang et. al., 2018). Opioid withdrawal symptoms were improved through anti-inflammatory treatments and dietary supplements (Cooper et. al., 2016; Hakimian et. al., 2019).

Future therapeutic interventions could include reshaping the ecology of the microbiota by inoculating the gut with bacterial species that reduce inflammation and return the gut microbiome to a more favorable state (Rinninella et al., 2019). In this emerging and complex field, more species-specific mouse studies are needed as well as longitudinal studies in diverse human populations (Wiss et. al., 2019). Reshaping the gut microbiomes of those with opioid addiction while decreasing inflammation, may be the key to decreasing the rate of relapse in opioid addiction (Haikimian et. al., 2019).

Table 1. Studies investigating the composition of the gut microbiota during opioid use

Reference	Mouse Model	Opioid(s) used	Treatment Regimen	Route of administration	Dose(s)	Bacterial changes during tolerance	Bacterial changes during withdrawal	Findings
Meng et. al., 2015	WT C57BL/6 mice	Morphine and methadone	Chronic	Subcutaneous implant	25 mg	↑ Staphylococcus ↑ Enterococcus ↑Escherichia Coli	NT	Increased gut permeability, inflammation, and sepsis. Bacterial populations rebalanced after naltrexone treatment.
Lee et. al., 2018	WT C57BL/6 mice	Morphine	Chronic and intermittent	Chronic- Subcutaneous implant Intermittent- IP	25 mg 10-40 mg/kg	↑Rikenellaceae ↑Clostridium	↓Lactobacillus ↑Ruminococcus	Increased neuroinflammation, impaired reward behavior
Wang et. al., 2018	WT C57BL/6 mice	Morphine	Chronic	Subcutaneous implant	25 mg	↑Flavobacterium ↑Enterococcus ↑Fusobacterium ↑Sutterella ↑Clostridium	NT	Increases in pathogenic bacteria seen within one day of morphine exposure. Effects antagonized by naltrexone. Morphine-treated mice infected with E. faecalis were more sensitive to pain than uninfected mice in a tail flick test. E. faecalis is a biomarker of morphine-induced changes in gut bacteria.

Table 1. Studies investigating the composition of the gut microbiota during opioid use

Reference	Mouse Model	Opioid(s) used	Treatment Regimen	Route of administration	Dose(s)	Bacterial changes during tolerance	Bacterial changes during withdrawal	Findings
O'Sullivan et. al., 2019	Sprague-Dawley mice	Morphine	Chronic	Subcutaneous implant	75 mg	NT	↓Clostridium ↓Butyricoccus ↓Bifidobacterium ↓Faecalibacterium ↑Bacteroides (>4-fold)	Withdrawal decreases the Firmicutes to Bacteroides ratio. Significant upregulation of the proinflammatory cytokine Tnf in neurons, microglia, and astrocytes. Broad neuroinflammation during opioid withdrawal.
Banjeree et. al., 2016	WT C57BL/6 mice	Morphine	Chronic	Subcutaneous implant	25 mg	↓Lactobacillus ↓Clostridium ↑Staphylococcus ↑Enterococcus ↑Bacillus	NT	Increased gut permeability. Firmicutes to Bacteroides ratio decreased. Microbial dysbiosis was reversed when morphine-exposed mice that were given fecal transplants from morphine naïve mice.
Zhang et. al., 2019	WT C57BL/6 and germ-free mice	Morphine	Chronic Intermittent	IV IV	15 mg/kg 5-40 mg/kg Escalating	↓Bifidobacterium ↓Lactobacillus	NT	Gut microbiota are involved in the development of analgesic tolerance. Probiotics enriched in Bifidobacterium and Lactobacillus decreased analgesic tolerance.

Table 1. Studies investigating the composition of the gut microbiota during opioid use

Reference	Mouse Model	Opioid(s) used	Treatment Regimen	Route of administration	Dose(s)	Bacterial changes during tolerance	Bacterial changes during withdrawal	Findings
Hakimian et. al., 2019	WT C57BL/6 mice	Remifentanil and oxycodone	Intermittent (self-directed intake)	IV	0.67 µL/g	During n-3 PUFA supplementation ↓Akkermansia (4-fold) ↓Parabacteroides (5.5-fold) ↑Lactobacillus ↑Bifidobacterium	↓Akkermansia (64-fold) ↓Bifidobacterium (8-fold) ↓Parabacteroides (5-fold)	n-3-PUFA-enriched diet decreases oxycodone-seeking behaviors and reduces anxiety n-3 PUFA supplementation increased microbial diversity and reduced the basal activation state of microglia
Khang et. al., 2017	Swiss Webster mice	Morphine	Chronic	Subcutaneous implant	75 mg	↓Bacteroidetes ↓Clostridiales ↓Lactobacillus ↑Enterobacteriales	NT	Increased gut permeability. ABX prevented the development of analgesic tolerance to chronic morphine exposure in both the tail immersion and acetic acid stretch assays.

NT = not tested, WT = wild type, IP = intraperitoneal, ABX = antibiotics
↑ = increased abundance
↓ = decreased abundance
n-3 PUFA= omega-3 polyunsaturated fatty acid

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COVID-19 and Its Impact on the Indian Education System

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The novel coronavirus disease (COVID-19) caused by the severe coronavirus -2 (SARS-COV-2) was discovered in the city of Wuhan, China in December 2019. The World Health Organization (WHO) recognized covid-19 as a pandemic after it caused widespread death and affected several countries worldwide. On March 24th, the Ministry of Home Affairs, Government of India declared covid-19 a national public health emergency and directed to take effective measures to prevent its spread. Since then, the nation's common goal has been to curb the spread of coronavirus by introducing measures that limit social contact.

This has led to drastic changes in the Indian education system. Universities have minimized all campus activities in order to decrease disease transmission. Educational institutions have temporarily implemented online learning, imparting education through various mediums such as Google classroom, Zoom, WhatsApp etc.

Initially, this led to a degree of confusion among educators, students as well as the managements. However, with time the adversity compelled everyone to keep up with the times and has created many challenges and opportunities for the educational institutes to strengthen their technological infrastructure.

However, there are two sides of the same coin. While teachers at the country's premier schools are able to provide adequate e-learning experience for their pupils via easy access to the internet along with their digital infrastructure required to craft and share course materials; this is unfortunately not the case when it comes to a vast majority of teachers in the country. In most of rural India, there is a lack of sufficient facilities that ensure remote access to digital learning at home. A study in the IJIRMF reported that the Midday Meal Scheme increased school enrollment at the 1st standard by staggering 30%, implying that food not education is the key driving force behind school enrollment. These students most certainly do not have access to electronic learning facilities at home.

