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Editorial

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Current Trends section – In precision medicine, doctors use information from certain lab tests to put together a plan of care that usually includes specific recommendations. In some cases, it can help make a more accurate diagnosis and improve treatment. In other cases, it can help people make decisions about healthy habits, earlier screening tests, and other steps they can take that might help lower their risk for a particular cancer.

In Profile Scientist –The never ending thrust for research has translated in many significant research contributions of Prof. Chakrabarty, in wide range of areas of biotechnology. Apart from his revolutionary discovery of 'bioengineered superbug', he has also achieved several other milestones including development of promiscuous bacterial protein/peptide based anti-cancer, anti-viral and antiparasitic drugs. He discovered a bacterial periplasmic protein azurin from Pseudomonas aeruginosa with potent antineoplastic properties (Chakrabarty 2003, 2010).

Bug of the month – ***Staphylococcus aureus*** is a Gram-positive spherically shaped bacterium, a member of the Bacillota, and is a usual member of the microbiota of the body, frequently found in the upper respiratory tract and on the skin. It is often positive for catalase and nitrate reduction and is a facultative anaerobe that can grow without the need for oxygen.

Did You Know? – The World Health Organization (WHO) ranks antibiotic resistance as one of the top ten threats to global health. There is therefore a great need for new solutions to tackle resistant bacteria and reduce the use of antibiotics. A group of researchers at Chalmers University of Technology in Sweden are now presenting a new spray that can kill even antibiotic-resistant bacteria, and that can be used for wound care and directly on implants and other medical devices.

Best Practices –The environment compasses not only the natural surroundings - air, water, plants, and animals used for food - but also shelter, modes of transportation and all other products of technology, including pollutants and waste materials; all of which interact to affect health. Environmental hygiene can be looked at from two aspects, Hygiene at household level and Hygiene at the community level.

Tickle yourself enjoying 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 for your continuous support.

Understanding Dengue (II)

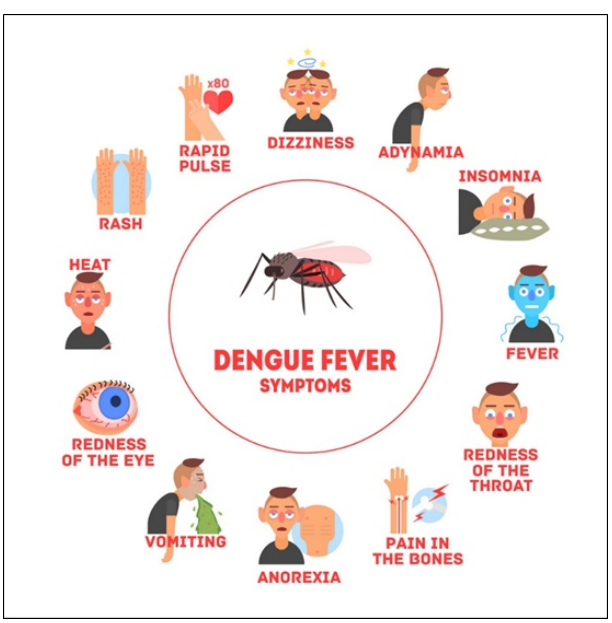
Dengue fever is a mosquito-borne virus disease of humans. In terms of numbers of individuals infected, it is by far the most devastating of all the recognised arthropod-transmitted virus diseases, also known as breakbone fever due to the severity of muscle spasms and joint pain, dandy fever, or seven-day fever because of the usual duration of symptoms. Although most cases are asymptomatic, severe illness and death may occur. *Aedes* mosquitoes transmit the virus and are common in tropical and subtropical parts of the world. The incidence of dengue has increased dramatically over the past few decades. The infection is now endemic in some parts of the world. It is estimated that more than 3 billion humans live in dengue endemic regions of the world, and currently, more than 50 million infections occur annually with at least 500,000 individuals requiring hospitalisation . Of these, tens of thousands have a high risk of developing haemorrhagic disease, potentially with fatal consequences depending to a large extent on the quality of the available medical services.

Dengue symptoms

The Virus cells after entering the host, multiply and take 2-12 days before any dengue symptoms start appearing in the host. Depending on the type of serotype, the symptoms and severity of the condition persist.

Symptoms include:

- Sudden, high fever
- Severe headaches
- Pain behind the eyes
- Severe joint and muscle pain
- Fatigue
- Nausea
- Vomiting
- Diarrhea
- Skin rash, which appears two to five days after the onset of fever
- Mild bleeding (such a nose bleed, bleeding gums, or easy bruising).



Sometimes, dengue fever symptoms are mild and can be mistaken for those of the flu or another viral infection. Younger children and people who have never had the infection before tend to have milder cases than older children and adults.

However, serious problems can develop. These include dengue hemorrhagic fever, a rare complication characterized by high fever, damage to lymph and blood vessels, bleeding from the nose and gums, enlargement of the liver, and failure of the circulatory system. The symptoms may progress to massive bleeding, shock, and death. This is called dengue shock syndrome (DSS).

