

Editorial

Contents

■ Editorial	1
■ Mini review	2
■ Current Trends	7
■ In Profile	10
■ Relaxed Mood	11
■ Bug of the Month	12
■ Did you Know	14
■ Best Practices	16
■ In Focus	19

Mini Review Section - Cervical cancer is one of the most common cancers in women worldwide. Most cervical cancer is caused by a virus called human papillomavirus, or HPV. You can get HPV by having sexual contact with someone who has it. Cervical cancer occurs when abnormal cells on the cervix grow out of control. The cervix is the lower part of the uterus that opens into the vagina. Cervical cancer can often be successfully treated when it's found early. It is usually found at a very early stage through a Pap test.

Current Trends - Ultraviolet (UV) light is a form of light that is invisible to the human eye. A unique characteristic of UV light is that a specific range of its wavelengths, those between 200 and 300 nanometers (billionths of a meter), are categorized as germicidal – meaning they are capable of inactivating microorganisms, such as bacteria, viruses and protozoa. This capability has allowed widespread adoption of UV light as an environmentally friendly, chemical-free, and highly effective way to disinfect and safeguard water against harmful microorganisms. Ultraviolet disinfection is a disinfection method that uses short-wavelength ultraviolet (UV-C) light to kill or inactivate microorganisms by destroying nucleic acids and disrupting their DNA, leaving them unable to perform vital cellular functions, hence used in a variety of applications, such as food, air, and water purification.

In Profile Section - Yellapragada Subbarow - an Indian biochemist who discovered the function of adenosine triphosphate as an energy source in the cell, and developed methotrexate for the treatment of cancer. Most of his career was spent in the United States.

Bug of the Month - *Campylobacter jejuni* is a Gram-negative slender, curved, and motile rod. It is a microaerophilic organism, which means it has a requirement for reduced levels of oxygen. It is relatively fragile, and sensitive to environmental stresses (e.g., 21% oxygen, drying, heating, disinfectants, acidic conditions). Because of its microaerophilic characteristics the organism requires 3 to 5% oxygen and 2 to 10% carbon dioxide for optimal growth conditions. This bacterium is now recognized as an important enteric pathogen.

Did You Know? The need for appropriate disinfection procedures is highlighted by the multitude of outbreaks resulting from improperly decontaminated patient-care items. Spaulding believed that how an object should be disinfected depended on its intended use. The three categories he described were critical, semicritical, and noncritical. Critical objects (those that enter sterile tissues or the vascular system or through which blood flows, such as implanted medical devices) should be sterile when used. Semicritical items (that touch mucous membranes or non intact skin, e.g., endoscopes, respiratory therapy equipment, and diaphragms) require high-level disinfection (i.e., elimination of all microorganisms except high numbers of bacterial spores). Noncritical items (bedpans, blood pressure cuffs, and bedside tables) require only low-level disinfection.

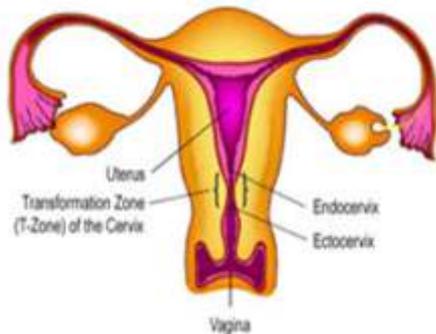
Best Practices - Vancomycin-resistant enterococci (VRE) are strains of *Enterococcus faecium* and *Enterococcus faecalis* that have become resistant to vancomycin. VRE occurs from the bowels of some people who have taken antibiotics, often at very low or undetectable levels. When people receive specific antibiotics such as vancomycin, VRE may be selected for and become detectable. Excessive use of antibiotics for minor infections, such as the common cold, where antibiotics are not required, is likely to be a major contributor to the emergence of VRE.

Don't forget to ease your mind with a light humour in our Relaxed Mood section.....

CERVICAL CANCER

What is cervical cancer?

Cervical cancer is cancer that starts in the cervix, the narrow opening into the uterus from the vagina. The normal “ectocervix” (the portion of the uterus extending into the vagina) is a healthy pink color and is covered with flat, thin cells called squamous cells. The “endocervix” or cervical canal is made up of another kind of cell called columnar cells. The area where these cells meet is called the “transformation zone” (T-zone) and is the most likely location for abnormal or precancerous cells to develop.



Most cervical cancers (80 to 90 percent) are squamous cell cancers. Adenocarcinoma is the second most common type of cervical cancer, accounting for the remaining 10 to 20 percent of cases. Adenocarcinoma develops from the glands that produce mucus in the endocervix. While less common than squamous cell carcinoma, the incidence of adenocarcinoma is on the rise, particularly in younger women.

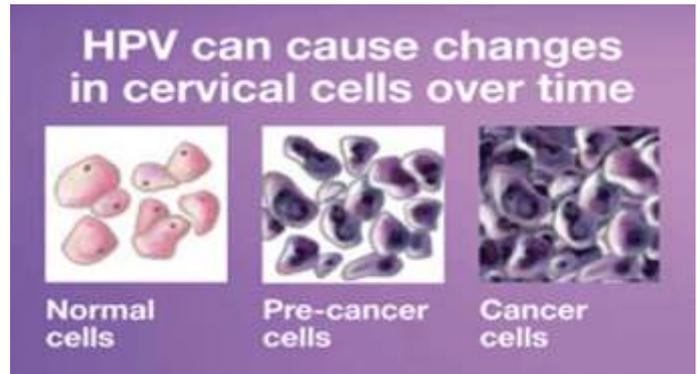
More than 12,000 women in the United States will be diagnosed with cervical cancer each year, and more than 4,000 of women will die. Cervical cancer is the second most common type of cancer for women worldwide, but because it develops over time, it is also one of the most preventable types of cancer. Deaths from cervical cancer in the United States continue to decline by approximately 2 percent a year. This decline is primarily due to the widespread use of the PAP test to detect cervical abnormalities and allow for early treatment. Most women who have abnormal cervical cell changes that progress to cervical cancer have never had a PAP test or have not had one in the previous three to five years.

Cancer of the cervix tends to occur during midlife. Half of the women diagnosed with the disease are between 35 and 55 years of age. It rarely affects women under age 20, and approximately 20 percent of diagnoses are made in women older than 65. For this reason, it is important for women to continue cervical cancer screening until at least the age of 70. Some women need to continue screening longer, so ask your health care provider what's best for you.

What causes cervical cancer?

Human Papillomavirus (HPV) is found in about 99% of

cervical cancers. There are over 100 different types of HPV, most of which are considered low-risk and do not cause cervical cancer. High-risk HPV types may cause cervical cell abnormalities or cancer. More than 70 percent of cervical cancer cases can be attributed to two types of the virus, HPV-16 and HPV-18, often referred to as high-risk HPV types.



HPV is estimated to be the most common sexually transmitted infection in the United States. In fact, by age 50 approximately 80% of women have been infected with some type of HPV. The majority of women infected with the HPV virus do NOT develop cervical cancer. For most women the HPV infection does not last long; 90% of HPV infections resolve on their own within 2 years. A small number of women do not clear the HPV virus and are considered to have “persistent infection. A woman with a persistent HPV infection is at greater risk of developing cervical cell abnormalities and cancer than a woman whose infection resolves on its own. Certain types of this virus are able to transform normal cervical cells into abnormal ones. In a small number of cases and usually over a long period of time (from several years to several decades), some of these abnormal cells may then develop into cervical cancer.

Symptoms of Cervical Cancer

Precancerous cervical cell changes and early cancers of the cervix generally do not cause symptoms. For this reason, regular screening through PAP and HPV tests can help catch precancerous cell changes early and prevent the development of cervical cancer.

Possible symptoms of more advanced disease may include abnormal or irregular vaginal bleeding, pain during sex, or vaginal discharge. Notify your healthcare provider if you experience:

- Abnormal bleeding, such as
 - Bleeding between regular menstrual periods
 - Bleeding after sexual intercourse
 - Bleeding after douching
 - Bleeding after a pelvic exam
 - Bleeding after menopause
- Pelvic pain not related to your menstrual cycle

Heavy or unusual discharge that may be watery, thick, and possibly have a foul odor
 Increased urinary frequency
 Pain during urination
 These symptoms could also be signs of other health problems, not related to cervical cancer. If you experience any of the symptoms above, talk to a healthcare provider.

