JOURNAL OF
HYGIENE SCIENCES
Committed to the advancement of Clinical & Industrial Disinfection & Microbiology
VOLUME - X ISSUE - VI FEB - MARCH 2018

Editorial

Contents

We would like to thank all our readers for their precious inputs & encouragement in making this Journal a successful effort. Here's another issue of JHS coming your way……..

Mini review section – In the previous article (issue1 and 2), we have discussed the antibacterial agents and their mode of action on the bacterial cell-wall. In this current issue, we shall continue to discuss other important cell-wall active agents which in addition play a vital role in defense mechanism of the immune system and finally conclude and summarize the topic.

Current Trends section - Enzyme cleaners are made using a few specific enzymes that break down biological substances like fats, oils, proteins, and starches .Enzyme cleaners break down those stains into elements like oxygen, hydrogen, and carbon. Enzyme cleaners are non-toxic and biodegradable, meaning they are safe to use in any area.

In Profile Scientist – "**Dr. John L. Leal** " He claimed that chlorine was not responsible for killing bacteria. Instead, he put forth the long-standing theory that chlorine when added to water liberated something called nascent oxygen, and it was the nascent oxygen was responsible for disinfection.

Bug of the month - *L. plantarum*, typically found in protein-rich environments like yogurt, has uptake systems for peptides. *L. plantarum* is a facultative heterofermentative that ferments sugars to produce lactic acid, ethanol or acetic acid, and carbon dioxide under certain conditions and selective substrates. *L. plantarum* is considered a probiotic because it secretes antimicrobial compounds, such as bacteriocin, that inhibit pathogenic gram-positive and gram-negative colonies from forming.

Did You Know? "Health benefits of Asparagus" There are plenty of reasons to fill your plate with more of this spring superfood. The bright-green veggie is packed with good-for-you vitamins and minerals like vitamins A, C, E, K, and B6, as well as folate, iron, copper, calcium, protein, and fiber. Thanks to all these nutrients, asparagus offers some serious health perks.

Best Practices - Hemodialysis systems include hemodialysis machines, water supply, water-treatment systems, and distribution systems. During hemodialysis, patients have acquired bloodborne viruses and pathogenic bacteria . Cleaning and disinfection are important components of infection control in a hemodialysiscenter. EPA and FDA regulate disinfectants used to reprocess hemodialyzers, hemodialysis machines, and water-treatment systems.

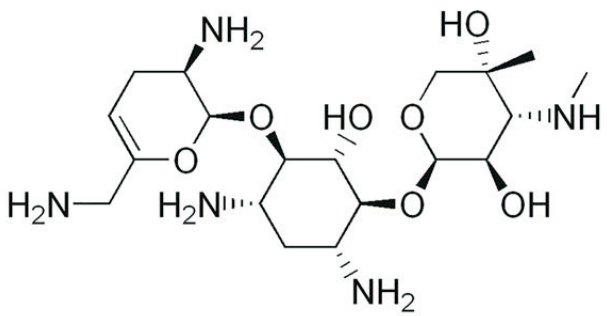
Have a light humour with some jokes in our Relaxed Mood section. Feedback & suggestions are always welcomed.

Common Antibacterial Agents Grouped by Mechanism of Activity (Issue 3)

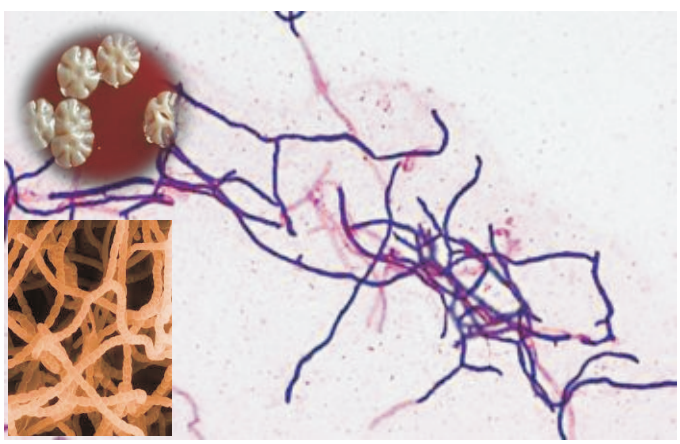
In the previous article (issue1 and 2), we have discussed the antibacterial agents and their mode of action on the bacterial cell-wall. This was further explained in the context of the antibiotics that inhibits cell-wall synthesis, such as the β-lactam antibiotics that have emerged into broad spectrum agents that inhibit most pathogenic bacteria, which includes penicillins and cephalosporins.

In this current issue, we shall continue to discuss other important cell-wall active agents which in addition play a vital role in defense mechanism of the immune system and finally conclude and summarize the topic.

III. Antibiotics That Inhibit Protein Synthesis



Aminoglycoside is a medicinal and bacteriologic category of traditional gram-negative antibacterial therapeutic agents that inhibit protein synthesis and contain as a portion of the molecule an amino-modified glycoside (sugar) (Levison, 2012). Aminoglycoside also refers generally to any organic molecule that contains amino-sugar sub-structures.



Streptomyces griseus

Aminoglycoside antibiotics display bactericidal activity against gram-negative aerobes and some anaerobic bacilli where resistance has not yet arisen but generally not against gram-positive and anaerobic gram-negative bacteria. It is commonly used to treat serious infections caused by many gram-negative bacilli and some gram-positive organisms. *Streptococci* and anaerobes are resistant to aminoglycosides. In 1943, a strain of *Streptomyces griseus* was isolated that elaborated streptomycin. Further strains of *Streptomyces* species furnished neomycin, kanamycin, tobramycin, amikacin and *Micromonospora* organisms produced gentamycin and netilmicin. They inhibit protein synthesis and act directly on the 30S subunit of the ribosome. Because aminoglycosides are poorly absorbed after oral administration, they are injected intramuscularly or intravenously.

Detailed analysis of streptomycin suggests three specific protein synthesis inhibition mechanisms:

1. Interference with "initiation complex" of peptide formation
2. Causing misreading of mRNA which results in incorrect amino acid incorporation
3. Promotion of polysomal dissociation into non-functional monosome.

These combined effects, occurring at the same time, are probably responsible for aminoglycoside bacteriocidal properties.

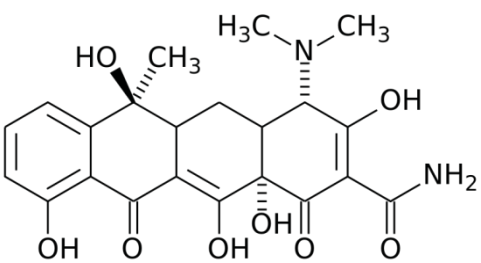
Spectrum of activity and clinical uses: gram-negative enteric bacteria especially if the microbe is suspected to be a drug-resistant isolate or sepsis may be present. Nearly, always used in combination with a ß-lactam to extend coverage to possibly gram-positive microbes. Aminoglycosides and ß-lactams are synergistic.

Penicillin-aminoglycoside combinations: bacteriocidal in enterococcal endocarditis, reduces therapy duration for viridans streptococcal and staphylococcal endocarditis.

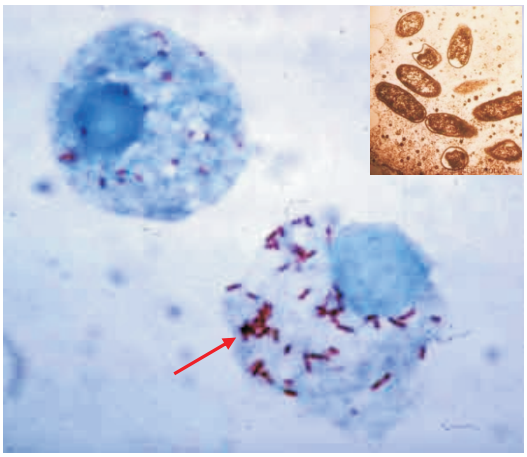
Classic adverse effects of aminoglycosides: They are ototoxic and nephrotoxic. It is in patients receiving a loop diuretic (furosemide) or other nephrotoxic antibiotics (vancomycin) or amphotericin B), worsens the renal toxicity.

Ototoxicity manifests as: tinnitus, high-frequency hearing loss or as vestibular damage leading to vertigo ataxia. Reduced creating clearance and increasing serum creatinine are associated with aminoglycoside-induced renal toxicity. First indications of aminoglycoside renal toxicity may be increased "trough" drug concentrations, reflecting decreasing renal drug clearance. Very high aminoglycoside doses produce neuromuscular blockade (paralysis) which is reversible in early stages by calcium infusion or by neostigmine.

Tetracyclines are broad-spectrum, bacteriostatic antibiotics that inhibit protein synthesis in bacteria by blocking the binding of



tRNA to the 30S ribosomal subunit. They are so named for their four ("tetra-") hydrocarbon rings ("-cycl-") derivation ("-ine"). They are defined as a subclass of polyketides having an octahydrotetracene-2-carboxamide skeleton, therefore they are collectively known as 'derivatives of polycyclic naphthacene carboxamide'.