Dengue haemorrhagic fever

Symptoms of dengue haemorrhagic fever

People with acute DHF usually have an acute high fever, face redness, headaches and an aching body, followed by skin bleeding (petechiae) from various points, including the arms and legs. They may also lose their appetite, vomit, feel nauseous, develop stomach pain. They don't want to drink any fluids and generally feel down, depressed and don't want to speak with anyone.

Some patients may also suffer from nosebleeds, pass black stools or vomit blood. People with DHF do not usually present any symptoms of a common cold, including coughing. The most dangerous time is the period when the fever begins to decrease after around 2-7 days. Only 2-3 % of patients develop shock which can lead to death if they suffer a severe shock or receive late treatment.

Other symptoms include cold hands and feet, discomfort, as well as an increased or decreased pulse rate. In cases where there is a severe drop in blood pressure, shock or death are both possible. Nevertheless, treatment for dengue haemorrhagic fever can be effective where the disease is diagnosed early enough.

Severity of dengue hemorrhagic fever :

The levels of severity for this condition can be categorized into the following four stages:

Grade 1: High fever with no signs of bleeding. At this stage, treatment in the form of drinking plenty of water and frequently dabbing the patient with a damp cloth to alleviate their fever can be effective.

Grade 2: If patients are still able to eat and drink as usual, this stage may not necessitate admission to a hospital. However, if they are unable to eat or drink, they should be brought to hospital to be diagnosed and monitored.

Grade 3: If the patient's pulse is weak, but has rapid pulse rate and they are also suffering from cold hands and feet, pale complexion and severe discomfort, it is a sign of a drop in blood pressure. The patient should be brought in to see a doctor and have vital signs examined immediately.

Grade 4: In cases where there is a serious drop in blood pressure, meaning it is difficult to even take a reading or the patient is suffering from shock, the patient should be brought to hospital immediately.

Some patients may only present grade 1 or 2 symptoms which might not require a stay in hospital. However, some patients have severe grade 3 or 4 symptoms and need to be admitted to hospital for immediate attention.

Diagnosis of Dengue Fever

Doctors can diagnose dengue infection with a blood test to check for the virus or antibodies to it. If you become sick after travelling or living near to people those already having dengue infection, let your doctor know. This will allow your doctor to evaluate the possibility that your symptoms were caused by a dengue infection.

Doctors may suggest a combination of blood tests and imaging tests to diagnose dengue fever infection, because the body's immune response to the virus is complex and dynamic. The dengue infection is difficult to diagnose without laboratory and radiology tests because initially symptoms may be the same as other diseases, such as malaria.

Tests may include:

Complete blood count (CBC or CBP) - to check the platelet count typical of the later stages of the illness and to detect the decrease in hematocrit, hemoglobin, and red blood cell (RBC) count (evidence of anemia) that would occur with blood loss associated with severe dengue fever.

Dengue Serology Test (Dengue IgG & IgM) - to detect antibodies produced by the immune system when a person has been exposed to the virus; these tests are most effective when performed at least 4 days after exposure in both primary and secondary infections.

Dengue Virus Antigen Detection (NS1) - to confirm Dengue viral infection. This test is useful to diagnose early dengue infection and can be conducted within 1-2 days following Dengue infection.

In case of severe symptoms Doctors may suggest other blood test and radiology imaging test to know the spread of dengue infection to other organs,

Treatment

There is no specific treatment for dengue. The focus is on treating pain symptoms.

Acetaminophen (paracetamol) is often used to control pain. Non-steroidal anti-inflammatory drugs like ibuprofen and aspirin are avoided as they can increase the risk of bleeding.

There is a vaccine called Dengvaxia for people who have had dengue at least once and live in places where the disease is common. For people with severe dengue, hospitalization is often needed.

Prevention and control

The mosquitoes that spread dengue are active during the day. Lower the risk of getting dengue by protecting yourself from mosquito bites by using:

- clothes that cover as much of your body as possible
- mosquito nets if sleeping during the day, ideally nets sprayed with insect repellent
- window screens
- mosquito repellents (containing DEET, Picaridin or IR3535)
- coils and vaporizers.

If you get dengue, it's important to:

- rest
- drink plenty of liquids
- use acetaminophen (paracetamol) for pain
- avoid non-steroidal anti-inflammatory drugs, like ibuprofen and aspirin
- watch for severe symptoms and contact your doctor as soon as possible if you notice any.

Precision Medicine

Most medical treatments are designed for the "average patient" as a one-size-fits-all-approach, which may be successful for some patients but not for others. Precision medicine, sometimes known as "personalized medicine" is an innovative approach to tailoring disease prevention and treatment that considers differences in people's genes, environments, and lifestyles. The goal of precision medicine is to target the right treatments to the right patients at the right time.

In cancer, precision medicine most often means looking at how changes in certain genes or proteins in a person's cancer cells might affect their care, such as their treatment options. But it can have other uses as well.

