Importance of Zinc in Boosting Immunity and Reducing Inflammation

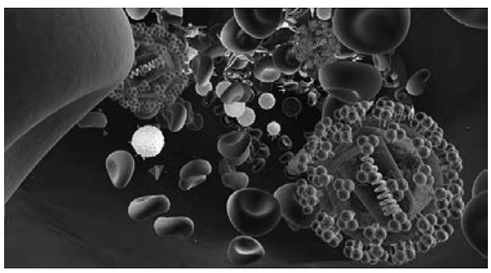
The nutritional importance of zinc is known for quite some time, but in the past few decades, zinc's importance in immune modulation has risen. The objective of the review article authored by Bonaventura P, Benedetti G, Albarède F, Miossec P. is to describe the mechanisms that are involved in the regulation of zinc homeostasis and assess their effects on the immune reaction. The main focus is on those which are associated in the physiopathology of rheumatoid arthritis. Zinc functions as a modulator of the immune response via its availability that is closely regulated by various transporters and regulators. Once this mechanism is disturbed, zinc availability is decreased and alters the survival, proliferation and differentiation of the cells of different organs and systems, especially cells of the immune system.

Zinc deficiency can affect cells that are involved in both innate and adaptive immunity at the survival, proliferation and maturation levels. These cells consist of monocytes, polymorphonuclear-,

natural killer-, T-, and B-cells. Functions of T cell and the balance between the diverse T helper cell subsets are susceptible to changes in zinc status. Acute zinc deficiency can result in a decrease of innate and adaptive immunity and chronic deficiency can increase inflammation. In chronic deficiency, the production of pro-inflammatory cytokines rises, which can influence the consequence of a huge number of inflammatory diseases, including rheumatoid arthritis.

Multiple Sclerosis Drug Shown to Block Transmission and Infection of HIV in Human Immune Cells

Fingolimod, an immune-modulatory drug, approved for the treatment of multiple sclerosis, blocks human immunodeficiency virus (HIV) infection and transmission in human immune cells. This study was recently published in the open-access journal *PLOS Pathogens* by Postdoctoral Fellow Rachel Resop and Assistant Professor Alberto Bosque of The George Washington University, and colleagues. These preliminary findings suggest that this compound may be a promising novel therapy for HIV treatment and prevention.



Bosque and colleagues investigated an alternative tactic to combat HIV infection by targeting Sphingosine-1-phosphate (S1P) receptors— a component of the immune system involved in the progression of infection. To do so, they focused on FTY720 (fingolimod) - a well-tolerated drug that blocks the action of S1P receptors and is approved by the U.S. Food and Drug Administration. They found that FTY720 blocks HIV infection in human immune cells called CD4+ T cells by hindering multiple steps in the HIV lifecycle. For example, FTY720 reduces the density of CD4—a protein found on the surface of T cells—thereby inhibiting viral binding and fusion. The drug blocked HIV transmission between the cells, and consequently reduced detectable latent virus. According to the authors, the role of S1P signaling in the establishment of HIV infection, and the potential to modulate this pathway to alter the course of infection or prevent establishment of the latent reservoir in CD4+ T cells, had not been previously reported. As such, targeting the S1P pathway with FTY720 could be a novel strategy to inhibit HIV replication and reduce the latent reservoir.

COVID-19 Death Risk in Men Linked with Obesity

US researchers have association between body mass index (BMI) and the risk of death among male patients diagnosed with COVID-19.

According to the study, published in journal *Annals of Internal Medicine,* this association was independent of the obesity-related comorbidities and other potential confounders.

The findings suggest that high BMI was more strongly associated with COVID-19 mortality in younger adults and male patients, but not in female patients and older adults.

The research team studied health records of more than 6,900 patients treated for COVID-19 in the Kaiser Permanente Southern California healthcare system in

the US to determine the association between obesity and deaths from COVID-19.

The obesity risk was adjusted for common co-morbidities, including diabetes, hypertension, heart failure, myocardial infarction, and chronic lung or renal diseases, which themselves are risk factors for poor outcomes in COVID-19.

The study also took into account when SARS-CoV-2 was detected. They found that patients in the highest weight group were four times likely to die within 21 days of COVID-19 diagnosis compared with those in the normal-weight group.

The findings showed that men and those younger than 60 with high body weight were particularly at high risk of death.

The research proves that obesity is an important independent risk factor for serious Covid-19 disease and that the risks are higher in younger patients.