Cervical Cancer Screening: PAP and HPV Tests

Each year, approximately 12,000 women are diagnosed with cervical cancer in the United States. Yet cervical cancer is one of the most preventable cancers today. In most cases cervical cancer can be prevented through early detection and treatment of abnormal cell changes that occur in the cervix years before cervical cancer develops. We now know that these cell changes are caused by human Papillomavirus, commonly known as HPV.

The traditional test for early detection has been the PAP test. For women age 30 and over, an HPV test may be used along with a PAP. HPV tests can find any of the high-risk types of HPV that are commonly found in cervical cancer. (One HPV test has recently been approved for use as primary cervical cancer screening for women age 25 and older, followed by a PAP test for women with certain results.)

PAP Tests



PAP Test (Ultra PAP test)

A PAP test is done to look for changes in the cells of the cervix. During a PAP test, a small sample of cells from the surface of the cervix is collected by your doctor. The sample is then spread on a slide (PAP smear) or mixed in a liquid fixative (liquid-based cytology) and sent to a lab for examination under a microscope. The cells are examined for abnormalities that may point to abnormal cell changes, such as dysplasia or cervical cancer. The recommended PAP test schedule is based on your age and on things that increase your risk. Talk to your doctor about how often to have this test.

A high-risk type of the human Papillomavirus (HPV) is the cause of most cases of cervical cancer. In women older than 30, an HPV test may be done at the same time as a PAP test. If you are age 26 or younger, you can get the HPV shot to prevent infection with the types of HPV that are most likely to cause cervical cancer.

The PAP test finds changes in the cells of the cervix (the mouth of the womb) that are not normal. When a female has a PAP test, she is positioned on an exam table and a device called a

speculum is gently inserted to open the vagina. The speculum allows the healthcare provider to view the cervix and upper vagina. Once the provider can see the cervix, a “broom” device or a brush/spatula combination will be used to collect the cells. While the technique is a little different depending on the device chosen, in general, the provider will gently rotate the device in the endocervix (the cervical canal) and the ectocervix (the portion of the cervix extending into the vagina) to collect squamous and glandular cells. The cells are sent to a laboratory where they are prepared and evaluated under a microscope.

When a female gets PAP test, she is being screened to make sure that there are no abnormal or precancerous changes in the cells on her cervix. If the PAP test results show these cell changes, this is usually called cervical dysplasia. Other common terms the healthcare provider may use include:

- Abnormal cell changes
- Precancerous cells changes
- CIN (cervical intraepithelial neoplasia)
- SIL (squamous intraepithelial lesions)
- “Warts” on the cervix

All of these terms mean similar things—it simply means that abnormalities were found. Most of the time, these cell changes are due to HPV. There are many types of HPV that can cause cervical dysplasia. Most of these types are considered “high-risk” types, which mean that they have been linked with cervical cancer.

Just because a female has cervical dysplasia, it does not mean she will get cervical cancer. It means that her healthcare provider will want to closely monitor her cervix every so often – and possibly do treatment – to prevent further cell changes that could become cancerous over time if left unchecked.

HPV Tests

The HPV test is primarily used to screen for cervical cancer and/or identify women who may be at increased risk of cervical cancer. The test determines whether a woman's cervical cells are infected with a high-risk type of human Papillomavirus (hrHPV). Such an infection, if long-lasting, can cause changes in cervical cells that could lead to cervical cancer. Now that hrHPV infection is known to be the cause of most cases of cervical cancer, HPV testing has become an essential part of women's health screening.

HPV tests can find any of the high-risk types of HPV that are most commonly found in cervical cancer. The presence of any of these HPV types in a woman for many years can lead to cell changes that may need to be treated so that cervical cancer does not occur. The HPV test is done at the same time as the PAP test by using a small soft brush to collect cervical cells that are sent to the laboratory, or the HPV testing sample may be taken directly from the PAP sample.

A word about genotyping: two “high risk” HPV types (also

called “genotypes), HPV 16 and HPV 18, are responsible for about 70% of cervical cancers worldwide. Knowing if a woman has these types of HPV gives healthcare providers more insight into her risk for developing cervical cancer.

When to get an HPV test.

Experts recommend HPV testing for women who are:

- Age 30 or older – as part of regular screening, with a PAP test, or
- Age 21 or older -- for follow-up of an abnormal PAP test result

You don't need to ask your doctor for an HPV test. Your doctor should offer you an HPV test if you need it and it is available in their practice.

Why is the HPV test NOT recommended as part of regular screening for younger women and teens?

HPV is very common in women under age 30. But it is not useful to test women under age 30 for HPV, since most HPV that is found in these women will never cause them health problems. Most young women will fight off HPV within a few years.

HPV is less common in women over the age of 30, who are at increasing risk for cervical cancer. HPV is also more likely to signal a health problem for these women, who may have had the virus for many years. Doctors may use the HPV test with the PAP test to tell if these women are more likely to get cervical cancer in the future, and if they need to be screened more often.

Getting regular PAP tests, even without the HPV test, is still a good way to prevent cervical cancer—for both younger and older women.

Preparing for a PAP and/or HPV Tes

There are steps you can take to ensure you get the best possible results from your PAP or HPV test.

- Try to schedule the test on a day when you do not expect to be on your menstrual period. If your period begins unexpectedly and will be continuing on the day of your test, try to reschedule the appointment.
- Avoid sexual intercourse 48 hours before the test.
- Do not douche 48 hours before the test.
- Do not use tampons, or vaginal creams, foams, films, or jellies (such as spermicides or medications inserted into the vagina) for 48 hours before the test.

Results

There are many different systems that healthcare providers use to classify a PAP test. Within each system, there are different degrees of severity or abnormalities. The various classification systems and degrees of severity include:

Descriptive System: Mild dysplasia, Moderate dysplasia, Severe dysplasia

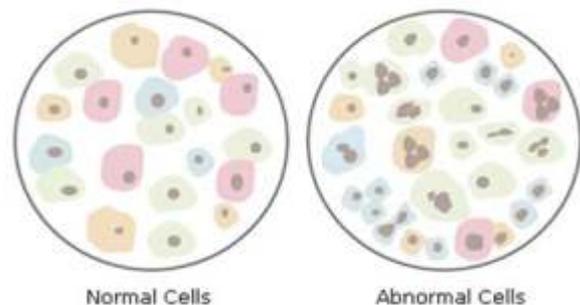
CIN System: CIN stands for cervical intraepithelial neoplasia. Results are classified as CIN 1, CIN 2, CIN 3

Bethesda System:

- ASC-US (Atypical Squamous Cells of Undetermined Significance): Means the results look borderline between “normal” and “abnormal” – often not HPV-related
- ASC-H (Atypical Squamous Cells-can not exclude HSIL):Borderline results, but may really include High-Grade lesions.
- Low-Grade SIL (LSIL) and High-Grade SIL (HSIL): SIL stands for squamous intraepithelial lesion. LSILs are considered mild abnormalities usually caused by an HPV infection. HSILs are considered more severe abnormalities and have a greater chance of progressing to invasive cancer.

Women with abnormal PAP test results are usually examined further for cervical problems. This may involve coming back for a colposcopy and biopsy, or coming back in a few months for another PAP test. If the PAP result is “ASC- US,” then a HPV-DNA test may be done in the lab to see whether HPV is causing this borderline “normal-abnormal” PAP result.

What if PAP test results are abnormal?



If a PAP test shows abnormal cells, additional tests may be performed. These tests include:

Colposcopy: A colposcopy is an examination of the vagina and cervix using a lighted magnifying instrument called a colposcope.

Cervical biopsy: In a biopsy, the healthcare provider removes a small amount of tissue for examination under a microscope to look for precancerous cells or cancer cells. Most women have the biopsy in the doctor's office, and no anesthesia is needed. To do the biopsy, the doctor will insert a speculum to hold the vagina open and take a very small sample. After the sample is taken, it will be sent to a laboratory where another doctor checks the tissue using a microscope. You may experience some bleeding and discharge after the exam and discomfort similar to menstrual cramps. Ibuprofen can be taken to relieve these symptoms.

Colposcopic biopsy: While viewing your cervix with a colposcope, the healthcare provider removes a tiny portion of abnormal tissue from the surface of the cervix with a special tweezers. The cells are then examined under a microscope.

Endocervical curettage: A procedure in which the mucous

membrane of the cervical canal is scraped using a spoon-shaped instrument called a curette. This can be done in your healthcare provider's office and does not require anesthesia. There may be some cramping and bleeding after the procedure.

Cone biopsy: A cone-shaped sample of tissue is removed from the cervix to see if abnormal cells are in the tissue beneath the surface of the cervix. This specimen is much bigger than the biopsy done in the office without anesthesia. A sample of tissue can be removed for a cone biopsy using a LEEP cone procedure, which can be done under local anesthesia, or a knife cone procedure, done in an operating room under local or general anesthesia. You may have some vaginal bleeding for about a week and some spotting for about three weeks after the procedure.