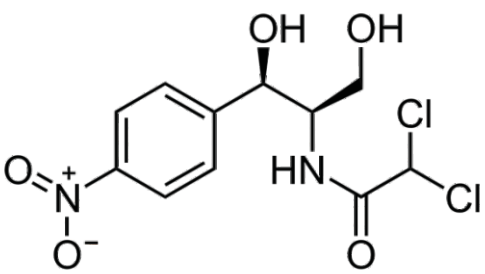
Hemolymph cells infected by R. Rickettsii*

Tetracyclines (e.g., tetracycline, doxycycline, minocycline) are effective in the treatment of infections caused by *Chlamydia*, *Mycobacteria*, *Rickettsia* and other selected aerobic and anaerobic gram-positive and gram-negative bacteria. Tetracyclines are used in the treatment of infections of the urinary tract, respiratory tract, and the intestines and, especially in patients allergic to β-lactams and macrolides.

They are absorbed rapidly from the gastrointestinal tract and distribute widely in most fluids and tissues, localizing particularly in bones and teeth. Because the tetracyclines will cause permanent discoloration of teeth, these antibiotics should not be used in pregnant women or children less than 8 years of age. Mode of protein inhibition by tetracycline is that it binds to 40S ribosomal RNA, blocking the association of amino acid-charged tRNA with its acceptor site on the ribosomal mRNA complex; hence the protein synthesis stops.

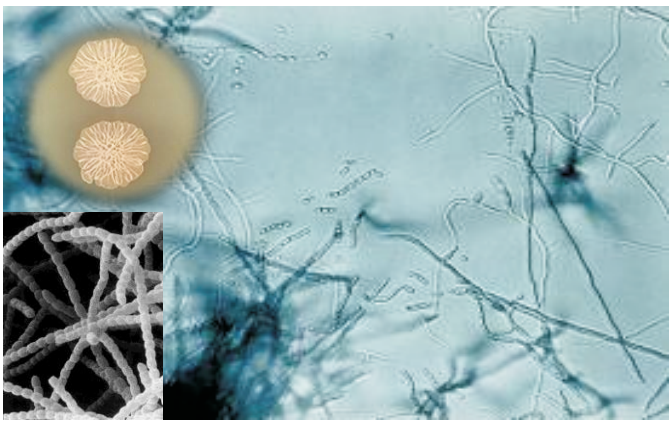
Tetracyclines general usefulness has been reduced with the onset of antibiotic resistance. Despite this, they remain the treatment of choice for some specific indications.

Chloramphenicol, a broad-spectrum, bacteriostatic antibiotic, inhibits bacterial protein synthesis by acting primarily on the 50S ribosomal unit. It was derived from the bacterium *Streptomyces*



venezuelae and is now produced synthetically. It is active against large number of gram-positive and gram-negative organisms, *rickettsiae* and some *chlamydia*, but is considered the drug of choice only for treatment of typhoid fever. The reason for this is, in addition to interfering with bacterial protein synthesis, chloramphenicol disrupts protein synthesis in human bone marrow cells and can produce aplastic anemia.

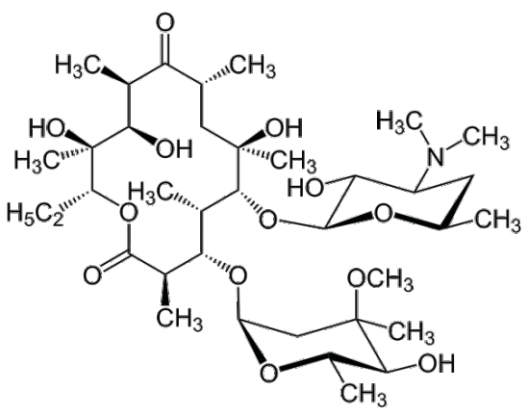
Inhibitors of protein synthesis (IPS): Rationale for targeting of bacterial protein synthesis, relationships between mechanism and therapeutic/adverse effects. Mechanisms of action for aminoglycosides: Chloramphenicol (Chloromycetin), macrolides, and clindamycin (Cleocin) bind to bacterial ribosomal RNA (50S subunit of 70S ribosomal RNA).



Streptomyces venezuelae

Chloramphenicol blocks binding of charged tRNA to its binding site on the ribosomal RNA-mRNA complex. It prevents protein chain elongation by inhibiting the peptidyl transferase activity of the bacterial ribosome. It specifically binds to A2451 and A2452 residues in the 23S rRNA of the 50S ribosomal subunit, as a result, transpeptidation cannot occur and the peptide is not transferred to the amino acid acceptor, thereby preventing peptide bond formation, hence protein synthesis stop.

Macrolides**,** a class of natural products, are a group of related antimicrobials which are protein synthesis inhibitors. They have a common macrocyclic-lactam ring. They consist of a large



macrocyclic lactone ring to which one or more deoxy sugars, usually cladinose and desosamine, may be attached. The lactone rings are usually 14-, 15-, or 16-membered. Macrolides belong to the polyketide class of natural products. Some macrolides have antibiotic or antifungal activity. These are obtained from *Actinomycetes* genus such as *Streptomyces* species.

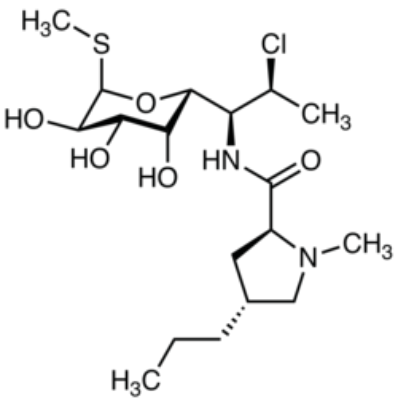
The members of this group include erythromycin, clarithromycin, azithromycin and spiramycin. All the agents have similar antimicrobial spectrum, including gram-positive organisms, *Neisseria*, *Haemophilus* and *Bordetella*, and some gram-negative anaerobes. They are also active against *Mycoplasma* sp., *Rickettsia* sp. and *Toxoplasma gondii*.

Macrolides are protein synthesis inhibitors. These agents disrupt the protein synthesis by binding to the 50S ribosomal subunit. The mechanism of action of macrolides is inhibition of bacterial protein biosynthesis, and they are thought to do this by preventing peptidyl transferase from adding the growing peptide attached to tRNA to the next amino acid (similarly to chloramphenicol) as well as inhibiting ribosomal translation. Another potential mechanism is premature dissociation of the peptidyl-tRNA from the ribosome. Erythromycin is used mainly to treat pulmonary

infections caused by *Mycoplasma*, *Legionella* and gram-positive organisms in patients allergic to penicillins.

Macrolides/Clindamycin: Macrolides and clindamycin (Cleocin) blocks the movement of peptidyl tRNA from the acceptor to the donor site. As a result, the next, incoming tRNA cannot bind to the still occupied acceptor site, as a consequence, protein synthesis stops.

Clindamycin is a semisynthetic derivative of lincomycin, a natural antibiotic produced by the actinobacterium *Streptomyces lincolnensis*. It is obtained by 7(S)-chloro-substitution of the

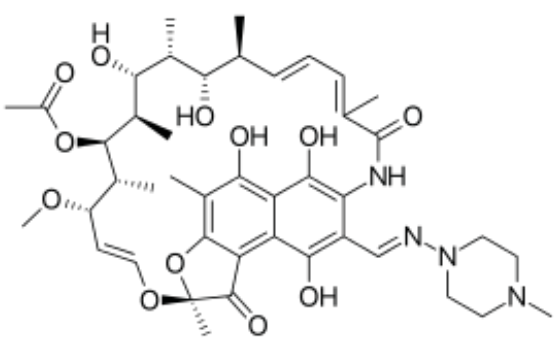


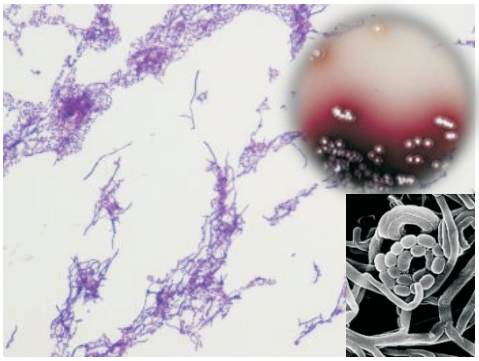
7(R)-hydroxyl group of lincomycin. This antibiotic also blocks protein synthesis by binding to the 50S ribosomal subunit. Clindamycin has a primarily bacteriostatic effect. It is a bacterial protein synthesis inhibitor by inhibiting ribosomal translocation, in a similar way to macrolides. It does so by binding to the 50S rRNA of the large bacterial ribosome subunit, overlapping with the binding sites of the oxazolidinone, pleuromutilin, and macrolide antibiotics, among others. It is active against *staphylococci* and anaerobic gram-negative bacilli but generally inactive against aerobic gram-negative bacteria. Clindamycin can be administered orally or intravenously with good penetration into tissues such as bone. Although intravenous administration of clindamycin is associated with relatively few side effects, oral administration can be responsible for gastrointestinal disturbances ranging from mild diarrhea to life-threatening pseudo-membranous colitis.

IV. Antibiotics That Inhibit Nucleic Acid Synthesis

Rifampin

A semisynthetic derivative of rifamycin B produced by *Streptomyces mediterranei*, bactericidal for *Mycobacterium tuberculosis* and is very active against aerobic gram-positive cocci. Because its resistance can develop rapidly, rifampin is usually combined with one or more other effective antibiotics. The drug inhibits DNA-dependent RNA polymerase.