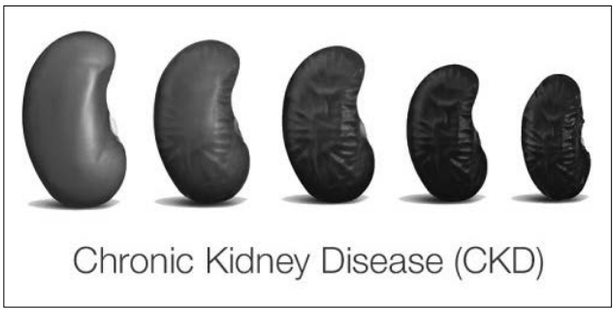
"Males are particularly affected, may reflect their greater visceral adiposity (excess weight that develops over time around the centre of the body, also called visceral fat) over females," the study authors noted.

Prevention of CV Events in Elderly High-Risk Hypertensive CKD Patients

The National Kidney Foundation Task Force and a statement from the American Heart Association Councils have recommended that CKD patients should be considered as a high-risk group for consequent CV events and the treatment recommendation should be based on CV risk stratification. The calcium channel blocker (CCB) and angiotensin II receptor blocker (ARB) combination is recommended as one of the most preferred combination therapies for the general hypertensive people.

Evidence shows that decreased GFR is an independent risk factor for cardiovascular (CV) events.

A multicenter, prospective randomized open-label blinded end-point study was conducted by Kim-Mitsuyama S, Ogawa H, Matsui K, Jinnouchi T, Jinnouchi H, Arakawa K. titled 'An angiotensin II receptor blocker-calcium channel blocker combination prevents cardiovascular events in elderly high-risk hypertensive patients with chronic kidney disease better than high-dose angiotensin II receptor blockade alone' was published in *Kidney Int. 2012*. The study compared the preventive effect of CCB plus ARB combination therapy versus high-



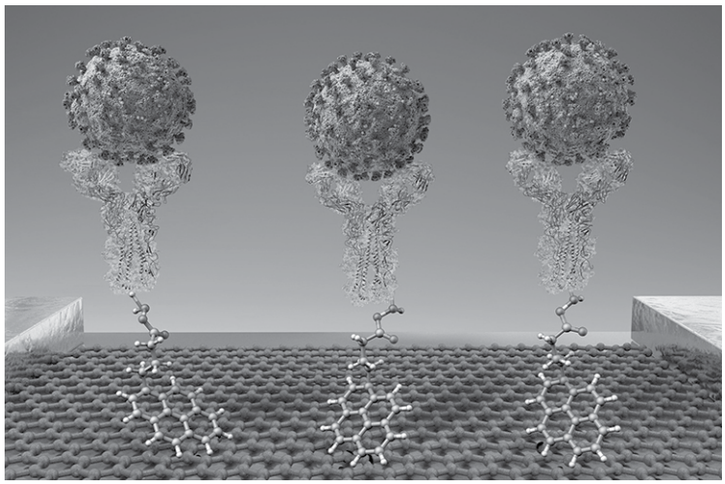
dose ARB therapy in the prevention of CV morbidity and mortality. The study included 1164 elderly hypertensive patients with baseline cardiovascular disease and/or type 2 diabetes. A subgroup analysis of the study according to baseline estimated GFR (eGFR) with CKD defined as an eGFR < 60 ml/min per 1.73m2 was performed.

Blood pressure was lower with the combination therapy than the high-dose ARB therapy in both with and without CKD groups. In patients with CKD, more primary events (a composite of CV events and non-cardiovascular death) occurred in the high-dose ARB treatment group compared to the combination group (30 patients vs. 16 patients, respectively, hazard ratio 2.25). Also, more

cerebrovascular and heart failure events occurred in the high-dose ARB treatment group versus the combination group. In patients without CKD, the occurrence of primary events appeared to be similar between the 2 treatment groups. Assignment to high-dose ARB treatment was an important independent prognostic factor for primary events in patients with CKD.

Thus, the study concluded that the CCB plus ARB combination therapy was more effective in the prevention of cardiovascular morbidity and mortality among elderly high-risk hypertensive patients with baseline CKD as compared to high-dose ARB therapy alone.

Graphene-Enhanced Sensor for Rapid COVID-19 Test



For use in a rapid COVID-19 test, Graphene Leaders Canada (GLC), along with its subsidiary GLC Medical (GLCM), has developed a graphene-enhanced sensor.

The new graphene-enhanced sensor has been designed to support the Rapid COVID-19 Virus Detection Test Kit, which provides results within seconds.

GLCM's graphene-enhanced sensor transmits a signal when exposed to the viral antigens, unlike other test which detect the byproducts of infection.