In such a scenario-it is hard to imagine a successful learning outcome. Even for the teachers, thriving in this new world will mean an up gradation in not just their personal skills but also in their teaching resources, which again might not be feasible for some. Both teachers and students alike are facing infrastructural and technological issues across the country; the problem is more serious for those who have limited access to the digital learning platform. Practical classes are a must in the field of Science and Medicine that require hands on training. Such practices cannot be simulated digitally.

There are numerous pros and cons to both classroom learning and remote electronic learning that needs to be pondered upon. There is an urgent need for an effective educational plan that can be implemented uniformly throughout country keeping in mind the educational requirements at various levels and field of study.

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Aromatherapy and Depression

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Aromatherapy utilizes essential oils of plant origin for healing purpose. This therapy is basically in the form of topical application of essential oil on the skin or inhalation. The purpose of aromatherapy is to improve physical, mental and emotional health.

As per the National Association for Holistic Aromatherapy (NAHA), aromatherapy is **"**the therapeutic application or the medicinal use of aromatic substances (essential oils) for holistic healing.**"** Ancient civilizations like Egypt, India and China have used aromatherapy as a popular alternative therapy for 6000 years.

Depression is a common illness and the greatest health concerns, affecting 264 million people worldwide. Depression is a mood disorder which makes a person feel persistent sadness, helpless and less interest in life. Feeling sad or depressed at a particular time is a normal reaction, which may be due to some loss or changes in life. But if these feelings persist for days to weeks, it may be a sign of clinical depression. This may affect regular activities of life, study, job, food habit, sleep, social relations etc. Depressive symptoms can be treated and managed by medications and psychotherapy.

Is aromatherapy effective to treat depression?

Though scientists have not confirmed the effectiveness of aromatherapy in depression, but as per a few studies, aromatherapy might be effective for the relief of depressive symptoms. However, aromatherapy should not be the only treatment of depression, it may consider along with other prescribed therapies. Therefore, aromatherapy may be used for patients with depression, as an alternative therapy. More research is required to establish the fact of whether aromatherapy can help in the treatment of depression.

How does aromatherapy act in Depression?

There are many essential oils which have shown significant antidepressant properties. Aromatherapy has become popular as it is natural and safe. It acts by integrating the aroma into the nose receptor signal after inhalation and sending it to the brain via olfactory bulb. The brain releases neurotransmitters e.g. endorphin, serotonin etc., after receiving this signal. These neurotransmitters link the physiological system to the nervous system and provide desired relief from depressive symptoms.

There are various methods for aromatherapy, those are:

- Body oils, creams, or lotions for massage or topical application
- Bathing salts for aromatic baths
- Diffusers
- Room sprays
- Aromatic spritzers
- Clay masks

Essential oils which may be used in aromatherapy for Depression conditions:

Essential Oil	Source
Bergamot oil	*Citrus bergamia*
Chamomile, Roman oil	*Chamaenemum nobile*
Everlasting oil	*Helichrysum italicum*
Clary sage oil	*Salvia sclarea*
Lavender oil	*Lavandula angustifolia*
Frankincense oil	*Boswellia carteri*
Lemon Balm oil	*Melissa officinalis*
Jasmine oil	*Jasminum officinale*
French Basil oil	*Ocimum basilicum*
Geranium oil	*Pelargonium graveolens*
Rose oil	*Rosa damascene, Rosa centifolia*
Vetiver oil	*Vetiveria zizanoides*
Neroli oil	*Citrus aurantinum var.amara*
Ylang Ylang oil	*Cananga odorata var.genuina*
Sandalwood oil	*Santalum album*
Sweet Marjoram oil	*Origanum majorana*

Different essential oils exert different action. Selection of essential oils for aromatherapy depends on the emotional state or causes of depression, which may vary from person to person. Using skill, understanding and expertise, a qualified aromatherapist selects the best essential oil or blend of different essential oils for a person.

It should be remembered that aromatherapy using essential oils is a holistic approach for better mental health conditions. Only aromatherapy should not be meant for cure or treatment of depression.

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An Alternative Source on the Epidemiological Control of Corona Virus (COVID-19)-Vitamin C

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Coronaviruses such as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and influenza viruses increase oxidative stress in the body leading to cellular and tissue damage. To combat this, administration of high-dose vitamin C (ascorbic acid or ascorbate), in addition to standard conventional supportive treatments, has been shown to be a safe and effective therapy for severe cases of respiratory viral infection. Morbidity, mortality, infectiveness and spread of infectious diseases are dependent on the host–pathogen relationship. In order to effectively fight the novel SARS-CoV-2 virus, medical professionals should explore readily available pharmaceutical and nutritional therapeutic agents with proven antioxidant, anti-inflammatory and immuno-supportive properties. Supplemental vitamin C may also provide additional benefits for the prevention of viral infections shorten the disease course and lessen complications of the disease.

Depending on the rising effect of infections, health experts are focused on finding a solution with fast-track vaccine and antiviral drug development. Using knowledge from the SARS-CoV and MERS CoV vaccine development path, several research groups have been able to start development of a SARS-CoV-2 vaccine within a few weeks of the initial outbreak. However, there is no evidence that this strategy would be effectively and timely or successful in combating the SARS-CoV-2 epidemic.

Medical professionals have published several clinical and observational studies documenting the clinical features and outcomes of SARS-CoV-2 infection. In a retrospective observational study of 710 patients with SARS-CoV-2 pneumonia, of 52 critically ill patients enrolled, 98% had a fever, 77% had a cough and 63.5% had dyspnoea. Moreover, 32 patients (61.5%) died after 28 days and the median duration from ICU admission to death was 7 days (Yang et.al. 2020).

Wang et al. reported the clinical characteristics of 138 confirmed SARS-CoV-2 cases and showed a 26% ICU admission rate and a 4.3% mortality rate. Among the patients admitted to the ICU, 11.1% received high-flow oxygen, 47.2% received invasive ventilation and 41.7% received non-invasive ventilation, suggesting that patients in the ICU could not breathe spontaneously.

