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Editorial

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Current Trends section – Disinfectants are chemical substances that are used to kill microbes that may potentially be harmful to humans. While they destroy every microbe on a surface, they still play an important role in controlling and preventing infection. Disinfectants also function as cleaning agents, although they may struggle to remove certain types of dirt like oil or rust stains.

In Profile Scientist – Thomas Milton Rivers was one of the most influential scientists in the history of medical research and is often regarded as the "Father of Modern Virology." His groundbreaking work laid the foundation for the scientific understanding of viruses and helped establish virology as a recognized field of study. Through his dedication, leadership, and remarkable scientific insight, Rivers transformed the study of infectious diseases during the twentieth century and contributed immensely to public health and medical science.

Bug of the month – ***Lyssavirus rabies*** (Rabies virus) is a neurotropic virus that causes rabies in animals, including humans. It can cause violence, hydrophobia, and fever. Rabies transmission often occurs through the saliva of animals and less commonly through contact with human saliva. Rabies virus, like many rhabdoviruses, has an extremely wide host range. In the wild it has been found infecting many mammalian species, while in the laboratory it has been found that birds can be infected, as well as cell cultures from mammals, birds, reptiles and insects. Rabies is reported in more than 150 countries and on all continents except Antarctica. The main burden of disease is reported in Asia and Africa, but some cases have been reported also in Europe in the past 10 years, especially in returning travellers.

Did You Know? -- New research suggests that a protein the body relies on to manage appetite and energy levels cannot function on its own. Instead, it depends on a partner protein to work properly. This discovery could help scientists better understand how genetic factors contribute to obesity.

Best Practices – Manufacturing plants and facilities are typically large and loud environments that operate heavy machinery and equipment. In these sometimes-harsh facilities, workplace safety can require a lot of attention to detail. In such difficult conditions, safety for both workers and potential visitors is crucial. With proper safety programs, procedures, and equipment, facilities can minimize the potential for workplace accidents and generally ensure employee safety and productivity.

Tickle yourself to enjoy the jokes in our **Relax Mood section**.

Our JHS team is thankful to all our readers for their ever-increasing appreciation that has served as a reward & motivation for us. Looking forward to your continuous support.

Power generation from wastewater using microbial fuel cells: A review

In recent decades, population growth, urban sprawl, industrial and agricultural production, and the consumption of various chemicals, on the one hand led to the production of sewage and environmental pollution. On the other hand, they lead to fossil fuels consumption and its generated pollutants. Lack of fossil fuel resources and the effects of global warming have led to a focus on biomass as a sustainable source of energy production. Unlike fossil fuels, biomass is renewable and has a closed carbon cycle. One of the most attractive technologies for bioenergy production is the microbial fuel cell (MFC), which is a good option for organic wastewater treatment and the co-production of energy.

MFCs are bioreactors that use microorganisms as catalysts to oxidize organic compounds and inorganic compounds and produce currents. A wide range of substrates, from pure compounds such as acetate, glucose, butyrate to complex mixtures such as municipal wastewater, brewery effluent and starch production and leachate. Substrate type widely affects the accumulation of microorganisms, their mortality, and power generation rate.

Microbial Fuel Cell Processes:

Microbial fuel cell technology is a promising green technology, with immense potential in waste management. MFCs are the devices which can convert biochemical energy into electrical energy through the action of microbes.

The MFCs involve (a) microbes as biocatalyst, (b) enable electron transport either directly or through mediators (electron shuttles), and (c) electron acceptors. The MFCs are galvanic cells, wherein the electrochemical reaction possesses negative free reaction energy leading to a positive standard cell voltage. The MFCs traditionally are made of anode and cathode compartment, separated by a proton exchange membrane.

The anode electrode placed in the anode compartment with the analyte is maintained under anoxic condition. On the other hand, the cathode electrode and catholyte placed in the cathode compartment are maintained under aerobic conditions. Proton exchange membranes ensure anaerobic anode chamber and aerobic cathode chamber. The electrons released because of oxidation of organic matter in the wastewater reaches the anode either in the presence or absence of mediators. The electron transfer between microorganisms and electrode takes place in the following ways: (a) through redox-active proteins present on the outer cell membrane (c-type cytochromes), (b) through mediators or electron shuttles, and (c) direct transfer of electrons from microorganisms to electrodes through specialised locomotive organs like pili, fimbriae, *etc.* The MFCs that employ mediators for electron transport are called mediator-based-MFCs. The mediators such as thionine, humic acid, neutral red, methylene blue aid in the transfer of electrons from the bacteria to the anode. The mediators capture the electrons from the bacterial cells and transfer them to the anode.