The company said that its in-vitro diagnostic device directly detects the coronavirus, while other tests including serological assays identify IgM and IgG antibodies post-infection, and nucleic acid tests identify active infection.

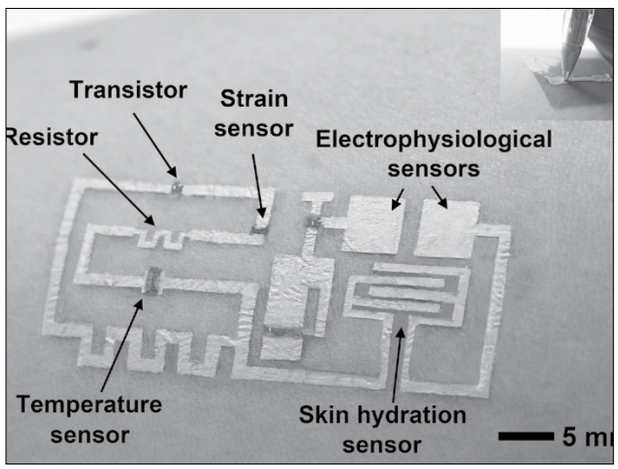
In addition, the diagnostic tests leverage nasopharyngeal swab for sample collection and a certified practitioner will interpret results using expensive equipment which consumes time.

To address the issues, the company has designed the new Rapid COVID-19 Virus Detection Test, which is the only saliva test that does not require the nasopharyngeal swab.

Also, the advanced test kit would prevent the need for expensive equipment, cross handling that increases scope for cross contamination, and does not need a certified practitioner to oversee.

Directly Drawing Electronic Circuits onto the Skin to Monitor Vital Signs

A team of researchers at the University of Houston has developed a way to simply write electronic circuits, including different kinds of body sensor, directly onto the skin. Using such an approach, the scientists have created fully functional sensing systems that can measure, with great accuracy and few artifacts, things such as skin hydration, electrophysiological signals, and body temperature. Other sensors still need to be developed using this technique, but once they're designed there should simply be a template that the user can follow to generate new ones.



The data obtained using the new sensors seem

to be nearly completely unaffected by movement, potentially allowing, for the first time, the gathering of highly accurate biomedical data when individuals are performing strenuous physical activities.

The technology relies on using three different inks extruded from a special pen. These inks can be used to create conducting pathways, semiconductors, and dielectrics. Combinations and special patterns lead to sensors.

One more potential use of this technology is on and around wounds. Running electricity through the inks helps to speed up healing, something the University of Houston researchers have already demonstrated in experiments.

Non-Invasive Vagus Nerve Stimulator for Asthmatics with COVID gets FDA Emergency Clearance

SARS-CoV-2 is a respiratory virus that can make breathing more difficult, particularly for people with asthma. The FDA has issued an Emergency Use Authorization for the gammaCore Sapphire CV non-invasive vagus nerve stimulator (nVNS) to help adult asthmatics with COVID-19 to overcome difficulties breathing when drugs are not appropriate or are insufficient.

The gammaCore stimulator has been approved as a treatment option for migraines and cluster headaches (see flashbacks below), but it was initially researched as a way for treating reactive airway diseases such as asthma. The new Emergency Use Authorization, in a way, validates that research.

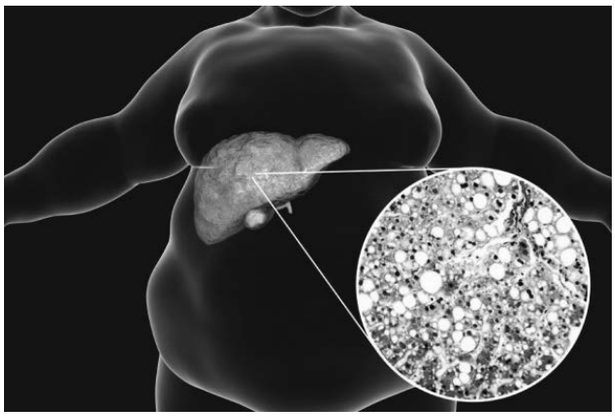
Implications of Fructose and Uric Acid in NAFLD

Fructose, its metabolite uric acid, and aldose reductase (AR) are strongly implicated in the development of non-alcoholic fatty liver disease (NAFLD). The role of AR or its metabolites is not clearly known in ALD. Investigators recently evaluated the role of AR or its metabolites in ALD with the help of human specimens, cultured cells and mouse models.