Lastly, in a separate report of 99 confirmed cases of SARS-CoV-2 pneumonia, Chen et al. found that 17 patients (17%) developed acute respiratory distress syndrome (ARDS) that led to 11 patients (11%) quickly worsening in a short period and dying of multiple organ failure (Chen et.al. 2020).

Therapeutic options are being explored *in vitro* and in animal studies, including vaccines, monoclonal antibodies, oligonucleotide-based therapies, interferon therapies and small-molecule drugs. However, these treatments may take months or even years to reach patients. There is an urgent need for a standard of care regimen for COVID-19 patients in the absence of effective antiviral drugs.

Understanding how corona viruses cause damage to human cells and organs could offer clues for developing a more effective therapy. Viruses cause infections that are often associated with redox modification characteristic of oxidative stress. Changes in redox homeostasis in infected cells are one of the key events in the pathogenesis of respiratory viral infections in all phases of the disease, contributing to severe inflammatory reaction and subsequent tissue damage (Dua et.al. 2019).

Viruses use several strategies to manipulate host cell machinery to their advantage. Among these, the imbalance of intracellular redox state caused by viruses could play an important role in

modulating the activity of several signalling pathways. Oxidative imbalance caused by viral infections ligand–receptor binding or cytokine storm could result in localised oxidation of reactive residues of redox-sensitive proteins.

As a common immunological defence mechanism, immune cells respond to foreign infection by producing large quantities of reactive oxygen species (ROS) to destroy invading organisms (Ghouleh et. Al. 2011).

Vitamin C has many properties that make it a valuable therapeutic agent for respiratory infections. It is a potent antioxidant with anti-inflammatory and immuno-supportive properties. Vitamin C is a small, water-soluble molecule that readily acts as a one- or two-electron reducing agent for many free radicals and oxidants. Specialised cells can take up reduced vitamin C (ascorbic acid) through Na^+-dependent ascorbate cotransporters (SVCT1 and SVCT2). Most other cells take up vitamin C in its oxidised form, dehydroascorbic acid, via facilitative glucose transporters. Almost all mammals, except for humans, primates and guinea pigs, can synthesise vitamin C in their livers, with increased production during stress. Vitamin C is an essential vitamin that acts as a cofactor for several enzymes and facilitates the production of catecholamines, vasopressin, l-carnitine, collagen neurotransmitters and cortisol, which are central to cellular function and homeostasis. Additionally, vitamin C plays a significant role in viral infection, including attenuation of the pro-inflammatory response, enhancement of epithelial barrier function, increased alveolar fluid clearance, and prevention of sepsis-associated coagulation abnormalities.

A high dose of vitamin C may be a proven therapeutic agent that not only ameliorates oxidative stress and inflammation during coronavirus infection, but also suppresses viral replication and improves antiviral immune defence and adrenal function.

Studies have shown that a high percentage of critically ill patients are deficient in vitamin C despite receiving standard nutrition. In an observational study, Carr et al. found that 75% of critically ill patients had plasma levels of vitamin C that were abnormally low, resulting from increased metabolism due to an overactive inflammatory response.

A common way to supplement vitamin C in the clinic is through intravenous (IV) vitamin C administration. High-dose IV vitamin C is commonly used by complementary and alternative medicine practitioners to treat a wide variety of conditions, including infections. A survey sent to practitioners showed that over 20 000 patients received IV vitamin C over a period of 2 years, with a mean number of infusions per patient of 19–24. There were no definitive serious adverse events reported and a very small number of minor reported adverse effects (Padayatty et.al. 2010).

Clinical trials have reported positive results for vitamin C therapy in respiratory infections. Nathens et al. infused ascorbic acid at 1 g every 8 h for 28 days in 594 critically ill surgical patients and found a significantly lower incidence of acute lung injury and multiple organ failure than in patients receiving mechanical ventilation. Vitamin C also significantly improved the ‘total respiratory score’ in the most severely ill patients with respiratory infection (Nathens et.al. 2002).

Dietary antioxidants rich in vitamin C significantly attenuate hyperoxia-induced acute inflammatory lung injury by enhancing macrophage function via reducing the accumulation of airway high-mobility group box 1 protein (HMGB1). In the critically ill patient population, there was a significant reduction in 28-day mortality in patients supplemented with antioxidant vitamin C and E (Patel et.al. 2020).

Vitamin C has also been shown to be effective against other medical conditions. Marik et al. reported the use of IV vitamin C in 47 septic ICU patients, finding a significant reduction in mortality rate in the group treated with high-dose IV vitamin C. Several other trials have also shown that administration of vitamin C to patients with sepsis is associated with better patient outcomes (Fowler et.al. 2019).

Vitamin C has been widely utilised in the prevention and treatment of the common cold with varying degrees of effectiveness. Hemilä and Chalker determined that many of the studies showed that vitamin C reduces the duration and severity of colds, but the results were not consistent.

Several ongoing clinical trials are investigating the effects of vitamin C, or ascorbic acid, in patients with COVID-19. According to the

clinical trials database (www.clinicaltrials.gov), there are a total of 13 active studies which are recruiting patients that have listed vitamin C or ascorbic acid as one of the interventions. Three of these studies are specifically studying the interaction of IV infusion vitamin C and its effects on COVID-19. One of these studies (ClinicalTrials.gov ID NCT04323514), conducted in Italy, is an uncontrolled longitudinal study in a cohort of 500 hospitalised patients with COVID-19 pneumonia. The patients will be administered 10 g of vitamin C with 250 mL of saline intravenously on top of conventional therapy.

Application of a high dose of vitamin C can dramatically reduce the need for treatment with high doses of corticosteroids, antibacterials and antiviral drugs. Vitamin C also can be effective for primary prevention of viral infections by boosting the innate immune response. In infected patients, vitamin C therapy may shorten the disease course and prevent complications of the disease. In addition to vitamin C, other nutraceutical antioxidants widely available as over-the-counter drugs or food supplements can be used to improve the redox balance and reduce tissue damage in patients with viral pneumonia and ARDS. These possible agents include, but are not limited to, tocopherol, lipoic acid, *N*-acetylcysteine, glutathione, l-carnitine, coenzyme-Q10, zinc and selenium compounds.

Given the fact that vitamin C is inexpensive and has a history of efficacy and safety in similar clinical circumstances, further investigation should be done on its prophylactic ability in low doses and therapeutic ability in high doses.