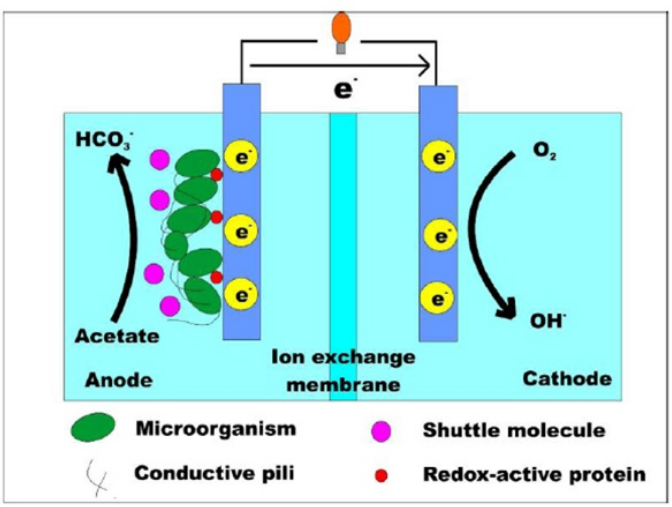
Exoelectrogens are a group of organisms capable of thriving on biodegradable substances. The electrons from the anode through a power load or resistor reaches the cathode. The terminal electron acceptor, mostly the oxygen, in the cathode compartment accepts electrons to form hydroxyl ion. The protons produced in the anode compartment on account of organic matter degradation move across the proton exchange membrane to reach the cathode compartment. The proton exchange membrane can be Nafion, Ultrex or salt bridge. The MFC can be a single chamber or traditional two-chamber MFC based on the absence or presence of proton exchange membrane respectively.

The processes occurring at the anode and cathode are explained below through the chemical equation: -

Anode: $C_6H_{12}O_6 + 6\,H_2O \rightarrow 6\,CO_2 + 24\,H^+ + 24e^-$

Cathode: $24\,H^+ + 24e^- + 6\,O_2 \rightarrow 12\,H_2O$

Oxidation-Reduction Reaction (ORR) taking place in MFCs is responsible for electricity generation. ORR involves electron release (substrate), transfer (electrodes) and acceptance (electron acceptor). ORR essentially aids in the removal of pollutants. In wastewater based MFCs, the electron donors are the substrates [wastewater] and the terminal electron acceptors are oxygen, nitrate, phosphate, Fe [III], *etc.*



The MFCs use bacteria as the main catalyst. Exoelectrogens are organisms used in MFC for bioelectricity generation. The microbial consortia isolated from wastewater streams are selected for employing in MFCs. The cellular respiration products of exoelectrogens include carbon dioxide, protons and electrons. These organisms can transport the electrons through electron transfer mechanisms such as oxidation-reduction active proteins, nanowires or mediators. It is reported that the microbial consortia or mixed culture possess better capabilities in wastewater treatment. The bacterial community composition directly depends on the enrichment conditions.

Commonly used microbes in MFC with the mode of operation and substrates.

Microbe for MFCs	Mode of operation	Substrates
Erwinia dissolven	Mediator MFC	Glucose
Proteus mirabilis	Mediator MFC	Glucose
Aeromonas hydrophila	Mediator less MFC	Acetate
Geobacter metallireducens	Mediator less MFC	Acetate
G. sulfurreducens	Mediator less MFC	Acetate
Rhodoferax ferrireducens	Mediator less MFC	Glucose
Shewanella putrefacien	Mediator less MFC	Lactose, pyruvate, acetate, glucose
Klebsiella pneumoniae	Mediator MFC	Glucose
Lactobacilus plantarum	Mediator MFC	Glucose
Aeromonas hydrophila	Mediator less MFC	Acetate
S. oneidensis MR-1	Mediator less MFC	Lactase

Application of MFC in wastewater treatment:

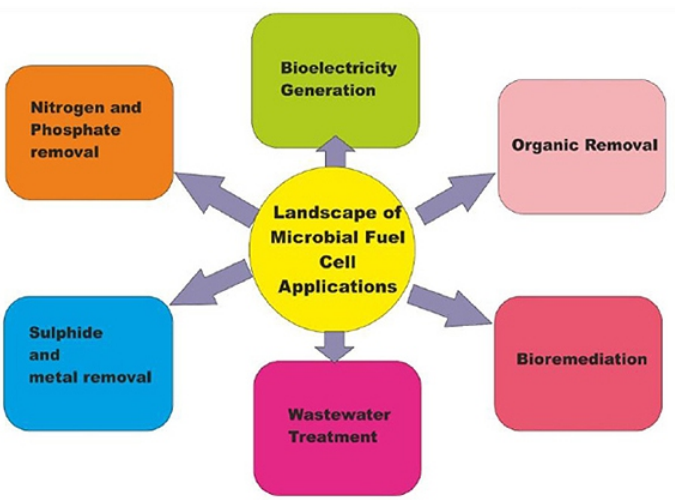
Wastewater is a source of concern as it pollutes the surface and groundwater bodies. It is reported that the wastewater contains nearly 3 to 10 times the energy required to treat wastewater. The energy in wastewater is present in the form of organic matter, nutrients and thermal energy. Though thermal energy constitutes the most, it cannot be harvested efficiently. The chemical energy locked either in the organic component or nutrients can be harvested.

The wastewater treatment plants involve activated sludge treatment process. This process involves a huge cost (aeration process, sludge disposal). Nevertheless, it shows good results concerning the treatment of wastewater. As regards the anaerobic digestion process, technology is employed to treat high strength wastewater. It also provides valuable bioenergy [biogas].