It was shown for the first time in liver specimens from alcoholic hepatitis (AH) patients that AR was upregulated and AR metabolites were raised (sorbitol, fructose, and uric acid) which had a significant correlation with:

- raised lipid peroxidation byproducts and ER stress,
- reduction in protective ER chaperones, and
- greater cell death and liver injury.

Investigators identified a causal role for AR in ALD as they demonstrated that the genetic deficiency of AR (knockout mice) prevented the alcohol-induced elevation in deleterious AR metabolites, toxic aldehydes, steatosis, ER stress, apoptosis and liver injury.



The study also noted the therapeutic potential of pharmacological inhibition of AR against alcohol-induced hepatic injury in experimental ALD, as reported in eMediNews.

Hepatic AR upregulation and the rise in fructose, sorbitol and/or uric acid contribute to alcohol-induced steatosis, ER stress, apoptosis and liver injury in experimental as well as human ALD. AR must therefore be assessed as a potential therapeutic target and AR inhibitors should be evaluated in alcohol-induced liver injury.

Study Reveals Link Between Cholestrol and Autism

Researchers from Harvard Medical School, Massachusetts Institute of Technology and Northwestern University have identified a subtype of autism arising from a cluster of genes that regulate cholesterol metabolism and brain development.

The study conducted by the researchers was published in the journal *Nature Medicine*.

The team identified the shared molecular roots between lipid dysfunction and autism through DNA analysis of brain samples--findings that they then confirmed by examining medical records of individuals with autism. Indeed, both children with autism and their parents had pronounced alterations in lipid blood, the analysis showed.

"Identifying the roots of dysfunction in each subtype is critical to designing both treatments and screening tools for correct and timely diagnosis--that is the essence of precision medicine." said study senior investigator Isaac Kohane, chair of the Department of Biomedical Informatics in the Blavatnik Institute at Harvard Medical School.

Thousands of gene variants, both rare and common, have been implicated in autism, likely through an intricate and not-well understood interplay between genetic and environmental factors--both before and after birth.

Among individuals with autism and abnormal lipid levels on their blood work, conditions such as epilepsy, sleep disorders and attention deficit hyperactivity disorder were markedly more common than among those without elevated lipid levels--a finding that suggests dyslipidemia may alter neurodevelopment in general, the researchers said. Individuals with autism and dyslipidemia were also more likely to have certain hormonal and metabolic conditions including anaemia, hypothyroidism and vitamin D deficiency.

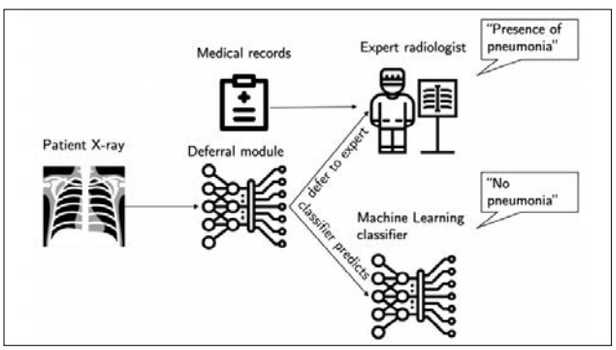
The autism-dyslipidemia link persisted even when the researchers accounted for the possible influence of drugs commonly used in people with autism, some of which are known to affect lipid levels. In fact, lipid abnormalities were more common among people with autism who were not taking such medications.

The newly found link offers a molecular explanation to the well-established observation that a mutation in a gene involved in cholesterol metabolism is also found in people with Rett syndrome, a neurodevelopmental disorder closely related to autism. Another striking observation that may be explained by the newly found link is that between 50 and 88 percent of children born with Smith-Lemli-Opitz syndrome, caused by a defect in cholesterol synthesis, also have autism.

Researchers Develop AI System to Review X-Rays

A team of MIT researchers has developed a machine learning system that can adjust how it makes clinically relevant decisions, whether to let an expert decide something or to do so itself, and to do so while taking into account how busy or experienced the clinician using it is.

Specifically, the new system reviews chest X-rays for conditions such as atelectasis (lung collapse) and cardiomegaly (an enlarged heart), and makes a decision to provide its diagnosis based



on who is looking at the results. The self-adjusting system was given a bunch of virtual experts to work with and, when reviewing potential cases of cardiomegaly, it showed an 8 percent improvement over using only experts or only the system's own recommendations.