LEEP (Loop Electro-Surgical Excision Procedure): The LEEP is performed using a small heated wire to remove tissue and precancerous cells from the cervix. This procedure can be done in your provider's office and requires local anesthesia. There may be some cramping during and after the procedure. You may have moderate to heavy vaginal discharge that lasts for up to three weeks.

Cervical Cancer Prevention

- Avoiding risk factors and increasing protective factors may help prevent cancer.
- The following are risk factors for cervical cancer:
 - HPV infection
 - Having a weakened immune system
 - DES exposure
 - In women with HPV infection, other risk factors are also associated with an increased risk of cervical cancer.
 - Many full-term pregnancies
 - Long-term use of oral contraceptives
 - Smoking
- The following protective factors decrease the risk of cervical cancer:
 - Avoiding sexual activity
 - Getting an HPV vaccine
 - Using barrier protection during sexual activity
- Cancer prevention clinical trials are used to study ways to prevent cancer.
- New ways to prevent cervical cancer are being studied in clinical trials.

Avoiding risk factors and increasing protective factors may help prevent cancer.

Avoiding cancer risk factors may help prevent certain cancers. Risk factors include smoking, being overweight, and not getting enough exercise. Increasing protective factors such as quitting smoking, eating a healthy diet, and exercising may also help prevent some cancers. Talk to your doctor or other

health care professional about how you might lower your risk of cancer.

The following are risk factors for cervical cancer:

HPV infection

Infection with human Papillomavirus (HPV) is the most common cause of cervical cancer. HPV infections that cause cervical cancer are spread through sexual contact. There are more than 80 types of human Papillomavirus and about 30 of these can infect the cervix. HPV types 16 and 18 are most often linked to cervical cancer.

Most of the time, the body's immune system can fight the HPV infection. Only a very small number of women infected with HPV develop cervical cancer.

Having a weakened immune system

Having a weakened immune system caused by immunosuppression increases the risk of HPV infection and cervical cancer. Immunosuppression is a condition in which the body's immune system is weakened and its ability to fight infections and other diseases is lessened. Long-term immunosuppression may increase the risk of cervical cancer because it lowers the body's ability to fight HPV infection.

Immunosuppression can be caused by the following:

Human immunodeficiency virus

- (HIV). This virus causes AIDS and weakens the body's immune system. Women who are infected with the HIV virus have an increased risk of HPV infection and cervical cancer compared with women who are not infected with HIV.
- Medicine
 - to prevent organ rejection after transplant. Women who have an organ transplant are given medicine to weaken the body's immune system and help prevent organ rejection.

DES exposure

Being exposed to a drug called diethylstilbestrol (DES) while in the mother's womb increases the risk of cervical dysplasia and clear cell adenocarcinoma of the vagina and cervix. Between 1940 and 1971, DES was given to some pregnant women in the United States to prevent miscarriage (premature birth of a fetus that cannot survive) and premature labor.

In women with HPV infection, other risk factors are also associated with an increased risk of cervical cancer.

Many full-term pregnancies

Among women who are infected with HPV, those who have had 7 or more full-term pregnancies have an increased risk of cervical cancer.

Long-term use of oral contraceptives

Among women who are infected with HPV, those who have used oral contraceptives ("the Pill") for 5 to 9 years have a **risk of cervical cancer** that is 3 times greater than that of women who have never used oral contraceptives. The risk is 4 times greater after 10 or more years of use. In women who stop taking oral contraceptives, over a 10 year period, the risk of

cervical cancer returns to that of women who never used oral contraceptives.

Smoking

Women who either smoke cigarettes or breathe in secondhand smoke have an increased risk of cervical cancer. The risk increases with the number of cigarettes smoked per day and how long the woman has smoked. Among women infected with HPV, current and former smokers have 2 to 3 times the risk of cervical dysplasia and invasive cervical cancer. The following protective factors decrease the risk of cervical cancer:

Avoiding sexual activity

Almost all cases of cervical cancer are caused by HPV infection, which is spread through sexual activity. Cervical cancer is seen more often in women who are sexually active at an early age and who have multiple sexual partners.

Getting an HPV vaccine

Vaccines that protect against HPV infection greatly reduce the risk of cervical cancer. These vaccines do not protect women who are already infected with HPV.

Several HPV vaccines have been approved by the U.S. Food and Drug Administration (FDA). These vaccines have been shown to prevent infection with the types of HPV that cause most cervical cancers. Protection against HPV infection lasts for 6 to 8 years. It is not known if the protection lasts longer.

Harms of HPV vaccines include dizziness, feeling faint, headache, fever, and redness, tenderness, or warmth at the place of injection. Allergic reactions are rare.

Using barrier protection during sexual activity

Some methods used to prevent sexually transmitted diseases (STDs) decrease the risk of HPV infection. The use of a barrier method of birth control, such as a condom or diaphragm, helps protect against HPV infection.

Cancer prevention clinical trials are used to study ways to prevent cancer.

Cancer prevention clinical trials are used to study ways to lower the risk of developing certain types of cancer. Some cancer prevention trials are conducted with healthy people who have not had cancer but who have an increased risk for cancer. Other prevention trials are conducted with people who have had cancer and are trying to prevent another cancer of the same type or to lower their chance of developing a new type of cancer. Other trials are done with healthy volunteers who are not known to have any risk factors for cancer.

The purpose of some cancer prevention clinical trials is to find out whether actions people take can prevent cancer. These may include eating fruits and vegetables, exercising, quitting smoking, or taking certain medicines, vitamins, minerals, or food supplements.

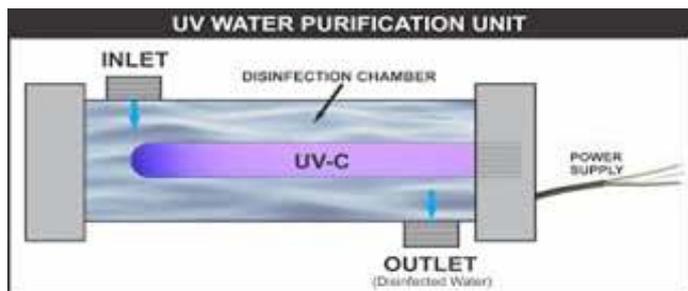
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UV LIGHT DISINFECTION

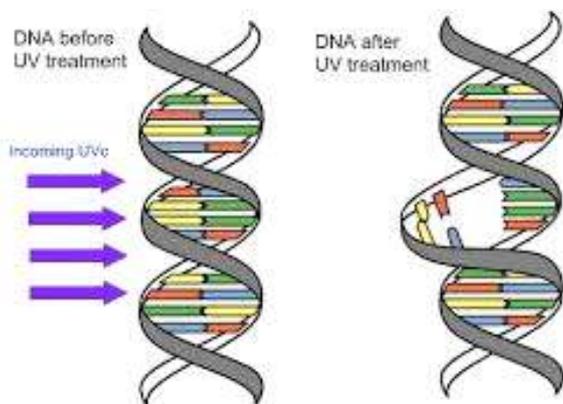
What is UV disinfection?

UV light, which continues to be a reliable means of disinfection, involves exposing contaminated water to radiation from UV light. The treatment works because UV light penetrates an organism's cell walls and disrupts the cell's genetic material, making reproduction impossible. A special lamp generates the radiation that creates UV light by striking an electric arc through low-pressure mercury vapor. This lamp emits a broad spectrum of radiation with intense peaks at UV wavelengths of 253.7 nanometers (nm) and a lesser peak at 184.9 nm. Research has shown that the optimum UV wavelength range to destroy bacteria is between 250 nm and 270 nm.



Mode of Action:

When microorganisms are subjected to UV light, cellular DNA absorbs the energy by purines and pyrimidine bases, and adjacent thymine molecules link together, as figure illustrates. Linked thymine molecules are unable to encode adenine on messenger RNA molecules during the process of protein synthesis. Moreover, replication of the chromosome in binary fission is impaired. The damaged organism can no longer produce critical proteins or reproduce, and it quickly dies. Ultraviolet light is especially effective in inactivating viruses. However, it kills far fewer bacteria than one might expect because of DNA repair mechanisms. Once DNA is repaired, new molecules of RNA and protein can be synthesized to replace the damaged molecules.