In the anaerobic digestion process, the sludge is acted upon by the microbes and the carbon in the sludge is converted into methane. In this regard wastewater based MFCs provide a sustainable pathway in wastewater treatment. MFCs are now established as a sustainable alternative to conventional wastewater treatment methods. MFCs do not involve issues of sludge management.

Sustainable wastewater treatment is the need of the hour. Sustainable wastewater treatment endeavours to minimise environmental pollution, to recover and reuse resource, and to generate energy.

MFC is a promising technology in sustainable wastewater treatment. Further, the benefits due to the adoption of MFCs include but not limited to energy benefits, economic and environmental benefits and generation of value-added products. Municipal and industrial wastewaters particularly food-processing industries, brewery industries are rich in organic carbon and considered as a source of energy. MFCs in wastewater treatment generate clean electrical energy and consume less energy as compared to the conventional wastewater treatment methods. Concerning pollutant removal, the decontamination potential of MFCs is significant. It is reported that the persistent contaminants, aqueous contaminants, nutrients [nitrogen and phosphorus], recalcitrant organic pollutants, sulphur compounds and metals are removed by the MFCs. Compared to the conventional wastewater treatment plants, MFCs offer environmental sustainability through low carbon footprint and low sludge production.



MFCs are preferred to be integrated with wastewater treatment. MFC integration with wastewater treatment plants enhances the robustness and stability of the system. Increasing, demand for clean water, resource and energy recovery, pollutant removal led to the development of sustainable green technologies. MFCs are a promising green technology that has been found to be applied in wastewater treatment including nutrient removal and recovery, organic removal and pollutant removal. Overall, microbial fuel cell technology has enormous potential for development, with ongoing research and development expected to deliver a game-changing source of alternative energy in the future.

The Science behind Disinfectants: How they work

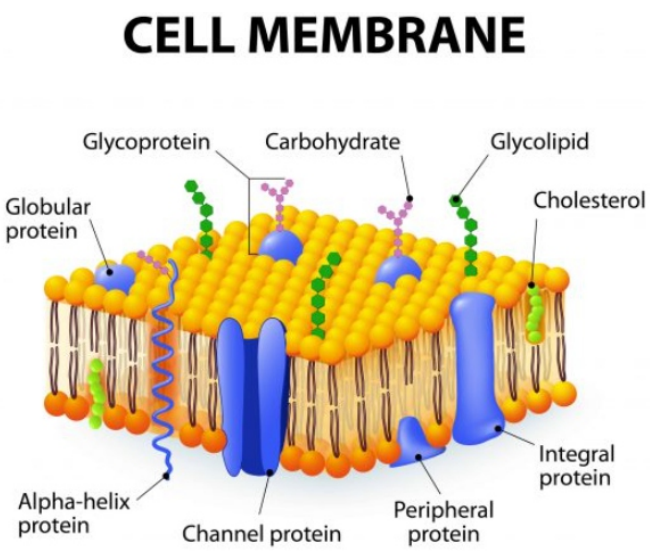
What are disinfectants?

Disinfectants are chemical substances that are used to kill microbes that may potentially be harmful to humans. While they destroy every microbe on a surface, they still play an important role in controlling and preventing infection.

Disinfectants also function as cleaning agents, although they may struggle to remove certain types of dirt like oil or rust stains.

The chemistry behind their action

All disinfectants kill microbes by destroying their external protective cover. This either means damaging the cell membrane (bacteria) or the protein envelope (viruses).



Disinfectants in action: how do they work?

Disinfectants work by destroying the protective membrane or protein envelope that covers a microbe. Once this is destroyed, the internal structure and contents leak out, killing the microbe or rendering it non-viable to reproduce, as in the case of viruses.

Exactly how the disinfectant destroys the membrane or protein envelope depends on the type of disinfectant being used. It could be through one or more of the following chemical pathways: -

a) **Cross-linking:** this happens when two or more molecules form covalent bonds and join. The process involves a molecule that contains at least two reactive ends that can attach to functional groups like primary amines and sulfhydryl's.
b) **Coagulation:** a process in which a fluid transforms into a solid or semi-solid state. For example, alcohols can cause microbial proteins to coagulate, thereby killing the microbes.
c) **Clumping:** like coagulation, some disinfectants cause proteins to clump together, which then leads to the collapse of the cellular membranes.
d) **Structure and function disruption:** cell membranes can lose their molecular structure and cohesion when disinfectant is applied. Certain disinfectants may attack the hydrophilic and hydrophobic components of the membrane. They also affect their permeability.
e) **Oxidizing:** during an oxidizing reaction, electrons are stripped from the cell membranes or protein envelope. This causes the protective cover to disintegrate.

Disinfectants are effective in killing microbes because they can destroy or disrupt the molecular integrity and functions of cell membrane or protein envelope.