In precision medicine, doctors use information from certain lab tests to put together a plan of care that usually includes specific recommendations. In some cases, it can help make a more accurate diagnosis and improve treatment. In other cases, it can help people make decisions about healthy habits, earlier screening tests, and other steps they can take that might help lower their risk for a particular cancer.

Your health care providers might not use the exact words "precision medicine" or "personalized medicine." Instead, they might talk to you about genetic, genomic, DNA, or molecular testing. Or they might talk about checking for biomarkers or getting a genetic profile. These are ways doctors and other health care providers might use a precision medicine approach when they are planning your care.

Precision medicine in cancer care

Advances in precision medicine have already led to powerful new discoveries and FDA-approved treatments that are tailored to specific characteristics of individuals, such as a person's genetic makeup, or the genetic profile of an individual's tumor. Patients with a variety of cancers routinely undergo molecular testing as part of patient care, enabling physicians to select treatments that improve chances of survival and reduce exposure to adverse effects.

Precision medicine is being used for certain cancers to help know what tests and treatment are best.

Doctors might use precision medicine to help them:

- Identify people who might be at high risk for cancer, and help these people lower their risk
- Find certain cancers early
- Diagnose a specific type of cancer correctly
- Choose which cancer treatment options are best
- Evaluate how well a treatment is working

Cancer diagnosis

For people with some types of cancer, their cancer cells might be tested for changes in certain genes (or for proteins made because of these gene changes). This testing can provide information about their cancer, including how it grows and spreads.

These tests can go by many names, including:

- Biomarker testing
- Tumor testing, tumor genetic testing, tumor marker testing, or tumor subtyping
- Genomic testing, genomic profiling, or genome sequencing
- Molecular testing or molecular profiling
- Somatic testing
- Next generation sequencing

For some types of cancer, testing the cancer cells for certain gene or protein changes can affect treatment options.

Having certain gene or protein changes can affect how a cancer responds to certain treatments. Some people's cancers have gene changes that are different from those in other people, even if they have the same type of cancer. For example, not every melanoma skin cancer has the exact same gene mutations, so these cancers don't always respond to a treatment the same way.

Before starting treatment, doctors can test the cancer cells for certain gene and protein changes to help determine which treatments are likely to work best. The goal is to give treatments that are most likely to work, while avoiding giving treatments that might not work.

The two types of treatment most often used in precision medicine are targeted drug therapy (drugs designed to attack a specific target on cancer cells) and immunotherapy (medicines used to help the body's immune system attack the cancer).

Types of cancer where precision medicine is used.

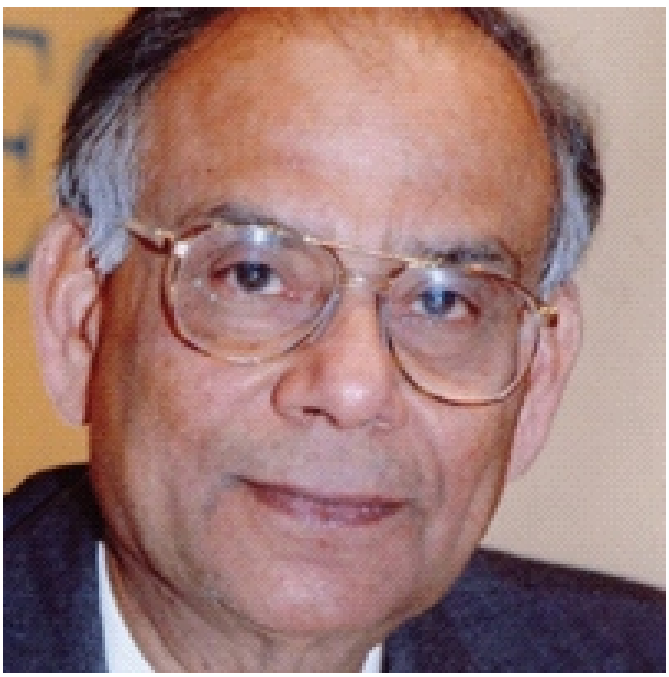
It's important to understand that precision medicine is not yet used for every type of cancer. However, the hope is that one day, treatments will be customized to the specific gene and protein changes in each person's cancer. A great deal of research is being done in this area.

Common cancers where precision medicine is being used to help with treatment decisions include:

- Colorectal cancer
- Breast cancer
- Lung cancer
- Certain types of leukaemia
- Certain types of lymphoma
- Melanoma
- Esophageal cancer
- Stomach cancer
- Ovarian cancer
- Thyroid cancer

Access to the latest precision medicine approaches might be limited in some places. A lot still needs to be learned about how precision medicine can be used in cancer care. Researchers are trying to fill those gaps, both in lab studies and in clinical trials.

Prof. Ananda Mohan Chakrabarty: The Superbug Superhero!