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Self-Esteem in Indian Science

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It is nearly a hundred year now since Prof. C. V. Raman reached the remarkable height in Indian Science and made the Indian feel proud. He created history in Indian Science by conquering the globally most acclaimed Nobel Prize of Physics in the year 1930. The most coveted recognition from the world scientific community came to him because of his groundbreaking works in the field of light scattering leading to the discovery of 'Raman Effect'. Discovery of 'Raman Effect' is considered one of the best ten scientific discoveries in basic science. Prof. Raman achieved fit for his dedication and hard work put in research which was done on Indian soil whereby, those days Indian Science was in primitive stage, not even in the formative stage of modern science. The remarkable achievement by Prof. C. V. Raman on Indian soil was possible only because of his self-esteem as an Indian.

In the past more than seventy years of Indian independence, very little has been achieved in science and technology on Indian soil. Thus, in spite of considerable investment and efforts directed towards modernization of Indian Science. Why is this so? This is something we should bother about.

There is no dearth of talents in India. There has been considerable growth of infrastructure in India to cater science. The oldest Indian Institute of Technology came up immediately after independence in the year 1951 founded by the visionary industrialist Jamsetji Tata, Indian Institute of Science which was given the status of a deemed university in the year 1958. There are many other infrastructure developments in post-independent India to cater the needs for teaching and research in science and technology still then there is poor performance of Indian Scientists on Indian soil in post-independent era.

Indian colleges and universities are still dependent on foreign countries for their basic infrastructural needs. A classic example is the non-availability of indigenous analytical tools such as IR, UV-Vis, NMR, etc. instruments which are required by the colleges and universities to cater basic science education and research. These instruments and other similar tools are not difficult to manufacture with an assurance in the market. In spite of huge domestic market, our scientists and technologists have not come up with solutions. IITs

and IISc have done very little in this direction; they are only producing talented technologists and researchers to cater the needs of developed countries at the cost of our own. Have we really lost our self-esteem as Indians?

Prominent Indian scientists and professors hardly publish their research papers in Indian journals. CSIR-NISCAIR journals are poorly managed in spite of the fact that most of these journals are headed by our own scientists and/ or academicians who are considered prominent in the country. Prof. EJ Thomas of the University of Manchester, UK once said "If we don't publish our research papers in our own journals published by us in our own country, how can we expect our journals to compete internationally?" Do we Indians have the similar sentiment and commitment to our country? What are really the problems with us Indians? Is it because of our low self-esteem?

The major crippling factors in Indian Science seem to be (i) lack of dedication; at the same time ambition for success by unethical means, (ii) lack of positive competition; rather there is severe negative competition, and (iii) lack of commitment to serve the nation; rather presence of favoritism in funding projects is observed.

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VITAMIN-C as Prophylaxis and Adjunctive Medical Treatment for COVID–19

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COVID-19-Coronavirus 2019, belonging to the Family - SARS – COV 2 (Severe Acute Respiratory Syndrome). It causes respiratory infection at times followed by Severe Systemic illness. Low dose Vitamin–C (0.5 – 2 gm/dl) may have benefits when used early in Severe Acute Respiratory Syndrome COVID-2 infections. After entry in to human cell the viral antigen undergoes various processes and produces antibodies against the body. Macrophages and are responsible for cytokine storm involving Interleukin- 6 and endothelin-1. Vitamin C at high dose can reduce the mediators such as Interleukin- 6 and Endothelin–1. Thus, Vitamin C may also benefit patients with severe late stage Coronavirus disease 2019. Preliminary data suggests that COVID-19 pneumonia is a late stage complication caused by Hyperactivation of immune effector cells. High dose of Vitamin–C linked to fast recovery in COVID-19 patients. Many severe patients have high level of IL-6 and Endothelin-1. These mediators vary with the age, dependence on severity of COVID-19 pneumonia, preponderance of male, obese or hypertensive patients as well as smokers. There is a clear evidence of Vitamin C which can reduce these mediators. Vitamin C is a cheap and safe. Hence using a relatively low dose of Vitamin – C as prophylaxis and in case of severe COVID-19 disease, a high dose regimen may be beneficial.

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Waardenburg Syndrome: A Rare Genetic Condition

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Introduction: Waardenburg Syndrome is a group of rare genetic conditions characterized by some degree of congenital hearing loss and pigmentation deficiencies, which includes bright blue eyes or patches of light skin. Usually, they are of four types. The most common types are I and II and types III and IV are rarer. Waardenburg Syndrome affects an

estimated 1 to every 10 to 20 thousand. In schools for the deaf, 2 to 3 of students have this condition.

Etiology: This syndrome is caused by mutations in any of the several genes that affect the division and migration of neural crest cells during embryonic development. Waardenburg syndrome is usually inherited in an autosomal dominant pattern. This disease is found on Chromosome 2, where only one parent has to pass the gene on.

Types:

- Type 1: Type 1 Waardenburg syndrome causes someone to have a wide space between their eyes. About 20 percent of people with type I experience hearing loss. They also have patches of color or lost color on the hair, skin, and eyes.
- Type 2: Hearing loss is more common in type 2 than type 1, with about 50 percent of people losing their hearing. This version of the disease is distinguished from type 1 primarily by an absence of a large space between the eyes**.**
- Type 3**:** Type 3 is similar to type 1 and 2, frequently producing hearing loss and pigment changes. People with this form typically have a wide space between their eyes and a broad nose. The characteristic feature of type 3 that distinguishes it from types 1 and 2 is issues with the upper limbs. People with type 3 may have weak arms or shoulders or malformations in their joints. Some also have intellectual disabilities or a cleft palate.
- Type 4**:** Type 4 causes changes in pigmentation and may result in hearing loss. Additionally, people with this form have a disease called Hirschsprung disease. This disorder can block the colon, causing severe constipation**.**

Signs and symptoms: Waardenburg syndrome has multiple different types with some variations in symptoms. The two most prominent features are some degree of congenital hearing loss and some degree of pigmentation deficiencies. Other associated symptoms are: Cleft lip, Constipation, Difficulty in completely straightening the joints, possible slight decrease in intellectual functions, a wide space between the eyes, pinched nose, broad nasal bridge.

Diagnosis: Most cases are diagnosed during infancy but the symptoms are present at birth. Special attention in school and hearing ability were tested. Other additional tests are: Audiometry, Colon Biopsy, Genetic Testing, Bowel Transit Time.

Treatment: There is no specific treatment for Waardenburg Syndrome. Help with hearing aids can be sought for deafness. Special diets may be given for constipation.