Here are four main mechanisms by which they can do this: -

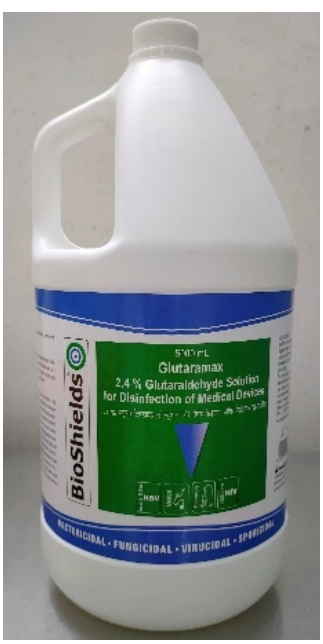
i. **Dissolving parts of the cell membrane-** alcohol based disinfectants can kill microbes in minutes by dissolving the polar parts of the phospholipids of the cell membrane.
ii. **Disrupting the molecule transport system-** a microbe's cell membrane can control which molecules can enter and exit the cells. Disinfectants can destroy microbes by interrupting this molecule transport system.
iii. **Denaturing proteins-** membrane proteins can bind with disinfectant molecules, causing them to be disorganised and weak. Some proteins may become denatured as a result.
iv. **Degrading biological functions-** when disinfectant molecules penetrate the cell membrane or protein envelope, they can degrade the microbes' normal metabolic processes.

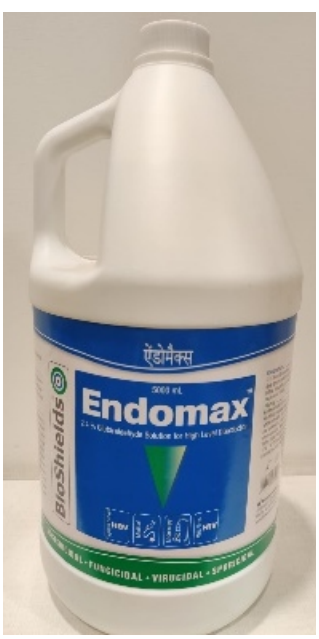
Mode of action of different disinfectants:

1. **Aldehyde:**

Aldehydes have antibacterial, antifungal, antiviral and sporicidal activity. These are helpful to destroy the spores of *Bacillus subtilis* and *Clostridium sporogenes*. Glutaraldehyde and formaldehyde are commonly used aldehydes in disinfectants. 2% solution inhibits the activity of the enzymes in the cell, denatures the cell proteins.

Examples: Glutaramex™ and Endomax™





2. **Alcohols**

All types of alcohols are antiseptic and antiviral agents. These are highly effective in combination with water. These are effective against Polio virus and Rhinovirus. 70% solutions of ethyl alcohol and isopropyl alcohol are commonly used as hand disinfectants in pharmaceuticals. Alcohol denatures cell was proteins.

Examples: Ecomax™ and Ecorub™

3. **Chlorine and Sodium Hypochlorite**
   Chlorine or Sodium Hypochlorite is generally used in water disinfection. This is sporicidal agent and acts against the spores' forming bacteria. It is an oxidising agent and reacts with the enzymes of the cell.
   Example: Surfax™

4. **Phenols**
   Chlorocresol and Chloroxylenol are used as disinfectants. These are general disinfectants have antifungal and antiviral properties. It denatures the proteins and enzymes of the cells.

5. **Hydrogen Peroxide (H_2O_2)**
   It is also an oxidizing agent that reacts with the proteins and DNA of the cell. A 5% solution in water is effective against bacteria and fungus. It is very effective in water system sanitation. High concentrations (10-30%) are effective against bacterial spores and viruses. It acts as oxidant and attacks on the essential cell components such as DNA, lipids and proteins.
   Example: Silvicide®

6. **Benzalkonium Chloride**
   A 0.0002% solution is effective against the vegetative cells. It increases the permeability of the cell membrane and causes the coagulation of cell contents.
   Examples: Zytall®, Surgiprep®, Aerosept™, Microlyse®, Acitar™

7. **Chlorhexidine Gluconate**
   It is a general antiseptic. A 0.5% solution kills all bacterial vegetative cells. It destroys the cell content by coagulation.
   Examples: Ecomax™, Ecorub™, Sterimax®, Triosept™, Savinox®, Savinox Plus®

Disinfectants used for sanitation and cleaning in pharmaceutical industries must be selected based on their mechanism of action. Disinfectants having same mechanism may lead to develop the resistance in microbes.
Therefore, the disinfectants should have difference in their mode of action. For example: if you have to select three disinfectants then the combination may be- one containing Aldehyde, one containing Hydrogen Peroxide and other should contain Benzalkonium Chloride.

Thomas Milton Rivers

Thomas Milton Rivers was one of the most influential scientists in the history of medical research and is often regarded as the "Father of Modern Virology." His groundbreaking work laid the foundation for the scientific understanding of viruses and helped establish virology as a recognized field of study. Through his dedication, leadership, and remarkable scientific insight, Rivers transformed the study of infectious diseases during the twentieth century and contributed immensely to public health and medical science.

Thomas Milton Rivers was born on September 3, 1888, in Jonesboro, Georgia, United States. He grew up in a modest family environment where education and discipline were valued. Initially, Rivers did not intend to become a scientist. He studied at Emory College and later pursued medical education at Johns Hopkins University School of Medicine, one of the most prestigious medical institutions of the time. He graduated with a medical degree in 1915.