Nandipur (now Sainthia) had been a little-known place in Birbhum district, West Bengal, India, until Prof. Chakrabarty was born there on 4th day of April 1938, to Shri Satya Dos and Smt. Sasthi Bala (Mukherjee) Chakrabarty. He was born in a middle class family and was the youngest among seven children. He completed his schooling at Sainthia High School and Ramakrishna Mission Vidyamandira. Prof. Chakrabarty completed his B. Sc. Degree from St. Xavier's College in 1958, and M. Sc. from Calcutta University, India in 1960. He completed his Ph D. from the Calcutta University itself in 1965. Soon after his Ph D., he moved to University of Illinois for research assignment (1965–1971); and later joined General Electric Research and Development Center, Schenectady, United States (1971–1979). He was appointed as Professor at the Department of Microbiology, University of Illinois, Chicago in 1979, and continued to serve the same department as Distinguished Professor up to 1989.

In 1971, Prof. Chakrabarty got notable recognition for development of a genetically engineered Pseudomonas, “an oil eating bacteria” also known as “superbug” while working at General Electric Research and Development Center. He invented a method of genetic cross-linking to transfer genes required for degradation of oil using plasmid transfer technique and as a result produced a new stable bacterial species (now known as Pseudomonas putida). He called it as a “multi-plasmid hydrocarbon-degrading Pseudomonas” which was capable of digesting two thirds of hydrocarbons found in typical oil spill and that too faster (about one or two orders of magnitudes) than previously existing strains of oil-eating microbes This discovery became a biological remedy for removing oil pollution especially during disastrous oil spills and leakages in marine ecosystems.

Later, he applied for a patent on this breakthrough technique which was the first ever on any living entity. However, it was initially denied and was then challenged in Court of Customs and Patents Appeals Office and finally in the Supreme Court. Prof. Chakrabarty argued that a living being must not always be naturally occurring and, in this case, the bacteria Pseudomonas was genetically engineered and hence can be claimed for filing a patent. After nine years of struggle, in 1980, he finally received his much deserving fame over settlement of this legal suite over patent and it was awarded to him after ruling of Supreme Court. In this way, he paved new gateways for bio-patenting of genetically modified microorganisms and other lifeforms and is rightfully called as 'Father of Patent Microbiology'. This also paved the way for bioremediation as a full-fledged industry. Since then, he took several advisory roles on such legal issues and served as member of many prestigious committees.

The never ending thrust for research has translated in many significant research contributions of Prof. Chakrabarty, in wide range of areas of biotechnology. Apart from his revolutionary discovery of 'bioengineered superbug', he has also achieved several other milestones including development of promiscuous bacterial protein/peptide based anti-cancer, anti-viral and anti-parasitic drugs. He discovered a bacterial periplasmic protein azurin from Pseudomonas aeruginosa with potent antineoplastic properties (Chakrabarty 2003, 2010). He co-founded two startup companies named CDG Therapeutics Inc., in Chicago and Amrita Therapeutics in India to develop vaccines, therapies and diagnostics specially for cancer and several other diseases. Based on his work at University of Illinois, Chicago, there are several US patents that have been issued and CDG Therapeutics Inc. holds its proprietary information. His patents on “cytoxic factors for modulating cell death” showed that different pathogens possess cytotoxic factors having anti-cancerous properties that can be used in preventing necrosis and apoptosis related conditions during infectious disease like cancer. Another patent on “cupredoxin derived transport agents and methods of use thereof” presented the methods and materials for delivering a cargo compound into a cancer cell using protein transduction domains derived from cupredoxins. Similarly, his patent on “transport agents for crossing the blood–brain barrier and into brain cancer cells, and methods of use thereof “ dealt with diagnosing and treating cancer particularly of brain as well as other brain related conditions. Another patent on “compositions and methods to control angiogenesis with cupredoxins” is related to the use of cupredoxins to repress the process of tumor-related angiogenesis in mammalian cells and tissues. Apart from these, there are many other patents in his name which include: compositions and methods to prevent cancer with cupredoxins], compositions and methods for treating conditions related to ephrin signaling with cupredoxins compositions and methods for treating HIV infection with cupredoxin and cytochrome 'c' , compositions and methods for treating malaria with cupredoxin and cytochrome

Prof. Chakrabarty was one of the founding members of United Nations Industrial Development Organization Committee which laid foundation of International Centre for Genetic Engineering & Biotechnology (ICGEB). He also assisted the Stockholm Environment Institute of Sweden. He was a member of NATO Industrial Advisory Group, Brussels, Belgium and member of

Board of Directors of The Einstein Institute for Science Health and the Courts (EINSHAC) now known as National Courts and Sciences Institute (NCSI), United States. He was awarded as the Scientist of the Year by Industrial Research Organization of the United States in the year 1975. He also received various awards including Inventor of the Year award, Patent Lawyers' Association, 1982, Public Affairs award, American Chemical Society, 1984, Distinguished Scientist award, Environmental Protection Agency, 1985, Pasteur Award, 1991, Procter and Gamble Environmental Biotechnology Award by American Society for Microbiology (ASM). In the year 2007 for his contributions in the field of genetic engineering he was awarded Padma Shri by the Government of India

From being a policy maker for biological products to being a legal advisor to judges of Supreme Court, Prof. Anand Mohan Chakrabarty always aimed to help and serve scientific community and humankind. He strived to prioritize patent oriented research and to make biotechnological products marketable. He also emphasized that every research and development organization should establish a patent cell. An extremely gentle, down to earth person, who has been an innovative thinker, philosopher and ready to accept challenges with result oriented out-of-the-box solutions, shall always be the reflection of his personality. We hope and pray that his immortal presence shall keep on inspiring the microbiologists and scientists of all over the world, forever!