SUN--Free Source of UV:

Sunlight contains some UV radiation, but the shorter wavelengths – those most effective against bacteria – are screened out by the ozone layer of the atmosphere. The antimicrobial effect of sunlight is due almost entirely to the

formation of singlet oxygen on the cytoplasm. Many pigments produced by bacteria provide protection from sunlight.

The U.S. Environmental Protection Agency (EPA) lists UV disinfection as an approved technology for small public water systems. In addition, EPA is considering the following variations of conventional UV treatment as “emerging” technologies: pulsed UV, medium-pressure UV, and UV oxidation (i.e., used in combination with peroxide or ozone)

Advantages

Generally, UV is simple to install and requires little supervision, maintenance, or space. Improved safety, minimum service time, low operation and maintenance costs, and the absence of a chemical smell or taste in finished water are primary factors for selecting UV technology rather than traditional disinfection technologies. UV treatment breaks down or removes some organic contaminants. UV achieves 1-log reduction of *Giardia lamblia* at an intensity of 80-120 mWs/cm², and 4-log reduction of viruses at an intensity of 90-140 mWs/cm². Only recently has the scientific community begun to accept UV as a highly effective tool for *Cryptosporidium* control. UV light disinfection does not form any significant disinfection byproducts, nor does it cause any significant increase in assimilable organic carbon (AOC). Research has confirmed that UV effectiveness is relatively insensitive to temperature and pH differences. In addition, researchers found that UV application does not convert nitrates to nitrites, or bromide to bromines or bromates. Recent pilot studies show that UV-treated drinking water inhibits bacterial growth and replication in the distribution system; however, conditions within distribution systems, such as leaks, still require additional residual disinfection (e.g., free chlorine). The advantages of using UV, rather than chemical disinfection, include: Has no known toxic or significant nontoxic byproducts; Has no danger of overdosing; Removes some organic contaminants; Has no volatile organic compound (VOC) emissions or toxic air emissions; Has no onsite smell and no smell in the final water product; Requires very little contact time (seconds versus minutes for chemical disinfection); Does not require storage of hazardous material; Requires minimal space for equipment and contact chamber; Improves the taste of water because of some organic contaminants and nuisance microorganisms are destroyed; Does not affect minerals in water; and Has little or no impact on the environment except for disposing of used lamps or obsolete equipment.

Limitations

Microbial and chemical characteristics are two major water quality factors that affect the UV unit performance. Microbial characteristics of water include type, source, age, and density. Chemical water characteristics include nitrites, sulfites, iron, hardness, and aromatic organic levels. UV radiation is not suitable for water with high levels of suspended solids, turbidity, color, or soluble organic matter. These materials can react with UV radiation, and reduce disinfection performance. Turbidity makes it difficult for radiation to penetrate water. Disadvantages of UV disinfection include: • No disinfection residual; of microbial testing. Laboratories typically test for

total coliform to judge microbiological activity in drinking water—but coliforms are sensitive to UV light. Because of this sensitivity, microbial tests for UV treated finished water should include a Heterotrophic Plate Count (HPC) test. HPC microorganisms may provide a better disinfection assessment than the UV sensitive coliforms.

Process Description UV light effectively destroys bacteria and viruses. However, how well the UV system works depends on the energy dose that the organism absorbs. If the energy dose is not high enough, the organism's genetic material may only be damaged rather than disrupted. An effective dose is measured as a product of the lamp's intensity (the rate at which photons are delivered to the target), including radiation concentration, proper wavelength, exposure time, water quality, flow rate, and the microorganism's type, and source, as well as its distance from the light source.

At a minimum, drinking water systems should install two UV units, which are both capable of carrying the amount of water the system was designed to handle. Having two units in place assures continuous disinfection when one unit is being serviced. Two units also can ensure operation during low-flow demand periods. Modular units designed for small drinking water systems are easy to install and operate (two plumbing connections per unit and one electrical hook-up). They should be equipped with automatic cleaners and remote alarm systems.

UV SYSTEM VALIDATION As microbes flow through a UV reactor they will all follow a different path

1. Some will receive a high dose and some a lower dose
2. To account for these differences, “Validated” reactors should be used
3. “Validation” involves a full-scale test of the UV system involving live microbes

APPLICATIONS

DISINFECTION

- LIQUIDS: water, syrups, emulsions, brines.
- SURFACES: packaging, conveyors, food, working surfaces.
- GASES/AIR: food preparation, clean rooms, air conditioning.

Infectious agents killed-Bacillus subtilis (spore), Clostridium tetani, Legionella Pneumophilla, Pseudomonas aeruginosa, Hepatitis A virus, Streptococcus feacalis, Hepatitis Poliovirus, Saccharomyces cervisiae, Infectious pancreatic necrosis

Pulsed UV Light

Pulse RX Pulsed UV Light Disinfection Systems offers the ultimate in safe, cost effective cleaning for healthcare facilities like hospitals and emergency rooms. Our disinfection services optimize UV (xenon) light to the highest frequency, killing even pan-resistant pathogens – and other community borne infections – more effectively than manual cleaning.

Targeted UV light “scrubs” areas known to harbour the most germs. Micro scratches in surfaces, cracks and crevices are often unreachable to a human, even when using steam cleaning and chemical disinfectants.

Pulsed xenon light has been shown to effectively kill MRSA,

VRE, CRE, C. diff, GNR, bacterial meningitis and other highly contagious pathogens that are most common in health care environments.

Who Can Benefit From Pulsed Xenon UV Disinfection?

- Hospitals
- Emergency Rooms
- Health Care Clinics
- Hospital Equipment
- Emergency Vehicles (Ambulance, police cars)
- Nursing Homes
- Sports Facilities (Locker rooms, team shower facilities)
- Universities (Dormitories, community washrooms)
- Hotels

What is Pulsed UV Technology?

Pulsed UV technology has been clinically proven to add an extra layer of protection in high risk environments where illness can spread rapidly. We offer leased disinfection services using a pulsed xenon light system. Our specially trained staff is here to help destroy ambient bacteria on all types of surfaces.

Traditionally, manual cleaning methods have involved a person or team of people entering an environment to clean by hand using disinfecting chemicals and the old trusty tools of the trade: mops, sponges and rubber gloves. As contagious illnesses continue to threaten populations all over the world, controlling the spread of illness using high tech cleaning methods has become a major area of focus.

Benefits of Pulsed UV

Pulsed UV technology can destroy deadly bacteria and significantly reduce mortality among people suffering from hospital acquired infections. Cleaning automation technologies allow a “no touch disinfection” process that protects patients, hospital staff and cleaning personnel from coming into contact with these deadly infections.

Ultraviolet (UV) Oxidation

Description

Ultraviolet (UV) oxidation is a destruction process that oxidizes organic contaminants in water. It works by the adding oxidizing agents such as ozone (O₃) or hydrogen peroxide (H₂O₂) to the contaminated groundwater. The contaminated solution is passed through a chamber where it is exposed to intense UV radiation. UV radiation is provided by UV light bulbs. Oxidation of target contaminants is caused by direct reaction with the oxidizers (for example, see description of Peroxone), and through the action of UV light in combination with ozone and/or hydrogen peroxide.

Limitations and Concerns

A major success factor is how well UV light is transmitted to dissolved contaminants. High turbidity (e.g., cloudiness) of the water would cause interference.

The water should be relatively free of heavy metal ions and insoluble oil or grease to minimize the potential for fouling of the lights.

This system does not destroy some volatile organics such as trichloroethane (TCA). Instead, the contaminants may be vaporized and would need to be treated in an off-gas system.

Energy requirements are very high, and this is a large drawback to this technology.

Handling and storage of hydrogen peroxide requires special safety precautions.

Applicability

UV treatment is used to destroy VOCs and UXO (explosive compounds such as TNT) in groundwater. Typically, easily oxidized organic compounds, such as those with double bonds (e.g., TCE, PCE, and vinyl chloride), as well as simple aromatic compounds (e.g., toluene, benzene, xylene, and phenol) are rapidly destroyed in UV/oxidation processes. UV Oxidation can also be used to treat organic compounds in air treatment systems Technology Development Status

The UV/oxidation technology is a commercially available groundwater treatment technology that has been used for more than 10 years. A majority of these applications are for groundwater contaminated with petroleum products or with a variety of industrial solvent-related organics such as TCE, DCE, and vinyl chloride. Its use for destroying explosive compounds has been more limited. The US Army Environmental Center (AEC) evaluations have shown it to be 99.9% effective in destroying common explosives in groundwater.