During the early part of his medical career, Rivers worked in pathology and bacteriology. At that time, bacteria were the primary focus of infectious disease research, while viruses remained mysterious and poorly understood. Scientists knew that certain diseases were caused by agents smaller than bacteria, but the exact nature of these agents was unclear. Rivers became deeply interested in these invisible infectious agents and gradually shifted his focus toward virus research.

In 1922, Rivers joined the Rockefeller Institute for Medical Research in New York, now known as Rockefeller University. This institution became the center of his scientific achievements. At Rockefeller, Rivers worked tirelessly to investigate viral diseases and develop methods to study viruses in laboratory conditions. His research helped scientists understand that viruses were unique infectious agents requiring living cells to reproduce. This realization became one of the cornerstones of modern virology.

One of Rivers' greatest contributions was his effort to define virology as a separate scientific discipline. Before his work, viruses were often studied only as a small branch of bacteriology. Rivers argued that viruses possessed distinct characteristics and required specialized research methods. His influential scientific papers and lectures encouraged universities and research institutions to establish dedicated virology programs. Because of his leadership, virology emerged as an independent and respected branch of medical science.

Thomas Milton Rivers also made important contributions to the study of viral immunity and vaccines. He conducted extensive research on diseases such as vaccinia; the virus used in the smallpox vaccine. His studies improved scientific understanding of how the immune system responds to viral infections. This knowledge later helped researchers develop safer and more effective vaccines against many diseases.

Another significant aspect of Rivers' career was his role in public health administration. During World War II, he served as an important medical advisor and contributed to efforts aimed at controlling infectious diseases among military personnel. Viral infections posed serious threats during wartime because soldiers often lived in crowded environments where diseases could spread rapidly. Rivers worked on strategies to prevent outbreaks and improve disease management. His contributions helped protect the health of thousands of soldiers.

Rivers was not only an excellent scientist but also a gifted teacher and mentor. Many young researchers trained under his guidance later became leading virologists themselves. He believed strongly in scientific discipline, careful experimentation, and ethical research practices. His students admired him for his intelligence, humility, and dedication to science. Through his mentorship, Rivers influenced several generations of medical researchers.

One of his most lasting achievements was his role in shaping scientific policy and medical research standards in the United States. He served on numerous scientific committees and advisory boards. Rivers played a key role in guiding research priorities and promoting cooperation among scientists. His influence extended far beyond the laboratory, reaching government institutions and public health organizations.

Thomas Milton Rivers also contributed to the understanding of viral encephalitis and other neurological infections caused by viruses. At a time when laboratory technology was limited, his research methods demonstrated remarkable precision and innovation. He emphasized the importance of experimental evidence and systematic investigation. His scientific approach became a model for future virologists.

In addition to his research contributions, Rivers wrote several influential scientific publications. His writings helped clarify

complex concepts related to viruses and infectious diseases. One of his famous achievements was organizing and editing important reviews of virology research, which became valuable resources for scientists around the world. These publications encouraged collaboration and accelerated the growth of the field.

Rivers received numerous honors and recognitions throughout his lifetime. He was respected internationally for his scientific achievements and leadership. Many scientific societies acknowledged his contributions to medicine and virology. Despite his fame, Rivers remained committed to advancing knowledge rather than seeking personal recognition. His humility and dedication earned him admiration from colleagues worldwide.

The importance of Rivers' work became even more evident in later decades as scientists discovered more viruses responsible for human diseases. Modern advances in virology, including vaccine development, antiviral medicines, and molecular diagnostics, all trace part of their foundation to the pioneering work of Thomas Milton Rivers. The field he helped establish became essential for combating diseases such as influenza, polio, HIV/AIDS, and COVID-19.

Thomas Milton Rivers retired after a long and distinguished career but continued to influence science through his writings and advisory work. He passed away on May 12, 1962. Although he is no longer alive, his legacy continues to inspire scientists and medical professionals worldwide. Today, he is remembered not only as a brilliant researcher but also as a visionary who recognized the importance of studying viruses long before the field became globally significant.

In conclusion, Thomas Milton Rivers was a pioneering scientist whose work transformed medical science and established the foundations of modern virology. Through his research, leadership, mentorship, and public health contributions, he helped humanity better understand viral diseases and how to fight them. His dedication to scientific excellence and his vision for the future of virology continue to influence medical research even today. Thomas Milton Rivers remains one of the greatest figures in the history of infectious disease research and an enduring symbol of scientific progress.

Jokes

A man walked into a doctor's clinic and said,
"Doctor, everyone ignores me."
The doctor looked up and shouted,
"Next!"

My friend said he knows a man with a wooden leg named Smith.
I asked, "What's the name of his other leg?"

A customer asked the waiter,
"Do you have frog legs?"
Waiter replied,
"Yes sir."
Customer said,
"Then jump and bring my order quickly."

Teacher asked, "Why are you talking during my lesson?"
Student replied,
"Why are you teaching during my conversation?"