Jokes

A Miracle?

Patient: "Will I be able to play the piano after this operation?"

Nurse: "Sure! Of course!"

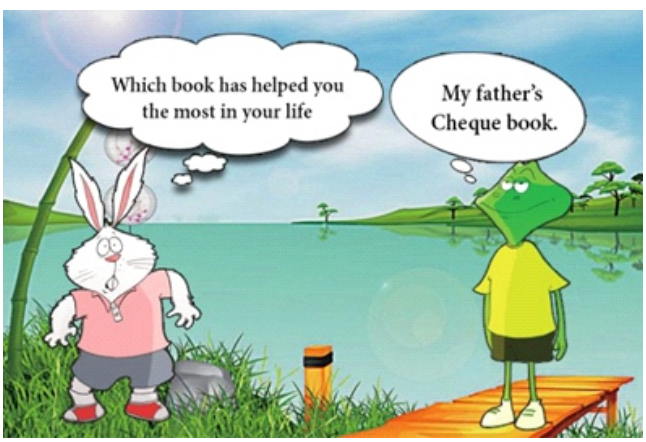
Patient: "That's awesome because I couldn't before!"

Teacher: If I lay one egg here and another there, how many eggs will there be?

Fred: None!

Fred (surprised): Why not?

Fred: Because you cant lay eggs!



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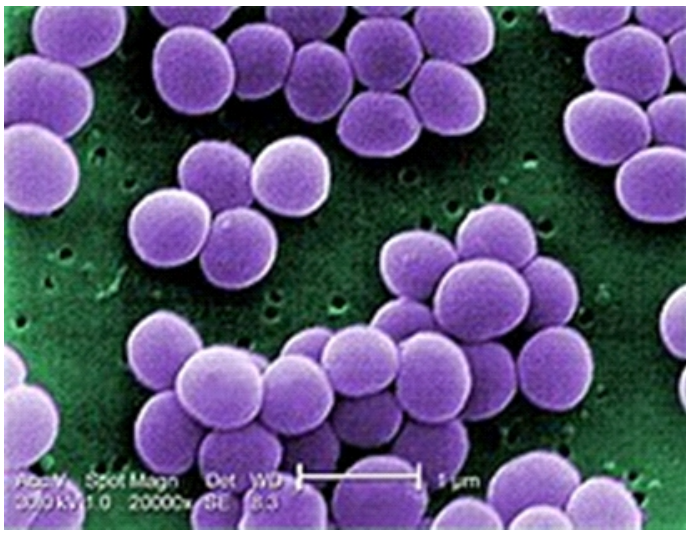
Mother : Susie, how was the play you attended at the theatre? Did it have a happy ending?

Susie : Yes, in a way. Everybody was very happy when it finally ended.

Staphylococcus aureus



Staphylococcus aureus is a Gram-positive spherically shaped bacterium, a member of the Bacillota, and is a usual member of the microbiota of the body, frequently found in the upper respiratory tract and on the skin. It is often positive for catalase and nitrate reduction and is a facultative anaerobe that can grow without the need for oxygen. Although *S. aureus* usually acts as a commensal of the human microbiota, it can also become an opportunistic pathogen, being a common cause of skin infections including abscesses, respiratory infections such as sinusitis, and food poisoning. Pathogenic strains often promote infections by producing virulence factors such as potent protein toxins, and the expression of a cell-surface protein that binds and inactivates antibodies. *S. aureus* is one of the leading pathogens for deaths associated with antimicrobial resistance and the emergence of antibiotic-resistant strains, such as methicillin-resistant *S. aureus* (MRSA), is a worldwide problem in clinical medicine. Despite much research and development, no vaccine for *S. aureus* has been approved.

An estimated 20% to 30% of the human population are long-term carriers of *S. aureus*, which can be found as part of the normal skin flora, in the nostrils, and as a normal inhabitant of the lower reproductive tract of females. *S. aureus* can cause a range of illnesses, from minor skin infections, such as pimples, impetigo, boils, cellulitis, folliculitis, carbuncles, scalded skin syndrome, and abscesses, to life-threatening diseases such as pneumonia, meningitis, osteomyelitis, endocarditis, toxic shock syndrome, bacteremia, and sepsis. It is still one of the five most common causes of hospital-acquired infections and is often the cause of wound infections following surgery.

S. aureus, is a facultative anaerobic, Gram-positive coccal (round) bacterium also known as "golden staph" and "oro staphira". *S. aureus* is nonmotile and does not form spores. *S. aureus* appears as staphylococci (grape-like clusters) when viewed through a microscope, and has large, round, golden-yellow colonies, often with hemolysis, when grown on blood agar plates. *S. aureus* reproduces asexually by binary fission. Complete separation of the daughter cells is mediated by *S. aureus* autolysin, and in its absence or targeted inhibition, the daughter cells remain attached to one another and appear as clusters.