According to a press release by MIT, the system has a classifier component that can predict a certain subset of tasks, and a rejector component that makes a decision on whether to use the classifier or divert the decision to the human. The preprint of the study is available in arXiv: Consistent Estimators for Learning to Defer to an Expert

Protection from COVID Reinfection Possible with Antibodies

According to researchers from the University of Washington in Seattle, people infected with the COVID-19 virus develop neutralising antibodies that can protect them from reinfection. These researchers were demonstrating immunity in human beings for the first time and raising hopes that vaccines will be effective against the disease.

In their study, the researchers carried out a retrospective analysis of a SARS-CoV-2 outbreak on a fishing vessel that departed from Seattle in May 2020 and was associated with a high

attack rate. Pre-departure viral and serological testing was conducted on most of the crew and repeated after they returned. The researchers found that three individuals who had a high antibody count remained uninfected even when there was an outbreak on the ship.

"None of these crew members with neutralising antibody titres showed evidence of bona fide viral infection or experienced any symptoms during the viral outbreak. Therefore, the presence of neutralising antibodies from prior infection was significantly associated with protection against reinfection," the researchers wrote.

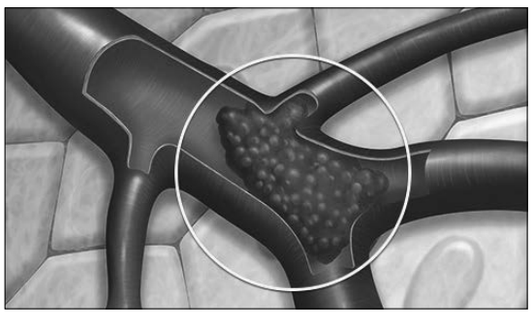
The study has thrown perspective on whether individuals infected with SARS-CoV-2 develop immunity.

Study Suggests Therapeutic Anti-Coagulation for COVID Thrombosis

According to a small observational study conducted in New York, prothrombotic autoantibodies were elevated in COVID-19 and linked to development of thrombosis.

Lupus anticoagulant (LA) appeared in 44% of COVID-19 patients tested versus 22% of other patients (30 of 68 vs 27 of 119, P=0.002), according to Morayma Reyes Gil, MD, PhD, of Montefiore Medical Center in New York City, and colleagues.

In the COVID-19 group, 63% of the LA-positive patients had documented arterial or venous thrombosis compared with 34% of the LA-negative patients (P=0.03), the group reported in



JAMA Network Open.

C-reactive protein (CRP) levels were higher with LA positivity but not linked with thrombosis. On the other hand, LA remained a significant independent predictor of thrombosis after adjusting for CRP, with an odds ratio of 4.39.

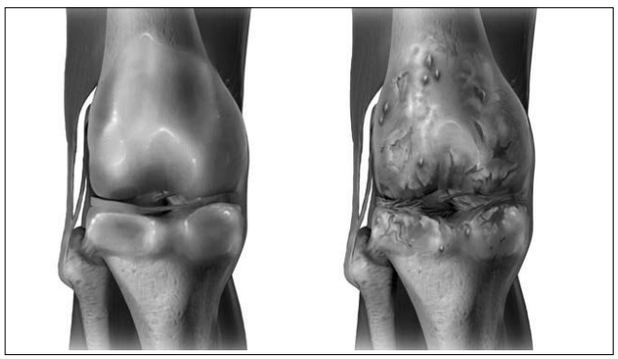
The group concluded that LA-positive individuals have a marked risk of arterial and venous thrombosis, and therapeutic anticoagulation should be considered in these patients.

LA has also been associated with thrombotic events in systemic lupus erythematosus, but the autoantibodies are not specific to lupus.

The researchers noted that mean prothrombin time and partial thromboplastin time (PTT) were more prolonged in LA-positive compared with LA-negative patients.

LA positivity was determined by the dilute Russell viper venom time, because PTT-based tests are interfered with by the elevated CRP levels seen in most patients with COVID-19.

Advancement in Osteoarthritis Treatment



The results of study conducted in the NYU Grossman School of Medicine revolve around the long-established idea that machines within animal and human cells turn the sugars, fats, and proteins we eat into energy used by the body's millions of cells. The molecule most used to store that energy is called adenosine triphosphate, or ATP. Along with this central role in metabolism, adenosine also helps signal other cells and serves as a building block of genetic material, and so is central to the growth of human tissue.

Previous research had shown that maintaining supplies of adenosine, known to nourish the chondrocyte cells that make cartilage, also prevented osteoarthritis in similar animal models of the disease.

In the new study led by NYU Grossman School of Medicine, researchers injected adenosine into the joints of rodents whose limbs had been damaged by inflammation resulting from either traumatic injury, such as a torn ligament, or from massive weight gain placing pressure on joints. The biological damage in these cases is similar, researchers say, to that sustained in human osteoarthritis.