Few Interesting Facts about Waardenburg Syndrome:

- People with this disease get their white patch of hair at the age of 12.
- 90% of people with this disease have a parent with the disease.
- Symptoms in the parent can be different from the child.
- Once hearing problems are fixed, most people live a normal life.

Conclusion: Early recognition of sensorineural deafness may play an important role in ensuring prompt intervention and appropriate supportive management. Special instruction may be recommended to assist in the development of speech and certain methods (for e.g: sign language, lip reading, use of communication devices) that may aid in proper communication.

INSTITUTIONAL ACTIVITIES DURING THE TENURE

Contribution in combating COVID-19 pandemic

Hand sanitizer preparation and distribution during the Corona pandemic

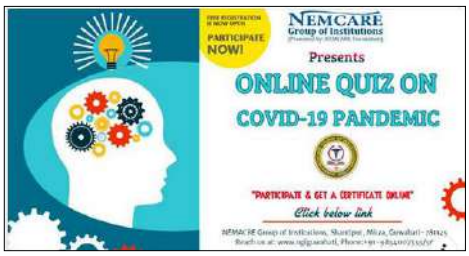
During the Corona pandemic period, the pharmacy faculties of NEMCARE Group of Institutions prepared and distributed hand sanitizer in the Central Research Laboratory of the college on 19-03-2020 and 20-03-2020 and distributed it to the NEMCARE Hospital, Guwahati as a service to the society. Being a health care professional, it is the moral responsibility to come forward during the pandemic time to help the needy peoples.

Relief material distribution

During the COVID-19 lockdown period a noble initiative was taken under the guidance of Dr. Bhargab Jyoti Sahariah, Principal, NIPS, Mirza to distribute essential food material to the nearby needy people. The people living near the Chandubi Lake were selected for the purpose and essential materials like rice, dal, mustard oil, potato, onion, salt, medicines were packed and distributed among them. All faculty and staff members participated in the exercise.

NSS Volunteer of NIPS Mirza at work

Ms. Priti Rekha Boruah, a student of B. Pharm.7th Semester and a volunteer of The National Service Scheme (NSS); Central Sector Scheme of Government of India, Ministry of Youth Affairs & Sports; prepared face masks at home and distributed it within her nearby communities.



Online COVID-19 Quiz

NEMCARE Group of Institutions organized an online quiz competition on 05-05-2020 with questions related to COVID-19 where e-certificates were distributed to the participants upon successful completion of the quiz. A large number of students participated in the competition and it was a grand success.

World Asthma Day, 2020

This year World Asthma Day was organized virtually on 05-05-2020 by creating an awareness campaign in the social media by NEMCARE Group of Institutions. Various posters, leaflets and lectures were circulated by the faculties and students of the college via Facebook, WhatsApp and Twitter to create awareness among the public regarding the severity of asthma.

World Red Cross Day, 2020

This year World Red Cross Day was organized virtually on 08-05-2020 by paying tribute to the Staff and Volunteers of the Red Cross Society in the social media by NEMCARE Group of Institutions. Posters and

leaflets were prepared and circulated highlighting the importance and role of Red Cross Society to the world by the faculties and students of the college via Facebook, WhatsApp and Twitter.

National Technology Day, 2020

National Technology Day was organized virtually on 11-05-2020 by NEMCARE Group of Institutions. The theme for this year was "Women in science" marking the contribution of Dr. Joyanti Chutia towards Science and Technology. A lecture was given virtually through Zoom platform by Dr. Bhargab Jyoti Sahariah, Principal, NIPS, Mirza for the students reminding their role towards the betterment of society with new innovations and ideas.

Online Essay writing competition

An Online Essay Writing competition was organized by NEMCARE Group of Institutions on 25-05-2020 based on topics "Category-1: Role of cleanliness and hygiene in developing a nation" and "Category-2: The fight against corona virus will help the people of developing countries in sustaining their livelihood". It was a state-level competition where prize money and certificates were awarded to the best essay writers. A large number of students participated in the competition and it was a grand success.

World No Tobacco Day, 2020

World No Tobacco Day was organized virtually on 31-05-2020 by creating an awareness campaign in the social media by NEMCARE Group of Institutions. Posters and leaflets were circulated by the faculties and students of the college via Facebook, WhatsApp and Twitter to create awareness among the public regarding the harmful effects of using tobacco and tobacco related products. NEMCARE Group of Institutions boasts of being a tobacco free campus.

World Environment Day, 2020

NEMCARE Group of Institutions observed the World Environment Day on 05-06-2020 where a plantation programme was organized for the students. Based on the ideology "One student one plant", students were given an assignment to plant a sapling and take care of it. Students submitted the photographs with the sapling on Day 1 and Day 30 of plantation. Faculty members also planted saplings in the college campus.

A Webinar during the COVID-19 pandemic

A webinar on "Reforming the Scenario of Examination Post COVID Pandemic Era" was conducted on 18-07-2020 by NEMCARE Group of Institutions. Dr. Satish B Bhise, Dr. Indranil Chanda, Dr. Sangadi Murali Mohan, Dr. Mrinalini Das, Prof. (Dr.) Mansi Mitra and Prof. Jagannath Sahu were the eminent lecturers who delivered their valuable lectures to keep the moral and spirit of the students high even during the COVID-19 lockdown period. The webinar was conducted virtually using Zoom platform.

International Yoga Day, 2020

YOGA day was organized on 21-07-2020 by NEMCARE Group of Institutions in association with NSS unit, NIPS, ASTU. This year the theme was "YOGA at home and YOGA with Family". Smt. Mamani Kalita of Mahila Patanjali Yog Samiti was invited as the Yoga Instructor. The Yoga session was held virtually through Zoom platform for the benefit of the participants during the COVID-19 pandemic along-with an online YOGA quiz session was organized where e-certificates were provided on successful participation.

Guest Lecture Series "Success Beyond Classroom"

A series of online guest lectures and interactive sessions was organized by NETES Institute of Pharmaceutical Science, Mirza with dynamic persons from various fields for the benefit of the students during the lockdown period of Corona pandemic. It immensely benefited the students as they interacted virtually with renowned persons and got inspiration to succeed in life.

Day 1: 10-08-2020: Interactive Session with ***Mr. Dimpu Baruah***, famous Youtube video blogger of Assam.

Day 2: 13-08-2020: Webinar session with ***Mr. Vavani Sarmah***, Business Startup Coach and Mentor, California State University for "Soft Skill Development and Job Opportunities in USA and Canada".