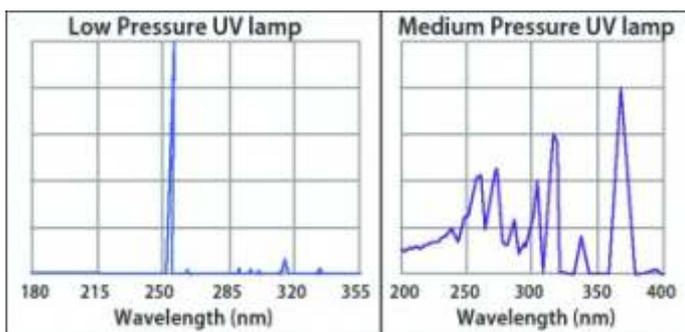
Medium Pressure UV Lamps Give More for Less

- Gives more disinfection per cm/inch than low pressure lamps
- Broad germicidal spectrum attacks different parts of the microorganism and destroys their repair mechanisms
- There is no danger of microorganism repair that compromises your product later on
- Uses much less UV energy than low pressure systems in virus inactivation - Adenovirus requires half the dose than with Low Pressure systems
- Easily inactivates microorganisms resistant to other disinfection methods such as chlorine, heat and low-pressure UV

Works effectively in cold and warm water - unlike Low Pressure UV

Fewer UV lamps needed

- Fewer lamps means significant maintenance reduction
- In some cases, 2 or 3 Medium Pressure lamps can replace more than 50 Low Pressure lamps



Low Pressure lamps emit one single wavelength (254nm), whereas Medium Pressure lamps emit a broad band of wavelengths all over the germicidal UV areas (200 - 415 nm)

UV LED

UV LEDs continue to make their way in the booming UV curing business, through replacement of incumbent technologies such as mercury lamps. Thanks to this an overall UV LED market that represented only -\$20M in 2008 grew to-\$90M in 2014, at a compound annual growth rate (CAGR) of 28.5%.

Such growth is likely to continue as LED-powered UV curing spreads across ink, adhesive and coating industries. By 2017/2018, the UV LED market should also see part of its revenues coming from UVC disinfection and purification applications, for which device performance is not yet sufficient. But this is only if we take into account standard applications, where UV LEDs replace UV lamps. The potential is even greater if we consider UV LEDs' ability to enable new concepts in areas like general lighting, horticultural lighting, biomedical devices, and in fighting hospital-acquired infections (HAIs). Even this is just scratching the surface of UV LEDs' real potential. While the new applications don't yet have a strong impact on market size, we expect them to possibly count for nearly 10% of the total UV LED market size by 2019.

The report presents a comprehensive review of all UV lamp applications including a deep analysis of UV curing, UV purification and disinfection and analytical instruments. It highlights the UV LED working principle, market structure, UV LED market drivers and associated challenges and characteristics, the total accessible market (TAM) for UV LEDs, and much more. The report also details the market volume and size metrics for traditional UV lamps and UV LEDs over the period 2008-2019, with splits by application for each technology.

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<http://www.lenntech.com/library/uv/will1.htm>

<http://www.cpeo.org/techtree/ttdescript/uvtreat.htm>

Best practices in surface and medical device disinfection

<http://www.nhs.uk/chq/Pages/880.aspx?CategoryID=118>

Yellapragada Subbarow

Born On : January 12, 1895

Born In : Bhimavaram,
Andhra Pradesh

Died On : August 9, 1948

Career : Biochemist

Nationality : Indian

Yellapragada Subbarow was an Indian biochemist who discovered the function of adenosine triphosphate as an energy source in the cell, and developed methotrexate for the treatment of cancer. Most of his career was spent in the United States.

Early Life

Yellapragada Subbarao was born in a poor Telugu 6000 Niyogi Brahmin family in Bhimavaram district in Old Madras Presidency, now in West Godavari district, Andhra Pradesh. He was born as the fourth child amongst seven children to Y. Jagganatham and Y. Venkamma. Though his father worked as a revenue inspector, the family suffered from many hardships of poverty due to the loss of several of his close relatives at a young age. As such, his schooling at Rajahmundry went through a traumatic phase, leading to his completion of matriculation in the third attempt from Hindu High School in Madras. He attained his intermediate education from Presidency College and took admission in Madras Medical College, his education being financed by his friends and Kasturi Suryanarayana Murthy. He later went on to marry Murthy's daughter.

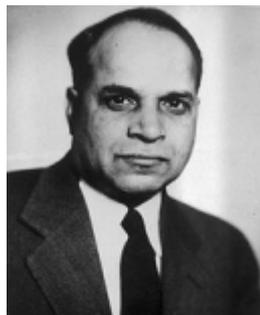
During the freedom movement, Subbarao was so influenced by Mahatma Gandhi that he gave up using British goods and started wearing khadi surgical dress. This displeased his Anglican partial racist professor, M.C. Bradfield who qualified him for a lesser LMS degree instead of a full MBBS degree, although he fared well in all written examinations. He tried to get through Madras Medical service but failed. Hence, he started working as an anatomy lecturer in Dr. Lakshmiopathi's Ayurvedic College at Madras. After gaining much interest in Ayurveda, he diverted his interest towards conducting his research in this field. But he was soon on track after he met an American doctor who was touring India for Rockefeller Scholarship. With financial support from his father-in-law Murthy and promise of support from Satyalinga Naicker Charities and Malladi charities, he sailed to Boston in US on October 26, 1922.

Life in America

Subbarao took admission in Harvard School of Tropical Medicine and on completing the diploma; he took up the job of a junior faculty member at Harvard. Living in poverty, he managed to work two or three jobs in shifts. This gained him appreciation from professors and won many scholarships. For the first time, Subbarao gained public attention with the discovery of the estimation of phosphorus in body fluids and tissues, along with Cyrus Fiske. This discovery came to be known as Fiske-Subbarao method, though it was technically named Rapid Calorimetric Method. Next came the accidental discovery of physiology in the body based on Adenosine Triphosphate and Phosphocreatine (ATP), which are the sources of energy in human body. With this, Subbarao's name was listed in the biochemistry textbooks in 1930s for the first time. In the same year, he obtained his PhD degree. He worked at Harvard till 1940 and later joined Lederle Laboratories, a division of American Cyanamid, as the Director of Research, after he was denied the post of a regular faculty at Harvard.

Contributions to Medicine

At Lederle, Subbarao discovered many more antibiotics for a wide range of cures, other than the already discovered penicillin and streptomycin. His research led him to the discovery of polymyxin



which is still used in cattle-feed. This led to laying the foundation for the isolation of vitamin B9, the antipernicious anemia factor, based on the work conducted by Lucy Wills in 1945. He applied different inputs given by Dr. Sidney Farber to develop an anti-cancer drug Methotrexate, one of the first cancer chemotherapy agents, which is still used worldwide. He was also credited with the discovery of drug Hetrazen, a cure for filariasis at Lederle. Today, this drug is the most widely used medicine for treating filariasis, including World Health Organization. Under his directorship, Benjamin Duggar gave birth to his discovery of the world's first tetracycline antibiotic, Aureomycin in the same year. This resulted as one of the largest distributed scientific experiments till date with American soldiers being asked to collect soil samples during World War II and deposit them at Lederle Laboratories for anti-bacterial agents from natural soil fungi. Another medicine that he discovered was Isonicotinic acid Hydrazide, an effective cure for tuberculosis.

Recognition

With so many discoveries and developments to his credit, Subbarao never marketed his work and hence, was always left behind in terms of work recognition and appreciation. He always sat in the audience and had to be pushed to the stage by a colleague or a collaborator to take a bow as each of his researches was revealed to the public. Further, he was seen giving interviews to the press or visiting nations on lecture tours. When his colleague George Hitchings won the Nobel Prize in Physiology or Medicine, along with Gertrude Elion, in 1988, he stated that some of the works initiated by Subbarao had to be rediscovered for the simple reason that his partner Fiske did not allow his contributions earn name and fame, probably out of jealousy. American Cyanamid honored Subbarao by naming a new fungus under his name "Subbaromyces splendens".

Personal Life

On being persuaded by his family, Subbarao was married to his distant cousin Seshagiri, daughter of Kasturi Suryanarayana Murthy, on May 10, 1919. She belonged to Anaparthi village in East Godavari district of Andhra Pradesh. After the couple went to America, his wife gave birth to a son in a couple months. However, the son died at nine months due to the dreadful disease "Sappi".