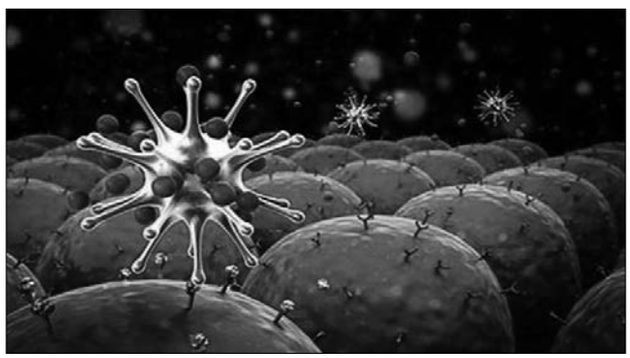
The study was published online in the journal *Scientific Reports.*

The lead study author Carmen Corciulo, Ph.D., a postdoctoral fellow at NYU Langone said that their latest study shows that replenishing adenosine stores by injection works well as a treatment for osteoarthritis in animal models of the disease, and with no apparent side effects.

Corciulo says it is too soon to use this experimental model as a therapy in people. Clinical trials must await a test drug that can be safely stored for days if not weeks, and experiments in larger mammals.

Study senior investigator Bruce Cronstein, MD, the Dr. Paul R. Esserman Professor of Medicine at NYU Langone Health, says the team's research is important because the few existing drug therapies for osteoarthritis, such as acetaminophen and COX-2 inhibitor drugs, including naproxen and ibuprofen, only numb joint pain, or like hyaluronic acid, just lubricate its tissues. None stall disease progression or reverse the damage. Painkillers, such as opioids, are often prescribed, but are also highly addictive, he cautions.

Malfunctioning of Immune System in Severe COVID-19 Cases Decoded



German scientists have found that severe COVID-19 does not solely result in a hyperactive immune system, but instead the body's defence response is caught in a continuous loop of activation and inhibition, an advance that may help develop better therapeutics to combat the deadly disease.

The researchers, including those from the German Center for Neurodegenerative Diseases (DZNE), assessed blood samples from a total of 53 men and women with COVID-19 from Berlin and Bonn in Germany, whose course of disease was categorised as mild or severe according to the World Health Organization (WHO) classification.

They used blood samples from patients with other viral respiratory tract infections as well as from healthy individuals as controls.

In the study, published in the journal *Cell*, they analysed the gene activity and the amount of proteins on the level of individual immune cells circulating in the blood of these patients using very high resolution single-cell OMICs technologies.

Yang Li, a co-author of the study from the Centre for Individualised Infection Medicine (CiiM) in Germany explained that by applying bioinformatics methods on this extremely comprehensive data collection of the gene activity of each individual cell, they could gain a comprehensive insight of the ongoing processes in the white blood cells.

They were able to decipher the changes in the immune system of patients with COVID-19 by combining the observation of important proteins on the surface of immune cells, said Birgit Sawitzki, another co-author of the study.

The scientists found that in severe cases of COVID-19, the immune cells called neutrophils and monocytes in these patients are only partially activated and they do not function properly.

However, these immune cells were found to be ready to defend the patient against COVID-19 in the case of mild disease courses, explained Antoine-Emmanuel Saliba, another co-author of the study. Saliba further added that the immune cells are also programmed to activate the rest of the immune system, which ultimately leads to an effective immune response against the virus.

But in severe COVID-19 cases, the scientists noted that there are considerably more immature neutrophils and monocytes that have a "rather inhibitory effect on the immune response"

According to the researchers, the current findings could lead to new therapeutic options.

COVID to Cause Bell's Palsy in Some Patients

Doctors who have been treating patients for five months now said that Novel coronavirus could cause temporary facial paralysis called Bell's palsy in some patients.

Neurologist Rajesh Benny, with Fortis Hospital, Mulund, said he saw an unusual number of cases of Bell's palsy between April-July. ``The incidence seems to have reduced in Mumbai now, but neurologist in areas where the infection is at its peak or reaching it, say they are seeing a surge in Bell's palsy cases," he said.

In other countries too, doctors noted the link between COVID-19 and neurological manifestations such as Bell's palsy. In April, doctors from China reported in a peer-reviewed journal, Neurology, were among the first to report Bell's palsy as a symptom of COVID-19.

"Covid-19 patients may present with Bell's palsy at an initial stage. Bell's palsy may be attributed to an immune response, caused by SARS-CoV-2,'' they wrote.