Streptomyces mediterranei

Quinolones (Fluoroquinolones)

A group of orally effective antibacterial agents are chemically related to nalidixic acid. The number of agents in this group of drugs has risen exponentially, such as, ciprpfloxacin, Enoxacin, ofloxacin, lomefloxacin and others. They are bactericidal against most gram-negative organisms and many gram-positive organisms. The mechanism of action of the quinolones is unique and involves antagonism of the DNA gyrase; the enzyme is involved in DNA synthesis.

Metronidazole

Metronidazole was originally introduced as an oral agent for treatment of *Trichomonas vaginalis*. It is also effective in treatment of amebiasis, giardiasis, and serious anaerobic bacterial infections (including *Bacteroides fragilis*) but has no significant activity against aerobic or facultative anaerobic bacteria. The antimicrobial properties of metronidazole appear to be intermediated, which results in DNA breakage. The drug diffuses well to all tissues, including the central nervous system.

V. Antibiotics with Anti-metabolic Activity

Sulfonamides Assertively, the sulfonamides cannot be classified as antibiotics because they are not produced by living organisms. They may be termed anti-infective or antimicrobials. The introduction of many newer antibiotics limited the use of sulfanamides until the introduction of trimethoprim-sulfomethoxazole combination. This combination is most commonly used for the sulfonamides. Sulfonamides inhibit the synthesis of folic acid in bacteria. Folic acid is required for DNA synthesis. The sulfanamides are similar in structure to para-aminobenzoic acid (PABA) and compete with PABA, then they inhibit the synthesis of folic acid that the most important in the synthesis of bacterial DNA. The sulfonamides are bacteriostatic against many gram-positive and some gram-negative bacteria. The combination of sulfomethoxazole with trimethoprim (SMX-TMP) shows synergistic activity against a wide variety of gram-positive bacteria and some gram-negative bacteria such as *Enterobacteriaceae*, *Pseudomonas* spp., *Haemophilus influenzae*, *S.aureus*, *S.pyogenes*, and *S.pneumoniae*. SMX-TMP is indicated in the treatment of selected urinary tract infections and selected respiratory and gastrointestinal infections.

Isoniazid drug is an anti-metabolite with specific toxicity for mycobacteria and which has long been used in combination with rifampin or streptomycin in the treatment of tuberculosis. It is administered as a pro-drug, requiring activation through the action of an intracellular bacterial peroxidase enzyme, forming isoniazid-nicotinamide adenine dinucleotide (NAD) and isoniazid-nicotinamide adenine dinucleotide phosphate (NADP), ultimately preventing the synthesis of mycolic acid, which is

essential for mycobacterial cell walls. Possible side effects of isoniazid use include hepatotoxicity, neurotoxicity, and hematologic toxicity (anemia).

Bacterial Resistance

Bacterial resistance to antibiotics may be present on a non-genetic basis or may develop on a genetic basis during therapy. Non-genetic resistance is most frequently attributable to the absence of targets for the drug in the bacteria. If the bacteria have no receptors that bind the drug or lack the metabolic pathway necessary for drug activity, the bacteria are intrinsically resistant (e.g., vancomycin or erythromycin). Inadequate permeability of a compound may also account for the ineffectiveness of tetracycline against some gram-negative bacteria.

Certain microorganisms can escape the consequences of drug action by:

a. Synthesizing an enzyme that destroys the antibiotic (e.g., the beta-lactamase that cleaves the beta-lactam rings of penicillin and cephalosporin.
b. Changing in the permeability of the outer membrane (e.g., gram-negative bacilli) that prevents some antibiotics from entering the periplasmic space through transmembrane channels, called porins, which usually provide access.
c. Altering the macromolecules to which the antibiotic binds.
d. Altering some metabolic activity to which the antibiotic effects.

Genetic resistance may be chromosomal in origin or may be transmitted by extrachromosomal plasmids. Chromosomal resistance to several unrelated antibiotics can be transferred to susceptible organisms by cell-to-cell contact or conjugation. The bacteria contain extrachromosomal DNA or resistance plasmids, act like viruses without coats. These plasmids are found in a variety of gram-negative bacilli.

Conclusion

New antibiotics are needed to combat bacterial pathogens, but progress in developing them has been slow. Over all, most antibiotics have come from a small set of molecular frames whose functional groups have been extended by the generations of synthetic modifications. The emergence of multi-drug resistance among the latest generation of pathogens suggests that the discovery of new set of molecular frames should be a priority. Promising approaches to molecular frames discovery are emerging; they include mining under-explored microbial niches for natural products, designing screens that avoid rediscovering old molecular structures, and re-purposing libraries of synthetic molecules for use as antibiotics.

To summarize this article topic, common antibacterial agents grouped by mechanism of activity, we can conclude that the antibacterial compounds exhibit selective toxicity, largely due to the differences between prokaryotic and eukaryotic cell structure. Cell wall synthesis inhibitors, including the β-lactams, the glycopeptides and bacitracin, interfere with peptidoglycan synthesis, making bacterial cells more prone to osmotic lysis. A variety of broad-spectrum, bacterial protein synthesis inhibitors selectively target the prokaryotic 70S ribosome, including those that bind to the 30S subunit (aminoglycosides and tetracyclines) and others that bind to the 50S subunit (macrolides, lincosamides, chloramphenicol, and oxazolidinones). Polymyxins are the lipophilic polypeptide antibiotics that target the lipopolysaccharide component of gram-negative bacteria and ultimately disrupt the integrity of the outer and inner membranes of these bacteria. The nucleic acid synthesis inhibitors rifamycin and fluoroquinolones target bacterial RNA transcription and DNA replication, respectively. Some antibacterial drugs are anti-metabolites, acting as competitive inhibitors for bacterial metabolic enzymes. Sulfonamides and trimethoprim are antimetabolites that interfere with bacterial folic acid synthesis. Isoniazid is an anti-metabolite that interferes with mycolic acid synthesis in mycobacteria.

Rising drug resistance is caused mainly by use of antimicrobials in humans and other animals, and the spread of resistant strains of bacterial species between the two. Antibiotics exposure increases the selective pressure in the bacterial populations, causing the vulnerable bacteria to die that increases the percentage of the resistant bacteria, which continue rising in number. With resistance to antibiotics becoming more common, there is a greater need for alternative treatments. This calls for new antibiotic therapies which have been issued, however new drug development is becoming rarer.

REFERENCES:

Archer, G.L., Polk, R.E., (1998). Treatment and prophylaxis of bacterial infections, In: Harrison's Principles of Internal Medicine 14th Ed., (Isselbacher, K.J., Braunwald, E., Wilson, J.D., Martin, J.B., Fauci, A.S. and Kasper, D.L., eds) McGraw-Hill, Inc (Health Professions Division), p. 859.

Chambers, H.F., Hadley, W. K. (1998). Micellaneous Antimicrobial Agents: Disinfectants, Antiseptics and Sterilant, In: Basic and Clinical Pharmacology, (Katzung, B.G., Ed.) Appleton-Lange, pp 803-804.

Chambers, H.F., Hadley, W.K., Jawetz, E. (1998). Aminoglycosides and Spectinomycin, in Basic and Clinical Pharmacology, (Katzung, B.G., Ed.) Appleton-Lange, pp. 753-754.

Francisco J. Alvarez-Leefmans; Eric Delpire (2009). Physiology and pathology of chloride transporters and channels in the nervous system: From molecules to diseases. Academic Press. pp. 142–146. ISBN 978-0-12-374373-2.

Gottlieb, David; Shaw, Paul D. (2012). Mechanism of Action. Springer Science & Business Media. p. 41. ISBN 9783642460517.

In: 'Clindamycin Hydrochloride'. The American Society of Health-System Pharmacists. University of Michigan.

In: 'Lincosamides, Oxazolidinones, and Streptogramins'. Merck. Manual of Diagnosis and Therapy. Merck & Co. November 2005.

In: The American Society of Health-System Pharmacists.

IUPAC, Compendium of Chemical Terminology, (1997). 2nd Ed. In: the "Gold Book". Online corrected version: 2006 tetracyclines.

Kapusnik-Uner, J.E., Sande, M.A., Chambers, J.F. (1996). Antimicrobial agents: Tetracyclines, Chloramphenicol, Erythromycine, and Miscellaneous Antibacterial Agents, In: Goodman and Gillman's, The Pharmacologial Basis of Therapeutics, (Hardman, J.G, Limbird, L.E, Molinoff, P.B., Ruddon, R.W, and Gilman, A.G., Ed.), The McGraw-Hill Companies, Inc., pp.1143-1144.

M.E., Levison, M.D., (2012). Aminoglycosides, In: The Merck Manual.

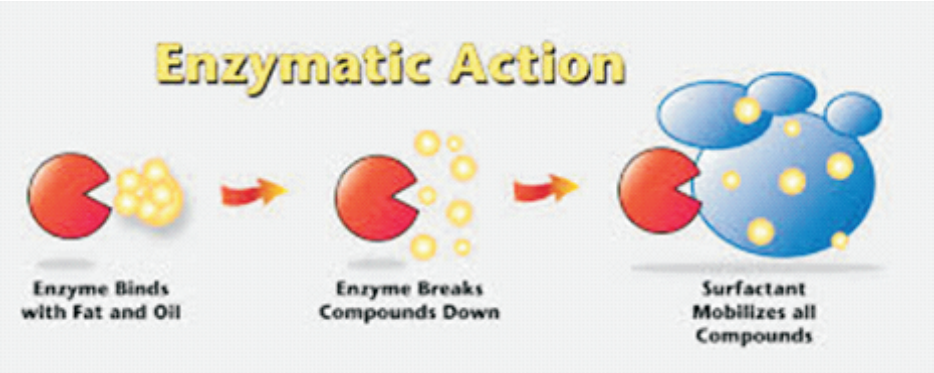
Mingeot-Leclercq M.P., Glupczynski Y., Tulkens P.M., (1999). Aminoglycosides: activity and resistance. Antimicrob. Agents Chemother. 43 (4): 727–37.