Death

Yellapragada Subbarao spent most of his career life in America without a green card. Thus, he remained an alien in America, although he performed several important medical researches during World War II. But he had always hoped of shedding the stigma of being an alien amidst people with whom he spent over 25 years. With this, he filed the "Declaration of Intention" to get the ruling of the Immigration and Naturalization Service that he has been legally admitted to United States. Despite getting the American citizenship, Subbarao was an Indian at heart and died as an Indian. On his death on August 9, 1948 in USA due to a massive heart attack, numerous obituaries appeared in Science, New York Times, New York Herald-Tribune, and several other newspapers and journals across the world in honor of this distinguished scientist. He was bestowed upon with "one of the most eminent medical minds of the Century" by Herald-Tribune.

Timeline

1895: Born on January 12 in Bhimavaram, Andhra Pradesh

1919: Married Seshagiri on May 10

1922: Went to America and took admission in Harvard School of Tropical Medicine

1930: Discovered the role of ATP and obtained PhD degree

1940: Joined Lederle Laboratories at Director of Research

1945: Discovered world's first tetracycline antibiotic Aureomycin and method to synthesize folic acid

1948: Died on August 9 in America, aged 53



FUNNY QUOTES

1. Before I got married I had six theories about bringing up children; now I have six children and no theories.
- *John Wilmot*
2. Always forgive your enemies; nothing annoys them so much.
- *Oscar Wilde*
3. Laughing at our mistakes can lengthen our own life. Laughing at someone else's can shorten it.
- *Cullen Hightower*
4. We learn something every day, and lots of times it's that what we learned the day before was wrong.
- *Bill Vaughan*
5. Don't ever wrestle with a pig. You'll both get dirty, but the pig will enjoy it.
- *Cale Yarborough*
6. An inventor is simply a fellow who doesn't take his education too seriously.
- *Charles F. Kettering*
7. Some people like my advice so much that they frame it upon the wall instead of using it.
- *Gordon R. Dickson*

GREAT THOUGHTS BY GREAT PEOPLE

Napoleon said

"The world suffers a lot...Not because of the violence of bad people, but because of the silence of good people!"

Michael Paul Said

I wrote on the door of heart, "Please do not enter it"

*Love came smiling and said:
"Sorry I am an illiterate"*

Einstein said

*"I am thankful to all those who said NO to me
Its Because of them I did it myself...."*

Abraham Lincoln said

*"If friendship is your weakest point then you are
the strongest person in the world"*

Shakespeare said

*"Laughing faces do not mean that there is absence
of sorrow!
But it means
That they have the ability to deal with it."*

Shakespeare said

*"In the time of crisis I was not hurt by the harsh
words of my enemies, but by the silence of my
FRIENDS"*

William Arthur said

*"Opportunities are like sunrises, if you wait too
long you miss them"*

Shakespeare said

*"Never play with the feelings of others because
you may win the game but the risk is that you will
surely loose the person for life time"*

Hitler said

*"When you are in the light, everything follows you.
But when you enter into the dark, even you own
shadow doesn't follow you."*

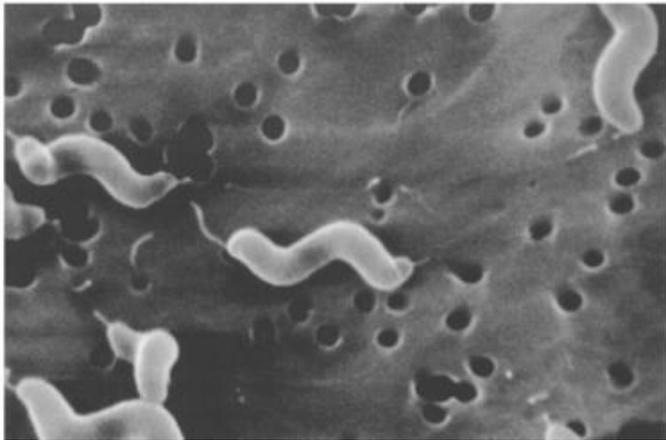
Shakespeare said

*"Coin always makes sound but the currency notes
are always silent. So when your value increases
keep yourself calm & silent"*

John Keats said

*"It is very easy to defeat someone, but it is very
hard to win someone"*

CAMPYLOBACTER JEJUNI



Scientific classification

Domain	: Bacteria
Phylum	: Proteobacteria
Class	: Epsilon Proteobacteria
Order	: Campylobacterales
Family	: Campylobacteraceae
Genus	: Campylobacter
Species	: <i>C. jejuni</i>

Campylobacter jejuni is a Gram-negative slender, curved, and motile rod. It is a microaerophilic organism, which means it has a requirement for reduced levels of oxygen. It is relatively fragile, and sensitive to environmental stresses (e.g., 21% oxygen, drying, heating, disinfectants, acidic conditions). Because of its microaerophilic characteristics the organism requires 3 to 5% oxygen and 2 to 10% carbon dioxide for optimal growth conditions. This bacterium is now recognized as an important enteric pathogen. Before 1972, when methods were developed for its isolation from feces, it was believed to be primarily an animal pathogen causing abortion and enteritis in sheep and cattle. Surveys have shown that *C. jejuni* is the leading cause of bacterial diarrheal illness in the United States. It causes more disease than *Shigella* spp. and *Salmonella* spp. combined.

Although *C. jejuni* is not carried by healthy individuals in the United States or Europe, it is often isolated from healthy cattle, chickens, birds and even flies. It is sometimes present in non-chlorinated water sources such as streams and ponds.

Because the pathogenic mechanisms of *C. jejuni* are still being studied, it is difficult to differentiate pathogenic from nonpathogenic strains. However, it appears that many of the chicken isolates are pathogens.

Name of Disease:

Campylobacteriosis is the name of the illness caused by *C. jejuni*. It is also often known as campylobacter enteritis or gastroenteritis.

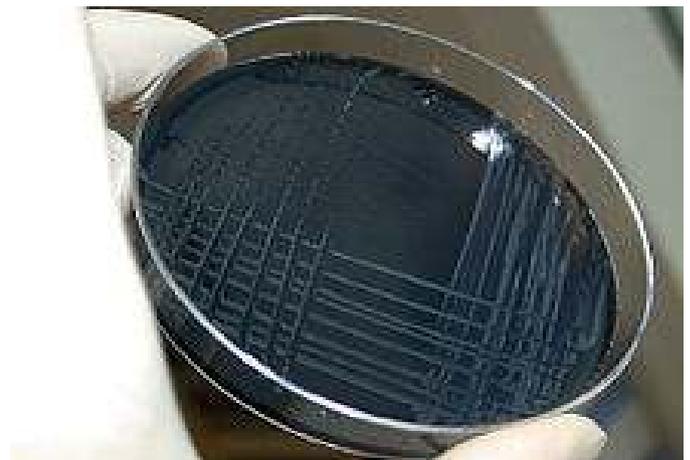
Major Symptoms:

C. jejuni infection causes diarrhea, which may be watery or sticky and can contain blood (usually occult) and fecal leukocytes (white cells). Other symptoms often present are fever, abdominal pain, nausea, headache and muscle pain. The illness usually occurs 2-5 days after ingestion of the contaminated food or water. Illness generally lasts 7-10 days, but relapses are not uncommon (about 25% of cases). Most infections are self-limiting and are not treated with antibiotics. However, treatment with erythromycin does reduce the length of time that infected individuals shed the bacteria in their feces.

The infective dose of *C. jejuni* is considered to be small. Human feeding studies suggest that about 400-500 bacteria may cause illness in some individuals, while in others, greater numbers are required. A conducted volunteer human feeding study suggests that host susceptibility also dictates infectious dose to some degree. The pathogenic mechanisms of *C. jejuni* are still not completely understood, but it does produce a heat-labile toxin that may cause diarrhea. *C. jejuni* may also be an invasive organism.

Isolation Procedures:

C. jejuni is usually present in high numbers in the diarrheal stools of individuals, but isolation requires special antibiotic-containing media and a special microaerophilic atmosphere (5% oxygen). However, most clinical laboratories are equipped to isolate *Campylobacter* spp. if requested.



Blood-free, charcoal-based selective medium agar (CSM) for isolation of *Campylobacter jejuni*

Laboratory characteristics

Characteristic	Result
Growth at 25 °C	-
Growth at 35-37 °C	+
Growth at 42 °C	+
Nitrate reduction	+
Catalase test	+
Oxidase test	+
Growth on MacConkey agar	+
Motility (wet mount)	+
Glucose utilization	-
Hippurate hydrolysis	+
Resistance to nalidixic acid	-
Resistance to cephalothin	+

Under light microscopy, *C. jejuni* has a characteristic "seagull" shape as a consequence of its helical form. *Campylobacter* is grown on specially selective "CAMP" agar plates at 42°C, the normal avian body temperature, rather than at 37°C, the temperature at which most other pathogenic bacteria are grown. Since the colonies are oxidase positive, they will usually only grow in scanty amounts on the plates. Microaerophilic conditions are required for luxurious growth. A selective blood agar medium (Skirrow's medium) can be used. Greater selectivity can be gained with an infusion of a cocktail of antibiotics: vancomycin, polymixin-B, trimethoprim and actidione ([Preston's agar]), [8] and growth under microaerophilic conditions at 42°C.