Day 3: 19-08-2020: Webinar session with ***Mr. Manoj Kumar Das***, Managing Director, NERAMAC on the topic "Future forecasting technology for career and Entrepreneurship in medical Science"

Day 4: 22-08-2020: Interactive Session with ***Dr. Geeta Dutta***, Doctor, Northeast cuisine expert and Food blogger on the topic "Traditional food habit, our Ecosystem and Health, Be "Vocal For Local", Scope for Entrepreneurship"

Few screenshots of the online event "Success Beyond Classroom"

Release of First Issue of "Rxplore – The Newsletter"

The "Central Drug Research Centre" of NETES Institute of Pharmaceutical Science, NEMCARE Group of Institutions, Mirza published the first issue of scientific news letter "Rxplore Volume 1, Issue 1, July, 2020". It is worthwhile to mention that even though most of the day-to-day activities were thwarted due to the COVID-19 situation, the collective efforts of the faculties and students of NGI resulted in the timely publication of the long awaited newsletter. This news letter was inaugurated by Dr. Nripen Das, Registrar of Assam Science and Technology University in an online virtual event. The newsletter aims to encourage the faculties and young mind to develop creative as well as analytical thinking ability and inculcating a research culture at undergraduate level.

Teachers' Day Celebration 2020

Amidst the COVID-19 restrictions, NEMCARE Group of Institutions wholeheartedly celebrated Teachers' Day on 05-09-2020 by cutting a cake along with a tea party among the Faculty members and non-teaching staff at the college premises. The occasion was celebrated by strictly adhering to the COVID-19 regulations.

Online Student Orientation Programme for the New Batches of 2020-21

Student Orientation programme for the new batch of students of B. Pharm. and D. Pharm. of NEMCARE Group of Institutions was organized from 10-09-2020 to 16-09-2020 virtually through Zoom platform. Dr Hridayananda Mahanta; Drug Controller-in-Charge (Assam State) was the Chief Guest at the inauguration ceremony. Various activities were organized virtually among the students and the winners were rewarded with certificates. A brief lecture series by the faculty members were organized during the program to make the students aware of the Pharmacy profession.

Dr. Bhargab Jyoti Sahariah felicitating Dr. H. N. Mahanta with a token of appreciation for presiding over the event.

A screenshot of the online event

A screenshot of the online event

Interactive session on Importance of Animal Welfare

An interactive session on the topic "Importance of animal welfare" was organised by NEMCARE Group of Institutions on 14-09-2020 in association with JBF (India) Trust and Rotary Club of Guwahati. Dr. Sashanka Sekhar Dutta, founder of JBF (India) Trust was the guest lecturer of the session who nicely explained the importance of animal care, its handling and the current ethical concerns. The session was organized virtually through Zoom platform for the benefit of the students, researchers and academicians.

Fit India Freedom Run

As per the Government of India initiative to engage people towards fitness during their homestay due to COVID-19 outbreak, NEMCARE Group of Institutions also encouraged its students to actively participate in the "Fit India Freedom Run" which was organized from 15-08-2020 to 02-10-2020. Many numbers of students participated in the run and they were awarded e-certificate.

CORONA awareness programme by NDRF at NIPS, Mirza

A Corona awareness programme was organized at NEMCARE Group of Institutions on 16-10-2020 by the NDRF team of Mirza. The group leader described the role of NDRF and highlighted the gatherings about the precautionary measures to be taken during the Corona pandemic and undertook the pledge to fight against the corona virus.

Vigilance Awareness Week, 2020

As per the recommendation of Government of India, this year the Vigilance Awareness Week was organized from 27th October to 02-11-2020 among the students at NEMCARE Group of Institutions in collaboration with Airport Authority of India. The theme for this year was Vigilant India, Prosperous India. An online essay writing competition was held among the students with large number of participants and the winners were felicitated by Airport Authority of India.

Student Induction Program 2020-21

A Student Induction Program was organized for the newly admitted batches of B. Pharm. and D. Pharm. students on 19-11-2020. The students who emerged as winners of the various competitive events of the Online Student Orientation program were felicitated by the Principal and Vice-Principal of NETES Institute of Pharmaceutical Science, Mirza. The parents-teachers meeting was the main highlight of the program wherein the parents and guardians got the opportunity to interact with the faculty members and got to know about the examination rules, hostel policies and course curriculum of the Institute. The "NIPS-Student Mentoring System (NIPS-SMS)" was also launched on the same day under the leadership of Dr. Bhargab Jyoti Sahariah, Principal, NIPS, Mirza and coordination of Mrs. Babita Deka, Assistant Professor, NIPS, Mirza.

National Pharmacy Week Celebration 2020

The National Pharmacy Week (NPW) 2020 with the theme; "Pharmacists: Frontline Health Professionals" was celebrated by NETES Institute of Pharmaceutical Science, Mirza on 21-11-2020 by organizing various competitive events like extempore speech and painting competitions to raise awareness among the students. The winners were awarded with certificates by the Principal and Vice-Principal of NIPS, Mirza. The key highlight of the event was an inspiring and informative presentation on the theme of NPW 2020 by Mr. Lakshyajeet Nath, Assistant Professor, NIPS, Mirza.

FACULTY ACHIEVEMENTS

Dr. Nilutpal Sharma Bora successfully defended his doctoral thesis entitled "Designing of a dermal cosmeceutical as UV radiation protectant in high altitude and glacial areas" on 24-06-2020 from Department of Pharmaceutical Sciences, Dibrugarh University, Dibrugarh, Assam, India. The final viva was conducted via an online mode of presentation wherein Dr. Hemant R Jadhav. Professor and Head, Department of Pharmacy, Birla Institute of Technology and Science (BITS), Pilani was present as the External Examiner along with the faculties and research scholars of the department. Dr. Bora has completed his Ph.D. under the supervision of Prof. Bhaskar Mazumder, Head, Department of Pharmaceutical Sciences, Dibrugarh University, Dibrugarh, Assam, India and Dr. Pronobesh Chattopadhyay, Scientist 'E' and Group Head, Division of Pharmaceutical Technology, Defence Research Laboratory (DRL), DRDO, Tezpur, Assam, India.