Prosser, Gareth; de Carvalho, Luiz Pedro S. (2013). "Kinetic mechanism and inhibition of Mycobacterium tuberculosis d-alanine: D-alanine ligase by the antibiotic d-cycloserine". FEBS Journal. 280 (4): 1150–1166. doi:10.1111/febs.12108. PMID 23286234.

Robertson, D.B, Maibach, H.I. (1998). Dermatologic Pharmacology, In: Basic and Clinical Pharmacology (Katzung, B.G., Ed.) Appleton-Lange, pp. 1000.

www.merriam-webster.com/medical/aminoglycoside.

Enzymatic Cleaners



Enzyme cleaners are made using a few specific enzymes that break down biological substances like fats, oils, proteins, and starches. Enzyme cleaners break down those stains into elements like oxygen, hydrogen, and carbon. Enzyme cleaners are non-toxic and biodegradable, meaning they are safe to use in any area.

Enzymatic Detergents. This type of detergent is a neutral detergent with added enzymes. Enzyme solutions dissolve biofilms, which keeps instruments from staining and becoming breeding grounds for bacterial growth. Enzymes are proteins which act as catalysts to break down bioburden and other organic materials, as follows: ▪ Protease – removes protein contained in blood and saliva ▪ Amylase – removes starches and carbohydrates ▪ Lipase – removes fats ▪ Cellulase – removes fibers and biofilm Enzymatic detergents are used to dissolve organic materials and help clean instruments; they are most effective at 3 to 5 minutes exposure at 60° to 140°F (15° to 60° C);

- Multi-enzymatic cleaners allows for the cleaning of surgical devices to occur rapidly and with less energy.
- Incorrect reprocessing can result in product failure and even in danger to the health and wellbeing of the patient. Improper cleaning of surgical devices can be a vector for Surgical Site Infections (SSIs) and Hospital Acquired Infections (HAIs).
- Removal of infectious agents, organic and inorganic soil, is critical for patient and staff safety.
- Enzymatic cleaners were originally designed as pre-cleaners for use in endo/GI labs to remove soil on endoscopes in patients' rooms.
- In the 1990's enzymatic cleaners were introduced to facilitate the reprocessing of surgical devices, and to provide a more neutral pH cleaning formulation for instrument preservation.
- Recent studies have shown that enzymatic cleaners may not only remove, but may actually degrade infectious agents.
- When utilizing enzymatic cleaners, several factors must be taken into account including water temperature and quality, contact time, concentration, and pH.
- Some enzymes, including proteases, are more active at higher pH, and some are active at neutral levels.
- Enzymatic detergents consist of a detergent with a neutral pH or low alkaline formulation to which one or more enzymes have been added to surfactants and stabilizing agents.
- Enzymes are catalysts that speed up chemical reactions up to 1,000,000 times.
- Even detergents with the same surfactants and ingredients without enzymes take at least 10 to 15 times more contact time to achieve an acceptable outcome.
- Although most enzymatic detergents are diluted in tap water for cleaning and automated washing, when RO or distilled water is used outcome and reprocessing times are improved. However, it is important to follow manufactures recommendations for dilution rates.
- Rinsing is important after cleaning with enzymatic cleaners to remove adherent soil and residue as enzymes in cleaning detergents keep working until they are washed away.
- PPE should be worn when handling enzymatic cleaners and when processing soiled devices.
- Enzymatic cleaners also clean waste pipes and washing machines, and contribute to the breakdown of contaminants in the waste water stream, as well as the target soiled devices.
- Caustic alkaline detergents release hazardous chemicals into the waste water stream, killing native aquatic species and affecting the sustainability of our planet.
- Traditional caustic alkaline detergents reduce the useful life of medical devices through pitting and corrosion, increasing instrumentation repair and replacement costs.
- Most alkaline cleaners require a neutralizer at an additional expense.
- Multi-enzymatic detergents are by nature biodegradable, and some are safe for aquatic life in waste water stream.
- pH neutral instrument chemistries are non-corrosive to delicate valuable instrumentation, extending the devices' useful life and reducing repair and replacement costs.
- pH neutral detergents often follow the enzymatic wash step, and provide chelating action and further removal of residue.
- pH neutral detergents are highly recommended for the final wash phase when processing eye instrumentation.
- Enzymes are specific to certain substrates, much[al1] as a lock and key.
- Cocktails of enzymes require stabilizers and coenzymes, as well as certain surfactants, to be effective.
- Some enzymatic solutions may not be properly stabilized so that the protease in solution will attack the other enzymes in the formula.
- Chemical analysis using a spectrophotometer measures enzyme activity.
- Incompatibility or degraded enzymes may be observed when separation is present in the solution; this lessens the efficacy of the detergent.
- Enzymatic cleaners must be stored at room temperature, away from heat source or they will degrade.
- Degrading enzymes have a significant odour. When this is observed, remove and discard the solution.

- Some enzymatic cleaners contain only one enzyme or two enzymes that are the same type, such as two proteases.
- Others have trace amounts of enzymes that may not be detected or have enough activity at use dilution.
- Multi-enzymatic detergents containing more than one type of enzyme will remove more types of soil like blood, fats, starches, and carbohydrates, than single or dual protease cleaners that only address protein.
- Multi-enzymatic cleaners come in ready-to-use and super-concentrated varieties that can work for pre-cleaning, soaking, automated washers, manual cleaning, and for one brand in ready-to-use single use wipes for manual cleaning.
- Liquid multi-enzymatic cleaners can be dosed for concentration unlike solid brick cleaners which melt and cannot be measured.
- Liquid multi-enzymatic cleaners demonstrate significant savings, providing a better ROI than other cleaning chemistries.
- Free-rinsing enzymatic cleaners remove residue on equipment surfaces and on surfaces of medical devices.

Enzyme-based cleaners can replace most common household cleaning products.

***Laundry*:** Enzyme cleaners make it easy to get fatty or oily stains out of clothes. So next time you end up with a little dinner splattered on your shirt, soak the fabric overnight in an enzyme pre-treatment then wash with an eco-friendly detergent. Tough stains like chocolate, grease, and coffee will come right out.

***Kitchen and bathroom*:** You can replace bleach and other toxic household cleaners with enzyme-based kitchen and bathroom cleaners. They'll get rid of the proteins that stain toilets, tubs, sinks, and countertops along with any lingering odors.

***Mold and Mildew*:** Those fuzzy looking mold and mildew stains you find on under sinks or behind appliances are actually collections of microscopic organisms that can be easily killed by an enzyme-based mold remover.

***Pet stain remover*:** Because enzymes react with biological molecules they are perfect for cleaning up nasty pet stains on upholstery, carpets, or hard floors. The enzymes will actually break down the proteins in the stain, meaning that not only will the stain be gone but you can also get rid of any persistent smells. Just blot up any remaining moisture, spray enzyme cleaner on the stain and let it soak for a couple of days, then scrub away.

Always keep in mind that enzymes are biological molecules, which means they work differently than other cleaning products. They can sometimes take several hours or days to finish their work, and they will be damaged by extreme conditions, so use them with warm (not hot) water and don't mix them with soap or other cleaners. When used correctly, though, enzyme cleaners are a safe, effective alternative to dangerous home cleaning products.

Enzymes, usually proteases, sometimes are added to neutral pH solutions to assist in removing organic material. Enzymes in these formulations attack proteins that make up a large portion of common soil (e.g., blood, pus). Cleaning solutions also can contain lipases (enzymes active on fats) and amylases (enzymes active on starches). Enzymatic cleaners are not disinfectants, and proteinaceous enzymes can be inactivated by germicides. As with all chemicals, enzymes must be rinsed from the equipment or adverse reactions (e.g., fever, residual amounts of high-level disinfectants, proteinaceous residue) could result. Enzyme solutions should be used in accordance with manufacturer's instructions, which include proper dilution of the enzymatic detergent and contact with equipment for the amount of time specified on the label . Detergent enzymes can result in asthma or other allergic effects in users. Neutral pH detergent solutions that contain enzymes are compatible with metals and other materials used in medical instruments and are the best choice for cleaning delicate medical instruments, especially flexible endoscopes 457. Alkaline-based cleaning agents are used for processing medical devices because they efficiently dissolve protein and fat residues; however, they can be corrosive. Some data demonstrate that enzymatic cleaners are more effective than neutral detergents in removing microorganisms from surfaces but two more recent studies found no difference in cleaning efficiency between enzymatic and alkaline-based cleaners.

Effective cleaning is a multistep process. The instrument cleaning and reprocessing steps defined in AAMI's Comprehensive Guide to Steam Sterilization and Sterility Assurance in Health Care Facilities are outlined below.