Associated Foods:

C. jejuni frequently contaminates raw chicken. Surveys show that 20 to 100% of retail chickens are contaminated. This is not overly surprising since many healthy chickens carry these bacteria in their intestinal tracts. Raw milk is also a source of infections. The bacteria are often carried by healthy cattle and by flies on farms. Non-chlorinated water

may also be a source of infections. However, properly cooking chicken, pasteurizing milk, and chlorinating drinking water will kill the bacteria.

Frequency of the Disease:

C. jejuni is the leading cause of bacterial diarrhea in the U.S. There are probably numbers of cases in excess of the estimated cases of salmonellosis (2- to 4,000,000/year).

Complications:

Complications are relatively rare, but infections have been associated with reactive arthritis, hemolytic uremic syndrome, and following septicemia, infections of nearly any organ. The estimated case/fatality ratio for all *C. jejuni* infections is 0.1, meaning one death per 1,000 cases. Fatalities are rare in healthy individuals and usually occur in cancer patients or in the otherwise debilitated. Only 20 reported cases of septic abortion induced by *C. jejuni* have been recorded in the literature.

Meningitis, recurrent colitis, acute cholecystitis and Guillain-Barre syndrome are very rare complications.

Target Populations:

Although anyone can have a *C. jejuni* infection, children under 5 years and young adults (15-29) are more frequently afflicted than other age groups. Reactive arthritis, a rare complication of these infections, is strongly associated with people who have the human lymphocyte antigen B27 (HLA-B27).

Recovery from Foods:

Isolation of *C. jejuni* from food is difficult because the bacteria are usually present in very low numbers (unlike the case of diarrheal stools in which 10⁶ bacteria/gram is not unusual). The methods require an enrichment broth containing antibiotics, special antibiotic-containing plates and a microaerophilic atmosphere generally a microaerophilic atmosphere with 5% oxygen and an elevated concentration of carbon dioxide (10%). Isolation can take several days to a week.

ENDOCLENS

New disinfection methods include a persistent antimicrobial-drug coating that can be applied to inanimate and animate objects (Surfacine), a high-level disinfectant with reduced exposure time (ortho-phthalaldehyde), and an antimicrobial drug that can be applied to animate and inanimate objects (superoxidized water). New sterilization methods include a chemical sterilization process for endoscopes that integrates cleaning (Endoclens), a rapid (4-hour) readout biological indicator for ethylene oxide sterilization (Attest), and a hydrogen peroxide plasma sterilizer that has a shorter cycle time and improved efficacy (Sterrad 50).

The need for appropriate disinfection procedures is highlighted by the multitude of outbreaks resulting from improperly decontaminated patient-care items. Because sterilizing all such items is unnecessary, hospital policies need to identify whether cleaning, disinfection, or sterilization is indicated based primarily on an item's intended use but considering other factors including cost. We review new methods of disinfection and sterilization. Criteria for inclusion were technologies cleared in 1999 or 2000 by the Food and Drug Administration (FDA) or submitted to the FDA or Environmental Protection Agency (EPA) but not yet cleared. These technologies have the potential to improve patient care, but in general their antimicrobial activity has not been independently validated

More than 25 years ago, Spaulding devised an approach to disinfection and sterilization of patient-care items or equipment that has proved to be so clear and logical that it has been retained, refined, and successfully used by infection control professionals. Spaulding believed that how an object should be disinfected depended on its intended use. The three categories he described were critical, semicritical, and noncritical. Critical objects (those that enter sterile tissues or the vascular system or through which blood flows, such as implanted medical devices) should be sterile when used. Semicritical items (that touch mucous membranes or nonintact skin, e.g., endoscopes, respiratory therapy equipment, and diaphragms) require high-level disinfection (i.e., elimination of all microorganisms except high numbers of bacterial spores). Noncritical items (bedpans, blood pressure cuffs, and bedside tables) require only low-level disinfection.

A new automated endoscope-reprocessing system has been submitted to FDA for clearance. The system is designed to provide rapid, automated, point-of-use chemical sterilization of flexible endoscopes and consists of a computer-controlled

endoscope-reprocessing machine and a new, proprietary liquid sterilant that uses performic acid. The sterilant is produced, as needed by the machine, by automatic mixing of the two component solutions of hydrogen peroxide and formic acid. This sterilant is fast-acting against spore-forming bacteria (Table 4). The system's major features are an automatic cleaning process, capability to process two flexible scopes asynchronously, automated channel blockage and leak detection, filter water rinsing and scope drying after sterilization, hard-copy documentation of key process parameters, user-friendly machine interface, and total cycle time less than 30 minutes. The reprocessor can also be disinfected automatically to prevent infection or pseudoinfection.

The reprocessor can independently process two endoscopes at the user's discretion since it has two washing/sterilization bays. The endoscopes are attached to special holders (racks), which slide into the machine bays located in the front of the machine and provide a connection between the reprocessor and the endoscope's inner channels. The endoscope racks are designed to accommodate all types of flexible endoscopes. During washing, enzymatic detergent is automatically dispensed, diluted with warm water (45°C), and sprayed onto the exterior endoscope surfaces and pumped through the endoscope lumens. The enzymatic detergent is pumped through the lumens with alternating pulses of compressed air to assist in removing any adhering material. Cleaning studies performed by the manufacturer using a synthetic soil show the system can satisfactorily clean and rinse detergents from an endoscope in preparation for point-of-use sterilization.

The concentration and temperature of the mixed chemicals are automatically measured by the machine with refraction and temperature sensors. Once pumped into the washing/sterilization bay, the sterilant is vigorously sprayed over all exterior endoscope surfaces and pumped through all endoscope lumens to sterilize the scope. Simulated-use studies with resistant spores suspended in 5% serum and inoculated on scope surfaces and inside lumens have demonstrated the effectiveness of the sterilant.

All water used for washing/sterilization and rinsing is filtered through a 0.2- μ m filter. The scopes are dried when the cycle is completed by using filtered compressed air that is sprayed over the exterior scope surfaces and through the interior lumens through the same connections used for the washing and sterilization steps.

The total cycle time for scope testing, washing, sterilization, and drying is less than 30 minutes. Upon completion of each cycle, the reprocessor prints a hard-copy record as well as retaining a record in memory, accessible through its floppy disk drive. Printer parameters are printed at the completion of each cycle and include scope identification, processing date, key cycle parameters, space for insertion of patient name or identification number, procedure type, and date[16]; CG Roberts, pers. commun., 2000).

EO has been widely used as a low-temperature sterilant since the 1950s. It is the most commonly used process for sterilizing temperature- and moisture-sensitive medical devices and supplies in U.S. health-care institutions. Until December 1995, EO sterilizers were combined with a chlorofluorocarbon stabilizing agent, but these agents were phased out because they were linked to destruction of the earth's ozone layer. Alternative technologies currently available and cleared by FDA include 100% EO and EO with different stabilizing gases, such as carbon dioxide (CO₂) or hydrochlorofluorocarbon[17]. A new rapid readout EO biological indicator, designed for rapid and reliable monitoring of EO sterilization processes, is available outside the United States but has not yet been cleared by FDA.

Sterilization (the complete elimination or destruction of all forms of microbial life) is recommended for all "critical" medical items, such as surgical instruments, cardiac and urinary catheters, implantable devices (e.g., heart valves), and needles. Because it is essential to ensure sterilization of critical items, monitoring of the sterilization process is advised. Monitors may be mechanical, chemical, or biological. Biological monitors are recommended because, unlike chemical indicators, they measure the sterilization process directly by using the most resistant microorganism (e.g., *B. subtilis*), not by merely testing the physical and chemical conditions necessary for sterilization[18,19].

The new rapid readout EO biological indicator will indicate an EO sterilization process failure by producing a fluorescent change, which is detected in an auto-reader within 4 hours of incubation at 37°C, and a visual pH color change of the growth media within 96 hours of continued incubation. The rapid readout EO biological indicator detects the presence of *B. subtilis* by detecting the activity of an enzyme present within the *B. subtilis* organism, beta-glucosidase. The fluorescence indicates the presence of active spore-associated enzyme and a sterilization process failure. The rapid readout EO biological indicator also detects acid metabolites produced during growth of the *B. subtilis* spore. The acid metabolites are the result of a series of enzyme-catalyzed reactions that occur

during spore growth. The growth produces a pH change in the medium that causes the medium to change color from green to yellow, indicating an EO sterilization process failure.