S. aureus is catalase-positive (meaning it can produce the enzyme catalase). Catalase converts hydrogen peroxide to water and oxygen. Catalase-activity tests are sometimes used to distinguish staphylococci from enterococci and streptococci. Previously, *S. aureus* was differentiated from other staphylococci by the coagulase test. However, not all *S. aureus* strains are coagulase-positive and incorrect species identification can impact effective treatment and control measures.

Natural genetic transformation is a reproductive process involving DNA transfer from one bacterium to another through the intervening medium, and the integration of the donor sequence into the recipient genome by homologous recombination. *S. aureus* was found to be capable of natural genetic transformation, but only at low frequency under the experimental conditions employed. Further studies suggested that the development of competence for natural genetic transformation may be substantially higher under appropriate conditions, yet to be discovered.

In humans, *S. aureus* can be present in the upper respiratory tract, gut mucosa, and skin as a member of the normal microbiota. However, because *S. aureus* can cause disease under certain host and environmental conditions, it is characterized as a "pathobiont".

While *S. aureus* usually acts as a commensal bacterium, asymptomatically colonizing about 30% of the human population, it can sometimes cause disease. In particular, *S. aureus* is one of the most common causes of bacteraemia and infective endocarditis. Additionally, it can cause various skin and soft-tissue infections, particularly when skin or mucosal barriers have been breached.

S. aureus infections can spread through contact with pus from an infected wound, skin-to-skin contact with an infected person and contact with objects used by an infected person such as towels, sheets, clothing, or athletic equipment. Joint replacements put a person at particular risk of septic arthritis, staphylococcal endocarditis (infection of the heart valves), and pneumonia.

Preventive measures include washing hands often with soap and making sure to bathe or shower daily.

S. aureus is a significant cause of chronic biofilm infections on medical implants, and the repressor of toxins is part of the infection pathway.

S. aureus can lay dormant in the body for years undetected. Once symptoms begin to show, the host is contagious for another two weeks, and the overall illness lasts a few weeks. If untreated, though, the disease can be deadly. Deeply penetrating *S. aureus* infections can be severe.

Depending upon the type of infection present, an appropriate specimen is obtained accordingly and sent to the laboratory for definitive identification by using biochemical or enzyme-based tests. A Gram stain is first performed to guide the way, which should show typical Gram-positive bacteria, cocci, in clusters. Second, the isolate is cultured on mannitol salt agar, which is a selective medium with 7.5% NaCl that allows *S. aureus* to grow, producing yellow-colored colonies as a result of mannitol fermentation and subsequent drop in the medium's pH.

Furthermore, for differentiation on the species level, catalase (positive for all *Staphylococcus* species), coagulase (fibrin clot formation, positive for *S. aureus*), DNAse (zone of clearance on DNase agar), lipase (a yellow color and rancid odor smell), and phosphatase (a pink color) tests are all done. For staphylococcal food poisoning, phage typing can be performed to determine whether the staphylococci recovered from the food were the source of infection.

For susceptible strains, the treatment of choice for *S. aureus* infection is penicillin. An antibiotic derived from some *Penicillium* fungal species, penicillin inhibits the formation of peptidoglycan cross-linkages that provide the rigidity and strength in a bacterial cell wall. The four-membered β-lactam ring of penicillin is bound to enzyme DD-transpeptidase, an enzyme that when functional, cross-links chains of peptidoglycan that form bacterial cell walls. The binding of β-lactam to DD-transpeptidase inhibits the enzyme's functionality and it can no longer catalyze the formation of the cross-links. As a result, cell wall formation and degradation are imbalanced, thus resulting in cell death. In most countries, however, penicillin resistance is extremely common (>90%), and first-line therapy is most commonly a penicillinase-resistant β-lactam antibiotic (for example, oxacillin or flucloxacillin, both of which have the same mechanism of action as penicillin) or vancomycin, depending on local resistance patterns. Combination therapy with gentamicin may be used to treat serious infections, such as endocarditis, but its use is controversial because of the high risk of damage to the kidneys. The duration of treatment depends on the site of infection and on severity. Adjunctive rifampicin has been historically used in the management of *S aureus* bacteraemia, but randomised controlled trial evidence has shown this to be of no overall benefit over standard antibiotic therapy.

Antibiotic resistance in *S. aureus* was uncommon when penicillin was first introduced in 1943. Indeed, the original Petri dish on which Alexander Fleming of Imperial College London observed the antibacterial activity of the *Penicillium* fungus was growing a culture of *S. aureus*. By 1950, 40% of hospital *S. aureus* isolates were penicillin-resistant; by 1960, this had risen to 80%.