Generally, Bell's palsy takes a month or two to disappear but could in some cases leave behind residual weakness, said Dr Sangeeta Ravat, who heads the neurology department of KEM Hospital, Parel. "As it usually has a viral cause, we treat the condition with antivirals and a short course of steroids," she added.

Bell's palsy can be painful in some patients. "While eyeballs can move, eyelids cannot. The cheek and lower jaw on the affected side too cannot move," said Dr Ravat. Patients may need physiotherapy to recover fully.

Mouthwashes to Potentially Reduce the Risk of Coronavirus Transmission

Based on the cell culture experiments by virologists from Ruhr-Universität Bochum together with colleagues from Jena, Ulm, Duisburg-Essen, Nuremberg and Bremen, SARS-CoV-2 viruses can be inactivated using certain commercially available mouthwashes. High viral loads can be detected in the oral cavity and throat of some COVID-19 patients. The use of mouthwashes that are effective against SARS-CoV-2 could thus help to reduce the viral load and possibly the risk of coronavirus transmission over the short term. This could be useful, for example, prior to dental treatments. However, mouth rinses are not suitable for treating COVID-19 infections or protecting against catching the virus.

The results of the study are described by the team headed by Toni Meister, Professor Stephanie Pfänder and Professor Eike Steinmann from the Bochum-based Molecular and Medical Virology research group in the *Journal of Infectious Diseases.*

The researchers tested eight mouthwashes with different ingredients, and mixed each mouthwash with virus particles and an interfering substance, which was intended to recreate the effect of saliva in the mouth. The mixture was then shaken for 30 seconds to simulate the effect of gargling. They then used Vero E6 cells, which are particularly receptive to SARS-CoV-2, to determine the virus titer. In order to assess the efficacy of the mouthwashes, the researchers also treated the virus suspensions with cell culture medium instead of the mouthwash before adding them to the cell culture.

All of the tested preparations reduced the initial virus titer. Three mouthwashes reduced it to such

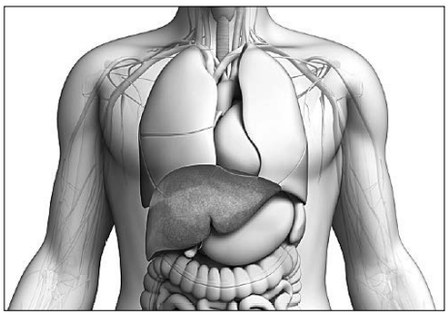
an extent that no virus could be detected after an exposure time of 30 seconds. Whether this effect is confirmed in clinical practice and how long it lasts must be investigated in further studies. The authors point out that mouthwashes are not suitable for treating COVID-19

Predicting Alcohol Relapse with HALT Score Post Liver Transplantation

Study conducted by Satapathy SK, Thornburgh C, Heda R, et al sought to assess different clinical, demographic, and behavioral factors for predicting post-LT alcohol relapse and graft survival.

This retrospective analysis was conducted among 241 LT recipients with AALD either as a primary or secondary indication for LT from 2006-2015.

It was noted that patients with less than 6 months of alcohol abstinence had significantly higher cumulative incidence for alcohol relapse in comparison with those who had >6 months of abstinence. Four variables were identified to predict harmful alcohol relapse after LT. These included age at LT, non-alcohol-related criminal



history, pre-LT abstinence period (Ref >6 months of alcohol abstinence), and number of drinks per day (Ref <10 drinks/day). Area under the curve (AUC) for the final model was found to be 0.79 (95% CI: 0.68-0.91).

The multivariable model was assessed with internal cross-validation; random sampling of the study participants 100 times gave a median C statistic of 75 (±SD 0.097) with an accuracy of 91 (±SD 0.026). The four-variable model formed the harmful alcohol use post-LT (HALT) score. Graft survival was shown to be significantly lower in patients with <6 months of pre-LT alcohol abstinence and those with blue-collar jobs.

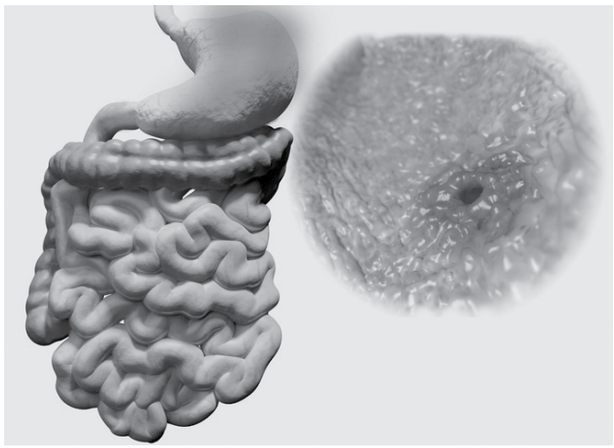
The study titled 'Predicting harmful alcohol relapse after liver transplant: The HALT score' was published in *Clin Transplant.*

It was concluded that the HALT score could identify LT candidates with AALD at significant risk for alcohol relapse and could have a role in guiding transplant centers for pre- and post-LT interventions.