A wife told her husband,
"I look fat. Can you give me a compliment?"
Husband said,
"You have perfect eyesight."

Boss: "You're late again!"
Employee: "Sorry sir, my alarm clock didn't go off."
Boss: "Then why didn't you come on time?"
Employee: "Because I didn't wake up to see the time."

Lyssavirus rabies

Lyssavirus rabies (Rabies virus) is a neurotropic virus that causes rabies in animals, including humans. It can cause violence, hydrophobia, and fever. Rabies transmission often occurs through the saliva of animals and less commonly through contact with human saliva. Rabies virus, like many rhabdoviruses, has an extremely wide host range. In the wild it has been found infecting many mammalian species, while in the laboratory it has been found that birds can be infected, as well as cell cultures from mammals, birds, reptiles and insects. Rabies is reported in more than 150 countries and on all continents except Antarctica. The main burden of disease is reported in Asia and Africa, but some cases have been reported also in Europe in the past 10 years, especially in returning travellers.

Rabies virus has a cylindrical morphology and is a member of the *Lyssavirus* genus of the *Rhabdoviridae* family. These viruses are enveloped and have a single stranded RNA genome with negative sense. The genetic information is packaged as a ribonucleoprotein complex in which RNA is tightly bound by the viral nucleoprotein. The RNA genome of the virus encodes five genes whose order is highly conserved. These genes code for nucleoprotein (N), phosphoprotein (P), matrix protein (M), glycoprotein (G) and the viral RNA polymerase (L).[5] The complete genome sequences range from 11,615 to 11,966 nt in length.

Rabies lyssavirus has a "negative polarity" (or is a negative-sense RNA virus 3'-5'), which means that its genetic material cannot be directly translated into proteins by the host cell's machinery. Once inside the cytoplasm of a cell, the viral polymerase uses the negative strand as a template to create positive-sense messenger RNA (mRNA) strands. These mRNAs are then translated by the host cell to make proteins, and later to replicate the viral genome. All transcription and replication events take place in the cytoplasm inside a specialized "virus factory", the *Negri body* (named after Adelchi Negri). These are 2–10 µm in diameter and are typical for a rabies infection and thus have been used as definite histological proof of such infection.

Rabies virus initially replicates in muscle tissue following a bite before entering neurons through their nerve endings and spreading to the nervous system. The retrograde axonal transport of Rabies virus to the central nervous system (CNS) is the key step of pathogenesis during natural infection. The exact molecular mechanism of this transport is unknown although binding of the P protein from Rabies virus to the dynein light chain protein DYNLL1 has been shown. P also acts as an interferon antagonist, thus decreasing the immune response of the host.

From the CNS, the virus further spreads to other organs. The salivary glands located in the tissues of the mouth and cheeks receive high concentrations of the virus, thus allowing it to be further transmitted due to projectile salivation. Fatality can occur from two days to five years from the time of initial infection. This however depends largely on the species of animal acting as a reservoir. Most infected mammals die within weeks, while strains of a species such as the African yellow mongoose (Cynictis penicillata) might survive an infection asymptomatically for years.

The first symptoms of rabies may be very similar to those of the flu, including general weakness or discomfort, fever, or headache. These symptoms may last for days. There may be also discomfort or a prickling or itching sensation at the site of bite, progressing within days to symptoms of cerebral dysfunction, anxiety, confusion, and agitation. At the onset of these progressive symptoms, the disease begins to worsen. As the disease progresses, the person may experience delirium, abnormal behavior, hallucinations, and insomnia. Rabies virus may also be inactive in its host's body and become active after a long period of time.

The incubation period for this virus, in some cases, can last anywhere from weeks to months. This does not depend on specific form of the virus. This long incubation period is most likely due to the presence of microRNA, which slow down viral replication in the muscles. However, when the patient starts to exhibit prodromal symptoms (fever, flu) and gastrointestinal symptoms, the virus has widely spread. Prodromal symptoms are noted within the first 2–10 days after incubation and include fever and fatigue. They can also involve the respiratory system, causing sore throat and cough, the gastrointestinal system, causing anorexia, nausea, vomiting, abdominal pain, diarrhea, and central nervous system. The central nervous system is the most prevalent in some cases and includes symptoms like headache, vertigo,

anxiety, nightmares, depression, and more. The neurological dysfunction starts when the central nervous system begins to slow and not function properly.

Despite hydrophobia being one of the most well-known symptoms, rabies does not cause a fear of water specifically. It causes painful spasms of throat muscles that cause swallowing water to become painful, and damage to the brain prevents the patient from differentiating between water and pain, leading to a *fear* of water that is more akin to a fear of swallowing. Rabies can also cause anemophobia.

Rabies virus is used in research for viral neuronal tracing to establish synaptic connections and directionality of synaptic transmission.

Recent research is focused on stabilizing the trimeric pre-fusion form of the rabies virus glycoprotein (RABV-G), which is the most immunogenic conformation of the protein. Mutations like H270P and H261L enhance the stability of this form, making it a more effective immunogen. This approach aims to develop vaccines that are both more cost-effective and have better protective coverage, addressing the ongoing global need for rabies prevention.