Methicillin-resistant Staphylococcus aureus (MRSA) is one of a number of greatly feared strains of *S. aureus* which have become resistant to most β-lactam antibiotics. For this reason, vancomycin, a glycopeptide antibiotic, is commonly used to combat MRSA. Vancomycin inhibits the synthesis of peptidoglycan, but unlike β-lactam antibiotics, glycopeptide antibiotics target and bind to amino acids in the cell wall, preventing peptidoglycan cross-linkages from forming. MRSA strains are most often found associated with institutions such as hospitals but are becoming increasingly prevalent in community-acquired infections.

Minor skin infections can be treated with triple antibiotic ointment. One topical agent that is prescribed is Mupirocin, a protein synthesis inhibitor that is produced naturally by Pseudomonas fluorescens and has seen success for treatment of S. aureus nasal carriage.

An important and previously unrecognized means of community-associated MRSA colonization and transmission is during sexual contact.

S. aureus is killed in one minute at 78 °C and in ten minutes at 64 °C but is resistant to freezing.

Certain strains of *S. aureus* have been described as resistant to chlorine disinfection.

The use of mupirocin ointment can reduce the rate of infections due to nasal carriage of *S. aureus.* There is limited evidence that nasal decontamination of *S. aureus* using antibiotics or antiseptics can reduce the rates of surgical site infections.

New spray fights infections and antibiotic resistance

The World Health Organization (WHO) ranks antibiotic resistance as one of the top ten threats to global health. There is therefore a great need for new solutions to tackle resistant bacteria and reduce the use of antibiotics. A group of researchers at Chalmers University of Technology in Sweden are now presenting a new spray that can kill even antibiotic-resistant bacteria, and that can be used for wound care and directly on implants and other medical devices. "Our innovation can have a dual impact in the fight against antibiotic resistance. The material has been shown to be effective against many different types of bacteria, including those that are resistant to antibiotics, such as Methicillin-resistant Staphylococcus aureus (MRSA), while also having the potential to prevent infections and thus reduce the need for antibiotics," says Martin Andersson, head of research for the study and professor at the Department of Chemistry and Chemical Engineering at Chalmers. It is already estimated that antibiotic-resistant bacteria cause nearly 1.3 million deaths a year worldwide. As part of the effort to slow down the spread and development of drug resistance, researchers at Chalmers are developing a new antibacterial material that can be used in health care and become an effective tool to fight antibiotic resistance. The material consists of small hydrogel particles equipped with a type of peptide that effectively kills and binds bacteria. Attaching the peptides to the particles provides a protective environment and increases the stability of the peptides. This allows them to work together with body fluids such as blood, which otherwise inactivates the peptides, making them difficult to use in health care. In previous studies, the researchers showed how the peptides can be used for wound care materials such as wound dressings. They have now published two new studies in which the bactericidal material is used in the form of a wound spray and as a coating on medical devices that are introduced into our bodies. This new step in the research means that the innovation can be used in more ways and be of even greater benefit in health care.

Kills bacteria without adversely affecting wound healing The wound spray, which can reach into deep wounds and other open areas on the body where bacteria can enter, is flexible and very useful for treating and preventing infection. The new material has many advantages over existing sprays and disinfectants "The substance in this wound spray is completely non-toxic and does not affect human cells. Unlike existing bactericidal sprays, it does not inhibit the body's healing process. The materials, which are simply sprayed onto the wound, can also kill the bacteria in a shorter time," says Edvin Blomstrand, an industrial doctoral student at the Department of Chemistry and Chemical Engineering at Chalmers University of Technology and one of the lead authors of the scientific article. Reduces the risk of infection from materials introduced into the body For treatments in which materials such as implants and catheters are inserted into our bodies, infections are a major problem. Therefore, there is great need for new antibacterial biomaterials, i.e., materials that treat, replace or modify organs, tissue or functions in a biological body. One of the major sources for hospital-acquired infection comes from the usage of urinary catheters. The Chalmers researchers' new coating can now be an effective new tool for reducing this risk and preventing infections. "Although the catheters are sterile when unpacked, they can become contaminated with bacteria while they are being introduced into the body, which can lead to infection. One major advantage of this coating is that the bacteria are killed as soon as they come into contact with the surface. Another is that it can be applied to existing products that are already used in health care, so it is not necessary to produce new ones," says Annija Stepulane, a doctoral student at the Department of Chemistry and Chemical Engineering at Chalmers and one of the lead authors of the article. In the study, the researchers tested the coating on silicone materials used for catheters, but they see opportunities to use it on other biomaterials. Research in parallel with product development The research on the antibacterial materials is being conducted in collaboration with the spin-off company Amferia AB, which is also commercializing the technology. Chalmers and Amferia have previously presented the antibacterial material in the form of hydrogel wound dressings, which are presently under clinical investigation for both human and animal wound care. More about the research and the new materials The beneficial properties of antimicrobial peptides have been known for many years. They exist in thousands of different variants in the natural immune systems of humans, animals and plants, and researchers have long sought to mimic and harness the peptides to prevent and treat infection. In their natural state, these peptides are rapidly broken down when they come into contact with body fluids such as blood, which makes their direct clinical use difficult. In the materials the researchers are developing, they have solved this problem by binding the peptides to particles. For both the spray and the coating, they have been able to measure that the bactericidal effect of the materials lasts for up to 48 hours in contact with body fluids and as long as a few years without contact with body fluids. The researchers have shown that 99.99% of bacteria are killed by the material and that the bactericidal capacity is active for approximately 48 hours, enabling its use in a wide range of clinical applications. Since the materials are non-toxic, they can be used directly on or in the body, preventing or curing an infection without adversely affecting the natural healing process.