Daily Dosage of Aspirin in Elderly Related to Major GI Bleeding Risk

According to the new ASPREE trial analysis, daily low-dose aspirin in healthy elderly individuals increased the risk of serious gastrointestinal (GI) bleeding by 60%.

The new analysis from the ASPREE trial is the first to show the connection in a large, randomized,



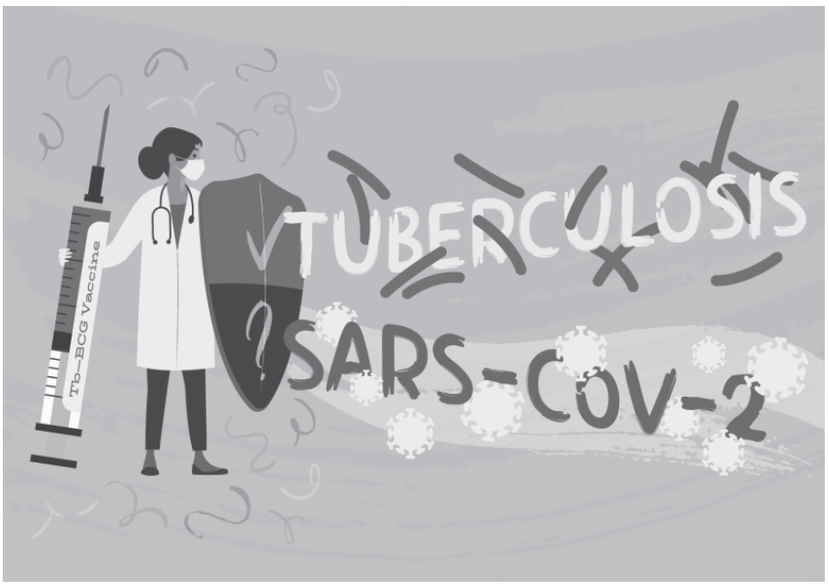
double-blind trial of over 19,000 healthy adults age 70 or older. At an average of 4.7 years of follow up, participants showed an increased risk of both upper and lower GI bleeding, which was exacerbated in individuals with additional GI bleeding risk factors. The independent risk factors identified in the study were advanced age, hypertension, obesity, smoking and chronic kidney disease.

ASPREE co-investigator Andrew T. Chan, MD, MPH, director for cancer epidemiology in the Mass General Cancer Center, chief of the Clinical and Translational Epidemiology Unit and vice chief for clinical research in the Division of Gastroenterology at Massachusetts General Hospital, commented in *MDedge* that this bleeding data should prove useful for clinicians to better weigh the risk and benefit of low-dose aspirin use.

The results of ASPREE and other recent trials on aspirin use pushed the American College of Cardiology/American Heart Association to eliminate aspirin's role in the primary prevention of atherosclerotic cardiovascular disease. The current recommendation among cardiologists is to not administer aspirin routinely for primary cardiovascular prevention in people over 70 years old, or in adults with increased bleeding risk.

Study Reveals BCG Shots to Potentially Slow Down Spread of COVID-19

A paper published in *Science Advances*, a peer-reviewed medical journal brought out by the American Association for the Advancement of Science, said that countries with mandatory Bacillus Calmette-Guérin (BCG) vaccination showed "slower infection and death rates" during the first 30 days of the COVID-19 outbreak in their country.



The researchers estimated only 468 people are likely to have died from Covid-19 in the US as of March 29, which is 19% of the actual figure of 2,467 deaths by that date, if it had instituted mandatory BCG vaccination several decades ago.

Countries, such as India and China, which have included BCG in the national immunization programme have had relatively lower death rates. Some sections of doctors believe it is the BCG vaccine that is protecting people against COVID related complications.

The US study analysed the day-by-day rate of increase of confirmed COVID cases in 135 countries and deaths in 134 countries in the first 30-day period of each country's outbreak. "Mandatory BCG vaccination correlated with a flattening of the curve in the spread of Covid-19," the analysis showed. However, the authors said BCG cannot be portrayed as a "magic bullet".