Interestingly, the rabies virus vaccine that was created using the SAD-B19 complex, which includes the L-P protein, was utilized in the creation of a vaccine for SARS-CoV-2. The S1 protein from SARS-CoV-2 was inserted into the rabies virus vaccine vector to create a new vaccine that was shown to be effective in protecting against COVID-19. Rabies virus has also been used to create a vaccine against Ebola, called FiloRab1, and it was found to be 100% effective for nonhuman primates.[48]

This tiny protein helps control how hungry you feel....

Scientists found that appetite control relies on a helper protein that keeps hunger signals running smoothly. When this support breaks down, the body's energy balance can be thrown off.
New research suggests that a protein the body relies on to manage appetite and energy levels cannot function on its own. Instead, it depends on a partner protein to work properly. This discovery could help scientists better understand how genetic factors contribute to obesity.

In a study published on December 16, an international research team led by scientists at the University of Birmingham examined how a helper protein known as MRAP2 supports an appetite regulating protein called MC3R. MC3R plays a key role in deciding whether the body stores energy or uses it.

Building on earlier hunger research
Previous studies had already shown that MRAP2 is essential for the activity of a related protein (MC4R), which is known to control hunger. The new research set out to determine whether MRAP2 provides the same kind of support for the closely related protein MC4R.

To explore this question, the researchers used cell models to observe how the proteins interact. They found that when MRAP2 was present in equal amounts with MC3R, cellular signaling became stronger. This result suggests that MRAP2 helps MC3R do its job of balancing energy intake with energy use. The team also identified specific regions of MRAP2 that are required for supporting signaling through both MC3R and MC4R.

How genetic mutations weaken appetite signals
The researchers then investigated what happens when MRAP2 carries genetic mutations that have been identified in some people with obesity. In these experiments, mutated versions of the supporter protein (MRAP2) failed to boost MC3R signaling. As a result, the appetite regulating protein did not respond as effectively.

These findings indicate that changes in MRAP2 can interfere with the hormone system that normally helps maintain energy balance. When this system does not work as intended, appetite regulation may be disrupted.

New clues for obesity risk and future treatments
Dr. Caroline Gorvin, Associate Professor at the University of Birmingham and lead author of the study, said: "The findings give us some important insights into what's going on in the hormonal system, related to some key functions like energy balance, appetite, and puberty timing.
"The identification of this protein, MRAP2, as a key aide or supporter to these essential appetite-regulating proteins also gives us new clues for people who have a genetic predisposition to obesity, and how MRAP2 mutations are a clear indication of risk."
By learning more about how MRAP2 supports appetite related signaling, researchers hope to determine whether future drugs could target this protein. Such treatments might strengthen feelings of fullness, reduce overeating, and improve the body's overall energy balance, offering new options for weight loss when dieting alone is not effective.

A collaborative effort in metabolism and cell signaling research
The research was carried out by a team from the Department of Metabolism and Systems Science and the Centre of Membrane Proteins and Receptors (COMPARE). COMPARE is a cross-University Research Centre involving the Universities of Birmingham and Nottingham, focused on studying how cells communicate in both health and disease. Its goal is to develop new therapies for widespread conditions such as cardiovascular disease, diabetes, and cancer. The center is supported by advanced research facilities, including the COMPARE Advanced Imaging Facility, which is available to researchers from academia and industry.

Industrial Safety: 10 Daily Workplace Safety Tips in Manufacturing

Manufacturing plants and facilities are typically large and loud environments that operate heavy machinery and equipment. In these sometimes-harsh facilities, workplace safety can require a lot of attention to detail. In such difficult conditions, safety for both workers and potential visitors is crucial.

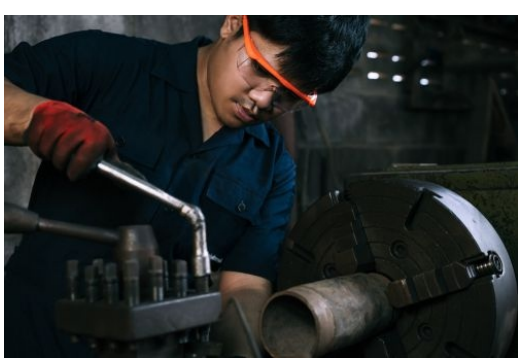
With proper safety programs, procedures, and equipment, facilities can minimize the potential for workplace accidents and generally ensure employee safety and productivity.

What is Industrial Safety?

Industrial safety refers to the protocols and practices that protect workers, equipment, and infrastructure in high-risk industrial workplace environments. It is the foundation for consistent output, workforce stability, and regulatory alignment. It means creating good daily safety habits that include identifying hazards, following protocols, and making sure that every employee whether a new employee or a veteran technician returns home safely.

10 Quick and easy tips for a safer manufacturing workplace.

1. **Use Machines, Equipment and Tools properly**
   Improper use of equipment is one of the leading causes of workplace accidents and injuries, according to the Occupational Safety and Health Administration (OSHA). It's extremely important that employees are using the right tool for the right job. Damaged tools can impose a serious threat, so be sure not to use anything damaged or broken. Always be sure to regularly check your machines, equipment and tools for any safety issues. Performing maintenance on any required equipment will keep it safe and in good working condition.