Instrument Cleaning Protocol

- Pre-preparation or presoaking.
  Presoaking instruments moistens and loosens the gross soil and therefore makes the cleaning step more efficient. In general, presoaking with a specialized product (e.g., an enzymatic solution) is recommended. If a prespray product is used, a neutral detergent without enzymes is best. Skin and eye irritation can result from exposure to enzymes. Therefore, enzymatic product should not be sprayed around hospital personnel. When presoaking instruments, personnel should refer to the solution manufacturer's written instructions for the correct dilution, temperature, and soak time. Presoaking should begin as soon as possible after instruments and equipment are used; therefore it is recommended this occur in or near the OR, not the SPD.

- Pre-Preparation of Instruments In or Near the OR
  Immediately after use, the items should be kept moist in the transport container by adding a towel moistened with water (not saline) or a foam, spray, or gel product specifically intended for this use. Allowing blood and tissue to dry can cause the instrument to rust and pit. Presoaking keeps bioburden moist until full cleaning begins. Presoaking also extends the life of the surgical instruments, reduces the risk of cross contamination, and provides the most complete cleaning.
  Instruments should be thoroughly rinsed after presoaking. Rinsing the items thoroughly ensures the removal of any potentially harmful residue from the soaking solution (e.g., detergent enzymes, which are proteins, and/or patient secretions).

- Manual cleaning. Manual cleaning is done prior to automated cleaning to remove gross organic material from instruments. Any instrument or medical device should be able to be cleaned manually. Manual cleaning is often recommended for delicate or complex medical devices, e.g., microsurgical instruments, lensed instruments, and air-powered drills. Items that are immersible should be cleaned under water to minimize aerosolization; items that cannot be immersed should be cleaned in a way that will not produce aerosols and should be rinsed and dried according to the device manufacturer's written instructions.

Lukewarm water and detergent solutions (at temperatures ideally in the range of 27°C to 44°C [80°F to 110°F], but not to exceed 60°C [140°F]) will prevent coagulation, thereby facilitating the removal of protein substances. The temperature of the soaking solution should be monitored and documented.
Because several factors, e.g., water hardness, pH, temperature, and the type of soil affect the effectiveness of enzyme cleaners and detergents, the detergent manufacturer's written instructions should be consulted. After cleaning, devices should be rinsed thoroughly to remove debris and detergent residues.
Abrasive cleaning compounds as well as metal scouring pads can damage items; these should not be used without specific written instructions from the instrument or device manufacturer. Brushes and other cleaning implements should be designed for use on medical devices; they should either be disposable, single-use, items or, if reusable, be decontaminated at least daily. The manufacturer should provide information regarding the appropriate brush size for cleaning devices with lumens.

A three-sink process is recommended for manual cleaning:
1. The first sink is the wash sink with detergent and water solution.
2. A plain water rinse is performed in the second sink.
3. The third sink contains processed or purified water to prevent spotting and other soils from redepositing.

Three-Sink Process for Manual Cleaning
Detergents used for manual cleaning should be:
- Low sudsing for the safety of the worker;
- Free-rinsing;
- User-friendly (i.e., safe and pleasant);
- Able to be used on surgical instruments, delicate instruments, and scopes; and
- Easily dispensed or have a dispensing mechanism.

● Ultrasonic cleaning (if needed). The ultrasonic cleaning process removes even the tiniest particles from hard to reach areas, such as box locks, cracks, crevices, and lumens.
Ultrasonic cleaners work by cavitation – a process in which bubbles implode (i.e., burst inward) to dislodge soil from the instrument. Ultrasonic cleaning is very effective with scopes and cannulated instruments because the cavitation process] reaches small areas that manual cleaning cannot.

Ultrasonic Cleaners
It is important to note that ultrasonic cleaners designed for cleaning medical devices are used for fine cleaning, not for disinfection or sterilization. Additionally, ultrasonic cleaning should be used only after the gross soil has been removed from items. The medical device manufacturer's written instructions should be followed to ensure that ultrasonic cleaning will not damage the device. Not all metals can be intermixed in theultrasonic process; therefore, the device manufacturer should specify any restrictions.

A low sudsing formulation from one of the following categories should be used:
- Enzymatic detergents;
- A neutral pH detergent; or
- An alkaline detergent.

The cleaning solution should be changed before it becomes heavily soiled, so that effective ultrasonic cleaning is not inhibited by soil and also to minimize the risk of cross-contamination. Ultrasonic cleaning should be followed by thorough rinsing to remove dislodged particles.

● Automated cleaning. An automated washer will remove the majority of soil and microorganisms on instruments through a cleaning and rinsing process, thus preparingit for sterilization. With automated cleaning equipment, detergent and water are forced through nozzles or rotating spray arms for cleaning.

Box or Cube Automated Washer
The following steps comprise a typical automated cycle process:
1. Prewash with cold water.
2. Enzyme wash.
3. Rinse.
4. Wash with detergent.
5. Rinse.
6. Thermal rinse.
7. Lubricant.
8. Dry.

http://www.greenhome.com/blog/a-guide-to-enzyme-cleaners
http://www.pfiedler.com/ce/1196/files/assets/common/downloads/The%20Role%20of%20Detergents%20and%20Disinfectants%20in%20Instrument%20Cleaning%20and%20Reprocessing%20-%20AST.pdf
http://www.sustainabilityroadmap.org/pims/264#.Wk9jdLyWbcs

John L. Leal

December 22, 1877: Publication date for "The Nascent State as Affecting Chemical Action." (Davies 1877) Before we understood that oxidation-reduction reactions involved electron transfers, chemists theorized that oxygen existed in a "nascent state." This state made it possible for oxidation reactions to take place. Such an outmoded chemistry concept is relevant to a discussion of the history of chlorination in the U.S.

The first continuous use of chlorine to disinfect a U.S. water supply occurred at Boonton Reservoir—the water supply for Jersey City, New Jersey. As recounted in a forthcoming book (*The Chlorine Revolution*), two trials defined the need for disinfection and documented how it happened. In the second Jersey City trial, Dr. John L. Leal claimed that chlorine was not responsible for killing bacteria. Instead, he put forth the long-standing theory that chlorine when added to water liberated something called nascent oxygen, and it was the nascent oxygen was responsible for disinfection. (McGuire 2013)

The concept of nascent oxygen originated with James Watt, who described the importance of liberated oxygen in the bleaching process. An equation suggested by Watt (Race 1918) showed chlorine producing oxygen when it was dissolved in water:

$Cl_2 + H_2O = 2HCl + O$

In which Cl_2 = chlorine, H_2O = water, HCl = hydrochloric acid, and O = nascent oxygen.

In a later, well-known publication, Albert D. Hooker stated the theory most clearly: "*It should be well understood that chloride of lime, in its industrial application of bleaching, deodorizing, or disinfecting, does not act by its chlorine, but by its oxygen.*" (Emphasis in original.) (Hooker 1913)

In 1918, Joseph Race described the controversy surrounding chlorine's mode of action in water. Race stated that Fischer and Proskauer (1884) believed that chlorine was not directly toxic. Warouzoff, Winograoff, and Kolessnikoff (1886) found that chlorine gas killed airborne tetanus spores. Interestingly, Race quoted at length John L. Leal's second-trial testimony supporting the theory of disinfection by nascent or potential oxygen. However, Race's laboratory work in 1915–17 appeared to convince him that disinfection was caused by the direct toxic action of chlorine and not by nascent oxygen. (Race 1918)

Other publications reflected the confusion over chlorine's mechanism of action. In his 1917 textbook, Ellms (who would testify in the second Jersey City trial) presented equations showing the formation of hypochlorous acid (HOCl) when chlorine was added to water. At this point in his discussion, he was correct. However, he then stated "The HOCL is decomposed into HCl and oxygen, which latter acts upon any oxidizable matter that may be present." (Ellms 1917)

$2HOCL \rightarrow 2HCl + O_2$

In this case, HOCl = hypochlorous acid and O_2 = oxygen.

"The energy liberated by the decomposition of the hypochlorous acid, as previously stated, explains the powerful oxidizing action of the evolved oxygen, and the destructive effect upon the microorganisms. Chlorine or the hypochlorites are therefore, merely agents for the production of oxygen under conditions which render it extremely active." (Ellms 1917)

Abel Wolman and I.H. Enslow tried to put a stop to the nascent oxygen theory in 1919, but it persisted long after that. (Fair and Geyer 1954) We know now that HOCl exists in water in equilibrium with the dissociated hypochlorite ion and that the degree of dissociation is a function of the water's pH.

$HOCL \leftrightarrow OCl^- + H^+$

For this equation, OCl^- = hypochlorite ion and H^+ = hydrogen ion.

In a textbook published in 1924, authors F.E. Turneaure and H.L. Russell tried to straddle the issue:

"The reaction of both hypochlorite and liquid chlorine in sterilization of water is substantially the same. The accepted theory is that the chlorine forms hypochlorous acid with the water setting free nascent oxygen which is considered the effective sterilization agent. Some authorities, however, contend that the chlorine itself has a toxic effect upon the bacteria." (Turneaure and Russell 1924)

A 1935 rewrite of Sedgwick's famous book on sanitary science favored the direct action of chlorine theory but did not totally discount the action by nascent oxygen.