L-R: Dr. Nilutpal Sharma Bora, Prof. Bhaskar Mazumder, Prof. L. K. Nath, Dr. Bibhuti B. Kakoti, Dr. Kamaruz Zaman at Dept. of Pharmaceutical Sciences, Dibrugarh University

Mr. Lakshyajeet Nath and Mr. Kunal Bhattacharya successfully completed the requirements of the CSIR-Summer Research Training Program (CSIR-SRTP) 2020. The training program was organized via online mode by the CSIR-North East Institute of Science and Technology (CSIR-NEIST), Jorhat, Assam, India. The training program constituted of lectures by eminent scientists, special sessions, project assignments, elocution videos, essay writing and Summer Research Completion Report submission. Post completion of the requirements, Mr. Nath and Mr, Bhattacharya were awarded with certificates which were jointly signed by Dr. G. Narahari Sastry, Director, CSIR-NEIST; Prof. Alok Dhawan, Director, CSIR-Indian Institute of Toxicological Research and Dr. Shekhar S. Mande, Director General, CSIR Secretary, DSIR, Govt. of India.

Mr. L. Nath

Mr. K. Bhattacharya

CSIR-SUMMER RESEARCH TRAINING PROGRAM
(CSIR-SRTP)2020 ONLINE

CERTIFICATE

Name: LAKSHYAJEET NATH Sl. No.: CSIR/SRTP/2020/NEIST/3104

has completed all the requirements of the CSIR-Summer Research Training Program (CSIR-SRTP) 2020 online during June to August, 2020 coordinated by CSIR-NEIST, Jorhat

DR. G. NARAHARI SASTRY, DIRECTOR, CSIR-NORTH EAST INSTITUTE OF SCIENCE AND TECHNOLOGY
PROF. ALOK DHAWAN, DIRECTOR, CSIR-INDIAN INSTITUTE OF TOXICOLOGY RESEARCH
DR. SHEKHAR C. MANDE, DIRECTOR GENERAL, CSIR SECRETARY, DSIR, GOVT. OF INDIA

CSIR-SUMMER RESEARCH TRAINING PROGRAM
(CSIR-SRTP)2020 ONLINE

CERTIFICATE

Name: KUNAL BHATTACHARYA Sl. No.: CSIR/SRTP/2020/NEIST/1538

has completed all the requirements of the CSIR-Summer Research Training Program (CSIR-SRTP) 2020 online during June to August, 2020 coordinated by CSIR-NEIST, Jorhat

DR. G. NARAHARI SASTRY, DIRECTOR, CSIR-NORTH EAST INSTITUTE OF SCIENCE AND TECHNOLOGY
PROF. ALOK DHAWAN, DIRECTOR, CSIR-INDIAN INSTITUTE OF TOXICOLOGY RESEARCH
DR. SHEKHAR C. MANDE, DIRECTOR GENERAL, CSIR SECRETARY, DSIR, GOVT. OF INDIA

ARTICLES-IN-BRIEF

Haemovigilance: a step towards blood and donor safety

Rayaz Ahmed Bhat[a], Amir Ali[b]
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Blood transfusion is a lifesaving medical intervention but risks are associated with this important intervention ranging from mild allergic reactions to life threatening anaphylactic shock and transfusion transmitted infections. The incidence of HCV (hepatitis C virus) and HIV by many hemophilia patients in the early 1980's and 1990's in the UK, France, Japan and USA, emphasized the need for safe blood transfusion and Haemovigilance. Haemovigilance, the term derived from two words, Greek word 'haema' means blood and a Latin word, 'vigil' means watchful. The concept of Haemovigilance first came into existence in France in 1990, almost with same ideas and vision of Pharmacovigilance. As per International Haemovigilance Network (IHN) and International Society of Blood Transfusion (ISBT), Haemovigilance is defined as an assembly of surveillance strategies covering the complete transfusion chain from the collection of blood and its components to the follow up of its recipients, designed to collect and appraise information on unexpected or undesirable reactions resulting from the therapeutic use of blood products, and to avoid their occurrence and recurrence.

The Haemovigilance programme of India (HvPI) was launched on 10th December 2012 in 90 medical colleges initially. It is a well-organized programme to assure blood transfusion safety and promote monitoring of adverse reactions associated with blood transfusion and donation, to assure patient safety and promote public health. The National Institute of Biologicals (NIB), Noida, is the National Co-ordinating Centre of HvPI. The Haemovigilance Programme of India (HvPI) was started under the broad ambit of Pharmacovigilance Programme of India (PvPI). This programme is non-punitive, confidential and system oriented programme. Enrolment of blood banks under this programme and consistent reporting can identify priority areas for action and monitor the implementation of solutions. An important feature of Haemovigilance is the sharing of experiences and results nationally and internationally to improve patient outcomes.

Objectives of HvPI:

1. Monitor transfusion reactions
2. Create awareness among health care professionals
3. Generate evidence based recommendations
4. Advise the Central Drugs Standard Control Organization (CDSCO) for safety blood transfusion regulatory decisions
5. Promotes rational use of blood and blood products
6. Improved donor & patient confidence and trust in blood system.
7. Haemovigilance systems have now been globally developed and implemented in many countries of the world to monitor risks, adverse reactions, events and incidents associated with blood transfusions and donations. India being one of the countries in developing a Haemovigilance system and is a member of International Haemovigilance Network (IHN). To participate in HvPI, a blood centre needs to fill enrolment form available on official website of NIB and forward the filled form to HvPI via email at haemovigilance@nib.gov.in or through post.

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Pharmacovigilance: A Key for the Safety of the Drug

Zeba Nazneen
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Anurag Pharmacy College, Kodad, Suryapet, Telangana, India

Pharmacovigilance is the science of assessment, understanding and preventing the effects of the drugs. Generally, we the human beings take food for our survival i.e. it provides all the nutritional requirements required for our body, but in the changing era of the world according to these changes people are taking medicines as of food, now-a-days drugs have become a part of our life we people can survive without eating food but, we can't be without drugs they have become a part in our life.

Pharmacovigilance is a scope to check the quality, safety and different adverse drug reactions shown by the drugs. It not only checks but also prevents the adverse reactions, it also provides correct information for the physicians and patients whether to take the drug or not. In order to reduce the risk, danger to the patients it provides good information and also helps pharmacovigilance is a large branch which is also called as drug safety.

As drugs are this much important for our survival they should be checked perfectly before releasing in to the market. This job is done by the pharmacovigilance. As village and farmers are backbones of our nation. Pharmacovigilance is also the back bone of the pharmacy.