Environmental hygiene

The environment compasses not only the natural surroundings - air, water, plants, and animals used for food - but also shelter, modes of transportation and all other products of technology, including pollutants and waste materials; all of which interact to affect health.

Environmental hygiene can be looked at from two aspects, Hygiene at household level and Hygiene at the community level.

Hygiene at household level

Good-quality housing is a key element for ensuring a healthy community. Poor housing can lead to many health problems, and is associated with infectious, diseases (such as tuberculosis), stress and depression. Everyone should therefore have access to good-quality housing and a pleasant home environment that makes them happy and content. Specific aspects of housing quality include ventilation, lighting, general cleanliness of homes, overcrowding in homes, etc.

Ventilation: Adequate home ventilation is particularly important, Ventilation may be improved by constructing houses with enough windows, particularly in cooking areas.

Lighting: Poor indoor lighting can have many harmful effects on health and well-being. A poorly lit working environment in the home can lead to eyesight problems. Increasing natural light is also important for home cleanliness: if a house is dark, it is more difficult to see dust and dirt and thus more difficult to clean properly.

Disease vectors in the home: Unless homes are kept clean and steps taken to prevent insects from entering, the homes can become infested with disease (vectors). Insect disease vectors can be reduced by keeping food covered and properly disposing of waste. If mosquitoes or flies are a problem, windows and doors should be covered with mesh screens and kept shut at night, and mosquito nets placed over beds. Cleanliness within and around home areas significantly reduces the risk of disease transmission.

Overcrowding in homes: Overcrowding in homes causes ill-health because it makes disease transmission easier and because the lack of private space causes stress.

Hygiene at the community level

According to the World Health Organization (WHO), good health is not merely the absence of disease it is also a reflection of the social and mental well-being of people in a community.

Thus, to achieve the WHO goal of providing health for all, improvements in a community should aim not simply to reduce disease, but also to reduce social tensions and mental ill-health to acceptable levels.

Many factors influence health, and some may have both good and bad influences. For example, surface water bodies can be beneficial as they can supply water for domestic and agricultural work, may be used for fishing and recreation, and can create a pleasant environment. However, they can also be breeding areas for insects and snails that transmit diseases such as malaria, dengue fever and schistosomiasis. Pollution of water bodies by humans also increases the risks to health. Factors that influence health can be grouped as follows:

- The environment: The environment includes both the physical environment we live in and the social fabric of the community, both significantly influence health. A clean environment helps prevent the spread of disease and may reduce depression. For example, safe and adequate water supplies, sanitation, drainage and solid waste disposal all benefit health by removing disease vectors from human contact. Dirty environments, by contrast, encourage the spread of disease and may adversely influence the mental and emotional well-being of individuals.

- The awareness of individuals and communities about health: The awareness of individuals about health is fundamental. If people do not understand the causes of ill-health and how they can improve their health, they cannot make decisions about investing resources and time to improvement or about lobbying for outside assistance. Such awareness should be developed in all areas that influence health.

- Personal hygiene: Personal hygiene is essential both for improving health and for sustaining the benefits of interventions. For example, if injuries

and minor cuts are not kept clean, they may become infected and lead to further health problems. And even though water supplies and sanitation facilities may be constructed in a community, unless people use these facilities properly and wash their hands after defecation, store water safely, bathe, and clean clothes and utensils properly, diseases caused by poor water and sanitation may still exist.

- Disease: Many diseases are caused by food, water and hands that are contaminated by disease-causing organisms or "pathogens" that come from faeces. The diseases caused by these pathogens are called faecal–oral diseases because faecal material is ingested. These diseases, which include dysentery, cholera, giardiasis, typhoid and intestinal worm infections, are responsible for much sickness and many deaths each year. Good quality drinking-water and good personal hygiene in food preparation and handling are therefore of utmost importance in preventing the spread of these diseases.

- Diseases transmitted by vectors such as mosquitoes (malaria) and sandflies (leishmaniasis) and those with intermediate hosts in fresh water such as snails (schistosomiasis) place a heavy burden on communities. They are closely linked to the characteristics of the local ecology (e.g. standing water or irrigation systems), human behaviour (water contact patterns) and socioeconomic status (capacity to maintain a clean environment). Since the flight range of most disease-carrying insects is relatively limited and the transmission of schistosomiasis is restricted to water contact points, communities can make substantial contributions towards making community healthier by managing their environment; by using simple vector control procedures; and by cleaning the community and its surroundings.

Highlights of the coming issue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