"The mechanism by which chlorine brings about germicidal action is still undetermined. It is believed by some that the bacteria are destroyed because of the direct toxic effect of the chlorine. Others maintain that the introduction of chlorine into water results in the formation of hypochlorous acid—an unstable compound—which breaks up and liberates nascent oxygen and hydrochloric acid, the supposition being that the bacteria are destroyed by the nascent oxygen. . . . Since chlorine compounds can destroy bacteria even when oxygen is not liberated it would seem that those mechanisms that explain the germicidal action of chlorine without hypothesizing the formation of nascent oxygen have a more sound scientific basis." (Prescott and Horwood 1935)

A 1944 publication by S.L. Chang appeared to put the controversy to rest: "The action of chlorine and chloramine compounds on cysts was attributed to the active chlorine which may oxidize or chlorinate the proteins in the protoplasm. The possibility of action by nascent oxygen liberated by HOCl was indirectly studied, and the evidence strongly indicated that this was unlikely to occur." (Chang 1944) Since Chang's publication, nascent oxygen has not been mentioned in professional publications except as a historical curiosity.

In their classic 1954 textbook on water and wastewater engineering, Gordon M. Fair and John C. Geyer addressed the historically curious concept and stated categorically that oxygen did not accomplish disinfection. It was chlorine in its various forms in water that was toxic to bacteria. (Fair and Geyer 1954) Like many a scientific theory that conveniently explained a troubling public relations problem, it took a lot of time to kill the nascent oxygen idea.

References:

(1) Chang, S.L. 1944. "Destruction of Micro-Organisms." *Journal AWWA*. 36:11 1192-1207. (2) Davies, Edward. 1878. "The Nascent State as Affecting Chemical Action." *The Pharmaceutical Journal and Transactions*. 8: 485-6. (3) Ellms, Joseph W. 1917. *Water Purification*. New York City, N.Y.: McGraw-Hill. (4) Fair, Gordon M., and John C. Geyer. 1954. *Water Supply and Waste-water Disposal*. New York City, N.Y.: John Wiley & Sons, Inc. (5) Hooker, Albert D. 1913. *Chloride of Lime in Sanitation*. New York City, N.Y.: John Wiley & Sons. (6) McGuire, Michael J. The Chlorine Revolution: *Water Disinfection and the Fight to Save Lives*. Denver:American Water Works Association, 2013. (7) Prescott, Samuel C. and Murray P. Horwood. 1935. *Sedgwick's Principles of Sanitary Science and the Public Health: Rewritten and Enlarged*. New York:McMillan. (8) Race, Joseph. 1918. *Chlorination of Water*. New York City, N.Y.: John Wiley & Sons. (9) Turneaure, F.E., and H.L. Russell. 1924. *Public Water-Supplies: Requirements, Resources, and the Construction of Works*. 3rd Edition. New York City, N.Y.: John Wiley & Sons, Inc.

Latest Jokes

My girlfriend's birthday is in two days.
And she told me "Nothing would make me happier than a diamond ring".
So I bought her nothing!

Difference between a beautiful night and a horror night.
Beautiful night is, When you hug your teddy bear and sleep.
Horror night is,
When your teddy bear hugs you BACK.

What is love▪
Love is our 7th sense that destroys all 6 sense
And makes the person nonsense.

8 p.m. I get an SMS from my girlfriend: Me or football▪ !
11 p.m. I SMS my girlfriend: You of course.

Once all the engineering professors were sitting in one plane.
Before the takeoff, one announcement came
"This plane is made by your students"
Then all professors stood up, ran and went outside.
But the principal was sitting.
One guy came and asked, "are you not afraid"▪
Then the principal replied
"I trust my students very well and I am sure the plane won't even start"

A guy in a plane stood up & shouted: "HIJACK!"
All passengers got scared
From the other end of the plane, a guy shouted back "HI JOHN"

A guy went for an interview at a big IT company for the position of "Computer Hacking Investigator"
The boss asked him: So, what makes you suitable for this job▪
Well, he replied, I hacked into your computer and invited myself to this interview.

My Chinese friend got really sick one day and had to go to a hospital.
I went to see him the next day.
He just kept whispering "yang qi guan" over and over and then died.
I was very sad and Googled his last message after the burial.
Apparently, it means "You're standing on my oxygen tube".

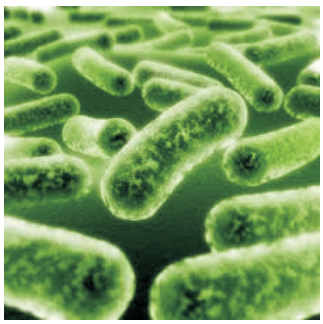
Two boys were arguing when the teacher entered the room.
The teacher says, "Why are you arguing▪"
One boy answers, "We found a ten dollar bill and decided to give it to whoever tells the biggest lie."
"You should be ashamed of yourselves," Said the teacher, "When I was your age I didn't even know what a lie was."
The boys gave the ten dollars to the teacher.

If a paper comes very tough in exam,
Just close your eyes for a moment,
Take a deep breath and say loudly,
"This is a very interesting subject; I want to study it again.
I asked why Wall of China is the wonder of the world!
Answer:
It's the only thing made in China that lasted years.

They say milk gives strength.
I drank 4 cups and couldn't move a wall.
But when I took 4 bottles of beers,
I saw the wall moving itself.
These scientists should better stop their lies.

Lactobacillus plantarum

Scientific classification
Domain: Bacteria
Phylum: Firmicutes
Class: Bacilli
Order: Lactobacillales
Family: Lactobacillaceae
Genus: *Lactobacillus*
Species: ***L. plantarum***
Binomial name
Lactobacillus plantarum



Lactobacillus plantarum (*L. plantarum*) is a rod-shaped, gram-positive lactic acid bacterium. It is commonly found in the human and other mammalian gastrointestinal tracts, saliva, and various food products. It can grow at temperatures between 15-45°C and at pH levels as low as 3.2. *L. plantarum* is a facultative heterofermentative that ferments sugars to produce lactic acid, ethanol or acetic acid, and carbon dioxide under certain conditions and selective substrates. Depending on the carbon source, these bacteria can switch from using heterofermentative and homofermentative ways of metabolism. This bacterium is acid and bile salt tolerant, which allows it to survive the passage through the gastrointestinal tract of humans. *L. plantarum*is of current interest to researchers and the food industry since it is considered a safe probiotic. It can help limit the amount of pathogenic bacteria or diseases that can have a negative impact on humans. In addition, recent research indicates that *L. plantarum* can be used as a vaccine vehicle.

Biosynthesis and Secretion

L. plantarum, typically found in protein-rich environments like yogurt, has uptake systems for peptides. Once these peptides are ingested, various types of peptidases degrade them inside the bacterium. *L. plantarum* has 19 different genes encoding peptidases that have different specific functions, three of which can cleave N-terminal proline residues. Even though this bacterium has protein degradation mechanisms, it is still capable of producing most amino acids, except branched-chain amino acids such as valine, leucine, and isoleucine.

In addition to synthesizing amino acids, *L. plantarum* can perform a mRNA independent nonribosomal peptide synthesis. Before this discovery, no other lactic acid bacteria was known to use this biosynthesis machinery. The *L. plantarum* nonribosomal peptide synthesis cluster contains two nonribosomal synthesis proteins, an important phosphopantetheinyl transferase, and proteins that are needed for precursors for regulation, transport, and enzymes.

Amino acids and peptides in *L. plantarum* are transported mainly through 57 ATP-binding cassette (ABC) transporters, of which 27 are importers and 30 are exporters. Since this bacterium cannot synthesize its own branched chain amino acids, it is able to obtain them through these transporters. In addition, *L. plantarum* has a high number of sugar import systems and regulatory proteins, which contribute to its flexible and versatile state as a bacterium. It can grow by using different carbon sources and can adapt to a wide array of environments.

L. plantarum is known to be able to adapt to stressful environments such as those in the gastrointestinal tract with a low pH or high salt content. Its genome encodes proteases that can degrade abnormal or nonfunctional proteins, as well as heat and cold-shock proteins to save energy under stress and to survive different climates. In order to survive in acidic environments, this bacterium uses the F_oF_1-ATPase and sodium-proton pumps to help regulate and maintain the intracellular pH. Furthermore, it has alkaline shock proteins to assist in pH tolerance. In addition, *L. plantarum* has developed ways to deal with oxidative stress by having catalases, peroxidases, and reductases, as well as a high intracellular concentration of manganese ions (Mn^{2+}) to scavenge oxygen radicals. This bacterium is able to obtain and accumulate manganese ions due to the P-type manganese translocating ATPase.

In addition to being able to adapt to the environment, *L. plantarum* has surface proteins that allow it to interact with the environment. It has a Sec transport system that is comprised of SecA/SecE/SecG/SecY/YajC (no SecDF) and it also has other proteins involved in secretion such as peptidases [1]. In addition, there are genes that encode for a sortase. Sortase is an enzyme that recognizes and cleaves carboxy-terminal sequences to modify the surface proteins to interact with different surfaces and substrates for growth. Lastly, *L. plantarum* has a protein machinery that is used to bind and uptake DNA from the environment. Scientists hypothesize that *L. plantarum* acquired its ability to adapt to many different environments from this uptake machinery. Researchers also have found very large regions in the genome of *L. plantarum* containing unusual base composition when comparing it to closely related species. An example of this are the genes for sugar uptake and catabolism. This reflects how *L. plantarum* is a very versatile species that can adjust to its environment.