Pharmacovigilance plays an important role in facing the problems and challenges posed by the newer drugs, as the population increases, different types of diseases are coming and to face them and provide correct and safety medication for us.

Post marketing surveillance (PMS) is the practice of monitoring the safety of a pharmaceutical drug or medical device after it has been released on the market and is an important part of the science of pharmacovigilance. Since drugs and medical devices are approved on the basis of clinical trials, which involve relatively small numbers of people who have been selected for this purpose – meaning that they normally do not have other medical conditions which may exist in the general population – postmarketing surveillance can further refine, or confirm or deny, the safety of a drug or device after it is used in the general population by large numbers of people who have a wide variety of medical conditions.

"Pharmacy is not just a PROFESSION but is a PASSION."

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5 New Drugs Coming Down the Pipeline in 2021

Durlabh Narayan Sarkar
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NETES Institute of Pharmaceutical Science, Mirza, Assam

The report highlights five new drugs that are expected to make an impact on the market in 2021. These are:

1. Roxadustat: a drug that treats anemia associated with chronic kidney disease (CKD). The report noted that anemia is common in patients with CKD, and can be associated with increased risk of hospitalization, cardiovascular complications, and death. In the U.S., approximately 4.8 million individuals are affected with anemia associated with CKD; about 500,000 of them receive dialysis. The manufacturer has applied to have Roxadustat approved for both the dialysis and the much larger non-dialysis market. One advantage of the treatment is that it provides an oral delivery system, as opposed to an injectable drug. The report noted that the price of Roxadustat has not been established, but a different drug to treat CKD anemia costs approximately $1,500 for 30 days.

2. Relugolix: this drug is designed to treat prostate cancer, the second-most common cancer in men in the U.S. Like other drugs that treat prostate cancer, it seeks to reduce levels of testosterone, which occurs naturally in the body. Relugolix blocks testosterone production through a mechanism that differs from current treatments. Trials have suggested the drug may be more effective than some current drugs, with fewer side effects. The drug would enter a competitive market, with one current drug in the market costing approximately $20,000 annually.

3. Inclisiran: a drug for treatment of low cholesterol in patients with atherosclerotic cardiovascular disease (ASCVD) and familial hypercholesterolemia (FH). Over 29 million people are affected with ASCVD and FH in the U.S., and of these patients, about 22 million are treated with statin drugs. For those who don't respond adequately to statins, Inclisiran may offer an add-on to statin treatment. Drugs in this class cost approximately $5,850 per year.

4. Berotralstat: Berotralstat is intended to prevent hereditary angioedema (HAE) attacks, a serious condition that causes swelling in various parts of the body and can be fatal when it affects breathing. Before therapies became available, the mortality rate for airway obstruction from HAE was as high as 30% of cases. Approximately 7,500 people are diagnosed and treated for HAE in the U.S. The report noted that there are already well-established therapies for HAE, but that Berotralstat, unlike the current top therapies, is an oral treatment as opposed to being injected. There remain questions about whether the oral treatment is as effective as the injected therapies. The cost is expected to be lower than current therapies, which are approximately $591,000 per year.

5. Lisocabtagene Maraleucel: this drug, which treats diffuse large B-cell lymphoma that has relapsed or not responded to other treatment, has seen a delay in its release due to some manufacturing restrictions caused by the COVID-19 pandemic. According to the report, the drug is a chimeric antigen receptor (CAR T) cell therapy, a therapy that takes naturally occurring infection-fighting T-cells, re-engineers them, and puts them back in the body to attack cancer cells. Like similar drugs, lisocabtagene maraleucel treatment is a one-time infusion that comes with several issues, including lack of long-term remission and challenges in preparation for the treatment. It is thought that the introduction of the new drug could lead to lower overall costs for this market. Current costs range from $373,000 to $475,000 for the one-time infusion.

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The Biology of Love

Abdul Mukit Barbhuiya
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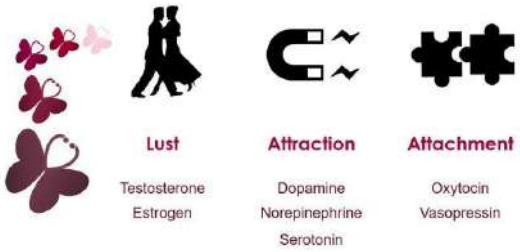
NETES Institute of Pharmaceutical Science, Mirza, Assam

Romantic love is an emotional feeling of love for, or a strong attraction towards another person. It can be broken down into three categories: lust, attraction, and attachment. Each category is characterized by its own set of hormones stemming from the brain.

Let's Get Chemical

Lust is driven by the desire for sexual gratification. The hypothalamus of the brain plays a big role in this, stimulating the production of the sex hormones **testosterone** and **estrogen** from the testes and ovaries. While these chemicals are often stereotyped as being "male" and "female," respectively, both play a role in men and women. As it turns out, testosterone increases libido in just about everyone.

Meanwhile, **attraction** seems to be a distinct, though closely related, phenomenon. **Dopamine,** produced by the hypothalamus, is a particularly well-publicized player in the brain's reward pathway – it's released when we do things that feel good to us. In this case, these things include spending time with loved ones and having sex.



High levels of dopamine and a related hormone, **norepinephrine**, are released during attraction. These chemicals make us giddy, energetic, and euphoric, even leading to decreased appetite and insomnia – which means you actually can be so "in love" that you can't eat and can't sleep. Finally, attraction seems to lead to a reduction in **serotonin,** a hormone that's known to be involved in appetite and mood.

Last but not least, attachment is the predominant factor in long-term relationships. While lust and attraction are pretty much exclusive to romantic entanglements, attachment mediates friendships, parent-infant bonding, social cordiality, and many other intimacies as well. The two primary hormones here appear to be oxytocin and vasopressin.

Oxytocin is often called "**cuddle hormone**" or "**love hormone**" for this reason. Like dopamine, oxytocin is produced by the hypothalamus and released by posterior pituitary gland in large quantities during sex, breastfeeding, and childbirth.

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ANNOUNCEMENTS

Applications are invited from the students & research scholars of various Institutes to carry out the animal study part of their project work at the state-of-the-art Animal house facility of NIPS, Mirza. For any query please contact:

Member Secretary
IAEC, NIPS, Mirza
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The Institute boasts of a young and dynamic IAEC and CPCSEA experts along with Veterinarian care for consultations of animal care during the experiment. Charges for conducting experiments and CPCSEA approval meetings will be applicable.

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