2. **Wear Safety Equipment Always (PPE)**
   Using the proper personal protection equipment (PPE) will greatly reduce the chance of workplace injuries. All employees, management, and any visitors should always have access to protective gear when in a harsh environment. Safety gear such as eyewear (goggles/glasses), hard hats, bright-coloured vests, gloves, and hearing protection (such as headsets or earmuffs), are recommended. Always wear the right PPE for the task. This applies whether you're operating machinery or handling spills and debris. PPE must be properly selected, correctly worn, and free of damage. This reduces your risk of injury.

3. **Keep Work Areas, Aisles, & Emergency Exits Clear**
   All aisles, walkways and emergency exits should remain clear. In the event of an emergency, this will allow employees to exit the building safely. Having blocked entryways can prevent a quick escape, leaving workers in harm.
   If you work with liquid, be sure to immediately clean up any spills/leaks that occur, never to leave anything on the floor. Having a clean area also includes maintaining any extra tools or equipment, such as loose nails or screws. Make sure there are no loose boards or holes in your work area, and if there are, be sure to report them immediately.

4. **Allow Only Authorized Personnel to Operate Machinery**
   Making sure that only certified or licensed employees use equipment like forklifts can help prevent workplace accidents.

5. **Eliminate Chemical & Fire Hazards**
When using combustible materials in the work environment, only keep the amount you need for the task at hand. Always store combustible chemicals and flammable materials in a safe storage area away from any potential ignition sources. How you dispose of chemicals and other fire hazards is also crucial for industrial safety. Always use metal trash receptacles and follow local and state laws regarding disposal.

6. **Conduct Safety Inspections & Audits**
Regular safety inspections should always be a priority as they can help prevent accidents. A great way to conduct inspections regularly is to create checklists or forms that allow your employees, supervisors, and health/safety committees to double-check the workspace. Always be on the lookout for things such as loose wires, blocked exits, poor lighting, and even improper usage of equipment. Scheduling routine safety audits into your weekly calendar can help you spot anything that can be a potential employee hazard.

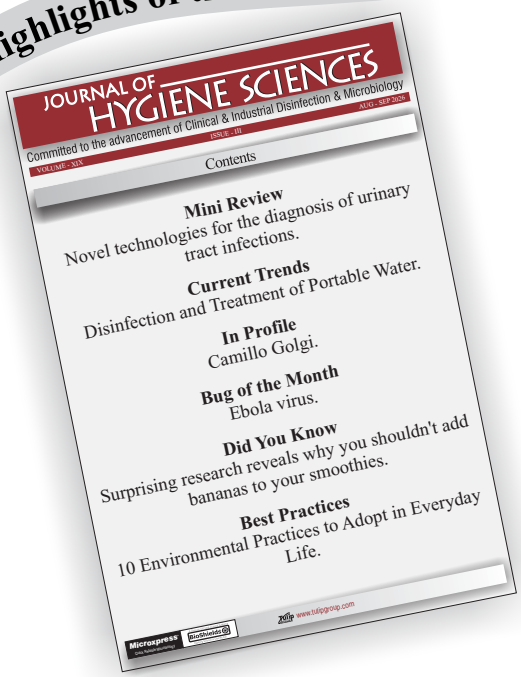
7. **Always Report Unsafe Conditions**
From time to time, equipment can become damaged or misplaced, and work areas can also become unsafe. Things such as wet floors, frayed electrical cords, loose bolts, or even a cluttered work area can pose a threat and cause potential hazards to employees. Report any unsafe conditions or abnormal activity to your supervisor immediately. In certain situations, a facility lockout/tagout protocol may need to be followed, so it's vital to always be aware. Always have warning signs and practice early reporting to help prevent injuries in your manufacturing facility.

8. **Encourage Breaks from Time to Time**
Heat stress happens indoors too. Manufacturing machinery creates high temperatures. Poor ventilation and physical exertion make it worse. This leads to worker fatigue, dehydration, and reduced alertness. When workers are overheated or overtired, they can't recognize hazards as well. This puts everyone at risk. Take regular breaks. It helps them stay alert and focused on the job.
Stay hydrated. Use cool-down periods to maintain focus and prevent heat-related incidents.

9. **Create an Emergency Action Plan**
Having an emergency action plan in place is a vital industrial safety tip. It includes having an emergency exit plan. All your employees should be aware of the emergency action plan and know where the facility's exits are located.

10. **Offer Ongoing Safety Training**
It is vital that both employers and employees partake in frequent training programs and safety meetings addressing all the possible safety topics in their place of work not only to familiarize themselves with the most up-to-date general workplace safety tips and recommendations but to also be able to always adhere to all the necessary requirements and regulations.
Providing opportunities for workplace safety skills can help employees retain new information and even refresh existing knowledge. Having a proper safety program for manufacturing safety will ensure that employees are all on the same page and know what to do in case of an emergency.

Highlights of the coming issue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