Probiotics and Biotherapeutic Applications

According to the Merriam-Webster Dictionary, a probiotic is a dietary supplement that contains live bacteria or yeast and is used to maintain the normal gastrointestinal flora. It is often taken orally and helps restore the flora after infection or antibiotic use. Some individuals, such as pregnant women, infants, and children with neurodevelopmental disorders, can benefit greatly from the use of probiotics .

In order for probiotics to be effective, they must be able to reach their target site after ingestion. They have to travel through the gastrointestinal tract to the stomach. Low stomach pH could disrupt the proton motive force or enzyme function, consequently leading to a disruption of energy supply to the bacteria. In addition, probiotics must go through the small intestine that contains bile salts that can act as surfactants and can disturb cell membranes, DNA, and RNA. Probiotics also must be somewhat resistant to antibiotics so that they can maintain the gastrointestinal tract homeostasis and aid in the recovery of intestinal microflora after treatment of antibiotics [11]. However, it is important to recognize that the antibiotic resistance genes could get transferred and form highly antibiotic resistant pathogenic bacteria.

L. plantarum is considered a probiotic because it secretes antimicrobial compounds, such as bacteriocin, that inhibit pathogenic gram-positive and gram-negative colonies from forming. Bacteriocin, which is a *Lactobacillus*-inhibitory factor

and toxin, inhibits the growth of similar bacteria and other antibiotic-like substances. *L. plantarum* also has a mannose-specific adhesion, which allows it to adhere to the epithelial lining in the human intestines and compete with both gram-positive and gram-negative pathogenic bacteria for nutrients. These traits, in addition to its pH and temperature tolerance, make *L. plantarum* a potential probiotic to be used for therapy for those who suffer from gastrointestinal diseases such as Crohn's Disease, inflammatory bowel disease (IBD), and colitis.

Vaccines

Recombinant strains of lactic acid bacteria are used to produce therapeutic proteins and to deliver these proteins to safe mucosal sites. These mucosal surfaces are a major site of pathogenic entry. Both systemic and mucosal immune responses can be induced at these surfaces. They are also used to secrete other proteins such as interleukins and antibodies. In addition, mucosal vaccines can cause IgA secretion and a systemic immune response with T-cells to stimulate the immune system .

For example, bacteria expressing allergens provide an advantageous method of immunotherapy compared to subcutaneous and sublingual therapies. It is beneficial because the allergen will be protected from proteases since it is contained within the bacteria and is cost-effective since the antigen does not have to be processed. Also, the components of the allergen and the lactic acid bacteria are presented at the same time as the immune response. Studies have shown that certain strains of *L. plantarum* can be used as delivery vehicles with an allergen to prevent certain allergies, such as dust mite allergies. If a recombinant strain has the dust mite allergen (Der p 1) for antigen delivery, it can reduce or prevent the stimulation of the ERK-pathway, which would lead to suppression of the chemokines that would cause inflammation.

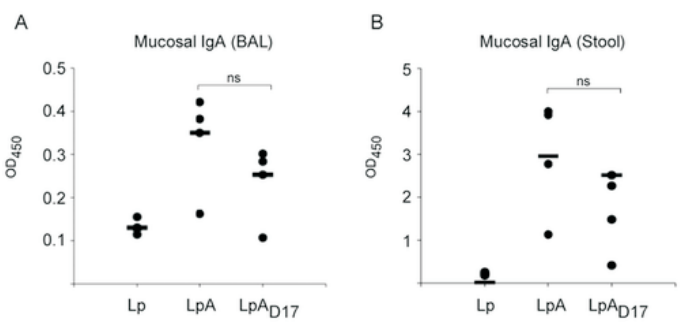


Figure 7. Antibody response to oral administration of recombinant *L. plantarum*: mucosal IgA. Rio 2010.[7]

In addition, proinflammatory recombinant strains of *L. plantarum* are hypothesized to be effective mucosal delivery vehicles for vaccine antigens. For example, a recent study used a strain of *L. plantarum* that expressed invasin from *Yersinia pseudotuberculosis* (*Y. pseudotuberculosis*). Invasin is a virulence factor that binds to β1-integrins on the surface of microfold cells (M cells) and stimulates the uptake of *Y. pseudotuberculosis*in the intestines. It can also cause inflammation of the host cell by activating the innate immune system. By modifying *L. plantarum* so that the extracellular domain of invasin is anchored to the bacterial surface by N-terminal anchoring motifs, this strain of the bacterium can imitate the early infection symptoms of *Y. pseudotuberculosis*, leading to increase adjuvant characteristics. In other words, this strain of *L. plantarum* can, through the use of different N-terminal anchoring motifs, target *Y. pseudotuberculosis* invasin to the cell surface of the bacterium. Since this strain of *L. plantarum* can change the immunological tolerance of an immune response, it can be used to increase antigen immunogenicity and as a delivery vehicle for mucosal vaccines.

Lastly, strains of *L. plantarum* can be used to stimulate production of antibodies. A study using *L. plantarum* that expressed *Borrelia burgdorferi* (*B. burgdorferi*) OspA lipoprotein found that it stimulated the production of OspA-specific IgA and IgG antibodies as wells as pro- and anti-inflammatory cytokines (Figure 7). It did not lead to secretion of cytokine (IL-8) by epithelial cells and did not induce inflammatory effects. The recombinant *L. plantarum* is capable of stimulating a protective immune response via T-cell (Th1/Th2) mediated immunity.

Conclusion

L. plantarum is a bacterium that is very versatile and can adapt to various environmental conditions since it can ferment different types of carbohydrates and sugars. Specifically, it is able to withstand and grow in the harsh conditions of the gastrointestinal tract. Because of this, it can be used as a probiotic to benefit human health. A variety of strains or recombinants of *L. plantarum* can aid in restoring the homeostasis of the flora in the intestines, limit the amount of pathogenic bacteria, and could be potentially used as a vehicles for vaccines. However, not all the mechanisms for vaccinations with *L. plantarum*are known. As a result, many research groups are trying to determine possible mechanisms. Within the next few years, it is expected that more developments will be made to utilize the probiotic property of *L. plantarum* to benefit human health.

Health benefits of Asparagus

Yes, eating asparagus does make your pee smell. But once you're past that, there are plenty of reasons to fill your plate with more of this spring superfood. The bright-green veggie is packed with good-for-you vitamins and minerals like vitamins A, C, E, K, and B6, as well as folate, iron, copper, calcium, protein, and fiber. Thanks to all these nutrients, asparagus offers some serious health perks.

"People should definitely take advantage of this vegetable while it's in peak season," says Keri Gans, RD, a New York City-based nutrition consultant and author of *The Small Change Diet*. "I love it roasted, grilled, or tossed into a pasta meal with olive oil, cherry tomatoes, and grilled shrimp."

Here, 10 reasons why you should eat more asparagus:

1) **It can help you meet your weight-loss goals**
Not only is asparagus low in fat and calories (one cup sets you back a mere 32 calories), but it also contains lots of soluble and insoluble fiber, making it a good choice if you're trying to lose weight. Because your body digests fiber slowly, it keeps you feeling full in between meals.
"Fiber can definitely help you feel satiated, making it beneficial for weight loss," says Gans. "It can also aid constipation, and research suggests it may help lower cholesterol."
To maximize the veggie's calorie-torching potential, pair it with a hard-boiled egg: the combination of fiber-rich asparagus with the egg's protein will leave you feeling satisfied.

2) **It may keep your urinary tract happy**
Asparagus contains high levels of the amino acid asparagine, making it a natural diuretic. In other words, eating more of the spears can help flush excess fluid and salt from your body, which may help prevent urinary tract infections.
"When women are not urinating enough, they can get a UTI," explains Gans. It's possible that a diet rich in asparagus could prevent these painful infections from developing, since going to the bathroom more frequently can help move bad bacteria out of the urinary tract.

3) **It's full of antioxidants**
Asparagus—purple asparagus in particular—is full of anthocyanins, which give fruits and veggies their red, blue, and purple hues and have antioxidant effects that could help your body fight damaging free radicals. When preparing asparagus, try not to either overcook or undercook it. Although cooking the veggie helps activate its cancer-fighting potential, letting it boil or sauté for too long can negate some nutritional benefits. "Overcooking asparagus could cause the vitamins to leech out into the water," says Gans.

4) **It contains vitamin E**
Asparagus is also a source of vitamin E, another important antioxidant. This vitamin helps strengthen your immune system and protects cells from the harmful effects of free radicals. To fill up on its benefits, roast asparagus with a little olive oil: "Our body absorbs vitamin E better if it's eaten alongside some fat," says Gans. "And when you cook it with olive oil, you're getting healthy fat and vitamin E."

5) **It may help you get in the mood**
You may want to consider adding asparagus to your next date night menu: the veggie is a natural aphrodisiac thanks to vitamin B6 and folate, which can help boost feelings of arousal. Plus, vitamin E stimulates sex hormones, including estrogen in women and testosterone in men.

6) **It can ease a hangover**
If you crave a greasy breakfast the morning after too many drinks, research suggests that a side of asparagus might be the better choice. A 2009 study published in the *Journal of Food Science*conducted on laboratory-grown cells suggested that the minerals and amino acids in asparagus extract may help ease hangovers and protect liver cells from the toxins in alcohol.

7) **It beats bloating**
When it comes to fighting bloat, asparagus packs a mean punch. The veggie helps promote overall digestive health (another benefit of all that soluble and insoluble fiber!). And thanks to prebiotics—carbohydrates that can't be digested and help encourage a healthy balance of good bacteria, or probiotics, in your digestive track—it can also reduce gas. Plus, as a natural diuretic, asparagus helps flush excess liquid, combating belly bulge.

8) **It's a rich source of folic acid**
Four asparagus spears contain 22% of your recommended daily allowance of folic acid. "Folic acid is essential for women who are planning on getting pregnant, since it can help protect against neural tube defect," says Gans. One 2009 study published in *PLoS Medicine* found that folic acid supplements help reduce risk of premature birth by 50% when taken for at least a year before conception compared with women who didn't take additional folic acid.

9) **It's filled with vitamin K**
Along with other green, leafy vegetables, asparagus is a good source of vitamin K. The vitamin is crucial for coagulation (which helps your body stop bleeding after a cut) as well as bone health.
"Most people think of calcium for healthy bones, but vitamin K is also important," says Gans. "It can actually help your body absorb calcium."

10) **It boosts your mood**
Asparagus is full of folate, a B vitamin that could lift your spirits and help ward off irritability. Researchers have found a connection between low levels of folate and vitamin B12 in people who are suffering from depression, leading some docs to prescribe daily doses of both vitamins to patients with depression. Asparagus also contains high levels of tryptophan, an amino acid that has been similarly linked to improved mood.

Disinfection in the Hemodialysis Unit

The combination of peracetic acid and hydrogen peroxide has been used for disinfecting hemodialyzers. The percentage of dialysis centers using a peracetic acid-hydrogen peroxide-based disinfectant for reprocessing dialyzers increased.

Hemodialysis systems include hemodialysis machines, water supply, water-treatment systems, and distribution systems. During hemodialysis, patients have acquired bloodborne viruses and pathogenic bacteria . Cleaning and disinfection are important components of infection control in a hemodialysiscenter. EPA and FDA regulate disinfectants used to reprocess hemodialyzers, hemodialysis machines, and water-treatment systems.

Non critical surfaces (e.g., dialysis bed or chair, countertops, external surfaces of dialysis machines, and equipment [scissors, hemostats, clamps, blood pressure cuffs, stethoscopes]) should be disinfected with an EPA-registered disinfectant unless the item is visibly contaminated with blood; in that case a tuberculocidal agent (or a disinfectant with specific label claims for HBV and HIV) or a 1:100 dilution of a hypochlorite solution (500–600 ppm free chlorine) should be used. This procedure accomplishes two goals: it removes soil on a regular basis and maintains an environment that is consistent with good patient care. Hemodialyzers are disinfected with peracetic acid, formaldehyde, glutaraldehyde, heat pasteurization with citric acid, and chlorine-containing compounds .Hemodialysis systems usually are disinfected by chlorine-based disinfectants (e.g., sodium hypochlorite), aqueous formaldehyde, heat pasteurization, ozone, or peraceticacid . All products must be used according to the manufacturers' recommendations. Some dialysis systems use hot-water disinfection to control microbial contamination.

At its high point, 82% of U.S. chronic hemodialysis centers were reprocessing (i.e., reusing) dialyzers for the same patient using high-level disinfection. However, one of the large dialysis organizations has decided to phase out reuse and, by 2002 the percentage of dialysis facilities reprocessing hemodialyzers had decreased to 63%. The two commonly used disinfectants to reprocess dialyzers were peracetic acid and formaldehyde; 72% used peracetic acid and 20% used formaldehyde to disinfect hemodialyzers. Another 4% of the facilities used either glutaraldehyde or heat pasteurization in combination with citric acid. Infection-control recommendations, including disinfection and sterilization and the use of dedicated machines for hepatitis B surface antigen (HBsAg)-positive patients, in the hemodialysis setting were detailed in two reviews. The Association for the Advancement of Medical Instrumentation (AAMI) has published recommendations for the reuse of hemodialyzers253.

Are disinfectant residues remained after cleaning hemodialysis machine procedure safe for patients?].

The dialysis machine shall be cleaned and disinfected after each patient treatment or after every 72 hours break in working. An acceptable disinfectants such as Puristeril plus or Puristeril 340, Citrosteril, Diasteril and Sporotal are used for decontamination. Puristeril 340 is designed for cold disinfection and due to the low pH value, the necessary decalcification of hemodialysis machines is easily achieved. It can be used for all haemodialysis systems like hemodialysis machines, water treatment devices and circuit pipes. Diluted Puristeril decomposes in a non-toxic way. Degradation products of peracetic acid, which is main component of Puristeril are: hydrogen peroxide and acetic acid. Peracetic acid is widely used for disinfection due to its exceptionally broad spectrum of microbiocidal activity at low concentrations and short exposure times. After use Puristeril is easily removable by rinsing with water. This paper deals with the effect of the Puristeril toxicity on blood as a function of its concentration and incubation time. Concentration range of 3.5-70 ppm was used, with particular emphasis on concentrations close to 5 ppm, a value is the limit of sensitivity of strips of starch potassium iodide, the tests for detection of peracetic acid. There was a strong increase in autohaemolysis and malondialdehyde concentrations with increasing concentration of Puristeril. There were also changes in dependence on the parameters of the incubation time, with the greatest effects obtained after 2 hours incubation with Puristeril. The detection limit of peracetic acid used strips of starch potassium iodide does not guarantee the safety of a patient undergoing hemodialysis. Even the residual concentration of Puristeril plus cause increased lipid peroxidation of membrane, and therefore suggest the routine use of stripes on the lower limit of detection of peracetic acid or implement measurement of hydrogen peroxide residues performed with sensitivity 1 ppm.

Biofilms have been observed in the fluid pathways of hemodialysis machines. The impacts of four biocides used for the disinfection of hemodialysis systems were tested against *Candida parapsilosis* sensustricto and *Candida orthopsilosis* biofilms generated by isolates obtained from a hydraulic circuit that were collected in a hemodialysis unit. Acetic acid was shown to be the most effective agent against *Candida* biofilms. Strategies for effective disinfection procedures used for hemodialysis systems should also seek to kill and inhibit biofilms.

Low-pH cleaning agents have also been used as disinfectants, and 3% hydrogen peroxide (vol/vol) may be used to treat biofilms on implants, on the implant-surrounding tissue, on the skin surface, or on infected wounds without devices.

Checklist for Dialysis Station Routine Disinfection

Using a wiping motion (with friction), disinfect all surfaces in the dialysis station in contact with the patient and/or staff. e.g., dialysis chair or bed; tray tables; blood pressure cuffs; countertops; keyboard, etc.

- Clean dialysis machine from top to bottom.
- If visible contaminant on the machine, wipe off using an absorbent material.
- Clean the machine using wipes/cloths with a disinfectant that is acceptable to the HD machine manufacturer and the HA renal program/infection control.
- Remove excess fluid from the wipes/cloth(s) prior to using to clean machine.
- Clean the monitor.

- If available on machine, activate the wipe screen option (pauses the screen).
- If any residue remains after cleaning, wipe down screen with a clean, dry cloth.
- Clean the top of the machine.

If the machine has a door(s), clean the front first, then the insides of the doors.

- Clean all components of the main interface (screen) and the back of the machine* unless recommended otherwise by the manufacturer. e.g., sensors and optical detectors.
- Clean exposed surfaces of dialysate, concentrate, and bicarb connectors.
- Clean each side of machine.
- Clean the area between the main interface (screen) and brakes, including the shelf.
- Clean the brakes.

* Frequency of cleaning back of machine is as per HA protocol.

¨ Ensure surfaces are visibly wet with disinfectant but not dripping. Allow surfaces to air-dry.

Air-drying is recommended to allow for sufficient contact time with the disinfectant.

¨ Remove gloves, eye goggles and gown.

¨ Perform hand hygiene.

Appendix 1: Checklist for Dialysis Station Routine

Disinfection

Do not bring patient or clean supplies to station until these steps have been completed.

REFERENCES:

Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008

William A. Rutala, Ph.D., M.P.H.1,2, David J. Weber, M.D., M.P.H.1,2, and the Healthcare Infection Control Practices Advisory Committee (HICPAC)3

https://www.ncbi.nlm.nih.gov/pubmed/24003659

http://aac.asm.org/content/57/5/2417.full

http://www.bcrenalagency.ca/resource-gallery/Documents/Cleaning%20and%20Disinfecting%20Hemodialysis%20Machines%20and%20Stations.pdf

Highlights of the coming issue


JOURNAL OF HYGIENE SCIENCES
Committed to the advancement of Clinical & Industrial Disinfection & Microbiology

Contents

Mini Review
Environmental Monitoring: Sampling techniques and its Applications.

Current Trends
Surfactants-Types.

In Profile
Selman Waksman.

Bug of the Month
Bifidobacterium.

Did You Know
Impetigo.

Best Practices
Diabetic foot treatment.

Printed and published by D.G. Tripathi, Edited by Akshaya Tendulkar for and on behalf of Tulip Diagnostics (P) Ltd., Tulip House, Dr. Antonio Do Rego Bagh, Alto Santacruz, Bambolim Complex, Post Office Goa - 403 202, India. Fax: 0832 2458544, **Website: www.tulipgroup.com.**