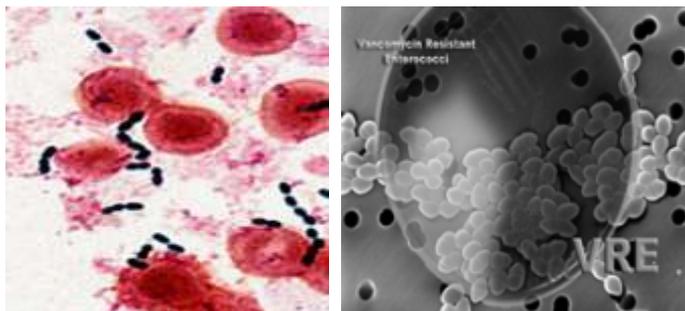
For hospital use, a monitor should be easy to use, inexpensive, and not subject to exogenous contamination; provide positive results as soon as possible after the cycle so that corrective action may be taken; and provide positive results only when the sterilization parameters (e.g., EO concentration, humidity, time, temperature) are adequate to kill microbial contaminants. However, the biological indicator should not be so resistant that it causes needless recall and overprocessing[18]. The rapid readout EO biological indicator has potential for substantially improving assessment of EO cycles. According to manufacturer's data, the enzyme was always detected whenever viable spores were present. This was expected because the enzyme is relatively EO resistant and is inactivated at a slightly longer exposure time than the spore.

The rapid readout EO biological indicator can be used to monitor 100% EO, EO-chlorofluorocarbons, and EO-hydrochlorofluorocarbon mixture sterilization cycles. It has not been tested in EO-CO₂ mixture sterilization cycles. The self-contained design (i.e., it contains both the spore strip and growth media) of the indicator makes it easy to use in the department where the sterilizer is located. The rapid readout EO biological indicator should be placed in a test pack (e.g., the Association for the Advancement of Medical Instrumentation) and placed in a full sterilizer load in the most challenging area for the sterilizer (for EO placement should be in the center). Data show that the 4-hour fluorescent sensitivity of this indicator is 97%, on the basis of the number of visual growth-positive indicators after 168 hours (7 days) of incubation at 37°C. In fact, all the 7-day growth-positive indicators were detected by fluorescence within 4 hours of incubation (Table 5), indicating that if there is no fluorescence at 4 hours, no growth-positive indicators will be detected with continued incubation.

The ability to monitor EO cycles in a surgical suite or central processing and to have results in 4 hours should enable operating room staff to intercept improperly sterilized items either before use or before a surgery ends. If a hospital could quarantine the load for the 4-hour readout, the need for recalls of potentially nonsterile packages and for informing physicians about the use of nonsterile medical devices could be eliminated. New indicator technologies such as the rapid readout EO biological indicators are likely to improve patient safety[20], PM Schneider, pers. commun., 2000).

VANCOMYCIN-RESISTANT ENTEROCOCCI (VRE)

What is VRE?



Vancomycin-resistant enterococci (VRE) are strains of *Enterococcus faecium* and *Enterococcus faecalis* that have become resistant to vancomycin. Enterococci are germs that live in the gastrointestinal tract (bowels) of most individuals and, generally, do not cause harm (this is termed “colonization”). If a person has an infection caused by VRE, such as a urinary tract infection or blood infection, it may be more difficult to treat.



Of more than a dozen forms of enterococci bacteria, two are the primary concern for human disease: *E. faecium* and *E. faecalis*. *E. faecium* is the most frequent species of VRE found in hospitals.

How is VRE Acquired and Spread? Risk factors for VRE acquisition include severity of underlying illness, presence of invasive devices, prior colonization with VRE, antibiotic use, and length of hospital stay. VRE is most commonly spread via the transiently colonized hands of healthcare workers who acquire it from contact with colonized or infected clients/patients/ residents, or after handling contaminated material or equipment. VRE can survive well on hands and can survive for weeks on inanimate objects such as toilet seats, taps, door handles, bedrails, furniture, and bedpans. Hospitalized clients/patients/residents with gastrointestinal carriage of VRE are the major reservoirs. VRE transmission via environmental sources includes: Most items in the healthcare environment including blood pressure cuffs,

electronic thermometers, monitoring devices, stethoscopes, call bells, and bed rails, touching articles soiled by feces. Contamination of the environment with VRE is more likely when a client/patient/resident has diarrhea. The number of colonized clients/patients/residents (“colonization pressure”) will also influence the likelihood of acquiring VRE. VRE is not transmitted through the air.

Where does VRE come from?

VRE occurs from the bowels of some people who have taken antibiotics, often at very low or undetectable levels. When people receive specific antibiotics such as vancomycin, VRE may be selected for and become detectable. Excessive use of antibiotics for minor infections, such as the common cold, where antibiotics are not required, is likely to be a major contributor to the emergence of VRE. In some parts of the world, the emergence of VRE has also been linked to use of antibiotics in animal husbandry.

When is hospital patients tested?

As the VRE germ lives in the bowel, testing for VRE involves taking a faeces sample or a rectal swab. Unfortunately, the VRE germ is difficult to detect and for this reason it may be necessary to take several samples. Pending the outcome of results, which will take several days to finalise, nursing staff will take special precautions such as the wearing of a gown and gloves. A card alerting the staff to take these precautions may be placed on the door.

BEST PRACTICES

Consistent use of Routine Practices with all clients/patients/residents is critical to preventing transmission of microorganisms from client/patient/resident to client/patient/resident and to staff.

Four elements include: hand hygiene, risk assessment, risk reduction and education.

RP is the base upon which additional precautions are applied as indicated by the nature of the microorganism or syndrome encountered. These practices describe prevention and control strategies to be used with all clients/patients/residents during all care, and include:



Hand hygiene with an alcohol-based hand rub (ABHR) or with antimicrobial soap and water before and after physical contact with a client/patient/resident, or with a contaminated environment. Personal protective equipment (PPE) to be worn to prevent healthcare worker contact with blood, body fluids, secretions, excretions, non-intact skin, or mucous membranes includes: gloves when there is a risk of hand contact with blood, body fluids, secretions, excretions, non-intact skin, or mucous membranes; gloves shall be used as an additional measure, not as a substitute for hand hygiene. a long-sleeved gown if contamination of uniform/clothing or skin is anticipated. a mask and eye protection or a face shield where appropriate to protect the mucous membranes of the eyes, nose, and mouth during procedures and care activities likely to generate splashes or sprays of blood, body fluids, secretions, or excretions.

Clients/patients/residents who visibly soil the environment, or for whom appropriate hygiene cannot be maintained, shall be placed in single rooms with dedicated toileting facilities. This includes mobile clients/patients/residents with faecal incontinence if stools cannot be contained in diapers and clients/patients/residents with draining wounds who do not keep their dressings in place. Preventing injuries from needles, scalpels, and other sharp devices; never recap used needles. Place sharps in approved sharps containers. Careful handling of soiled linen and waste to prevent personal contamination and transfer to other clients/patients/residents. Cleaning and disinfecting all equipment that is being used by more than one client/patient/resident between uses.

Contact Precautions is the term used to describe additional practices to reduce the risk of transmitting infectious agents that are normally spread via contact with an infectious person. Contact Precautions are used in addition to Routine Practices. Contact Precautions include: Hand hygiene as described in Routine Practices. Appropriate patient placement as described in Routine Practices (e.g. single room). Gloves for entering the patient's room or bed space. Long-sleeved gown for contact with patient, bed space, frequently touched environmental surfaces or objects. In acute care, putting on a gown on room entry may be advisable. Dedicated use of equipment or adequate cleaning and disinfecting of shared equipment. Visitor Contact Precautions for VRE include: If a visitor is in contact with other patients or is providing direct patient care, they shall wear the same PPE as healthcare workers. Visitors shall receive education regarding hand hygiene and the appropriate use of PPE

Role of the Laboratory Infection Prevention and Control

programs must have an established working relationship with a microbiology laboratory.

Screening for other multidrug resistant organisms is based on culture methods. Vancomycin resistant enterococci may be detected in the course of screening programs, and isolates of enterococci from specimens are screened for vancomycin resistance routinely. Isolates that are suspected of being resistant are referred for confirmatory testing.

Notification/Flagging Tracking clients/patients/residents who are colonized or infected with VRE (e.g. by flagging their chart or electronic file) and their contacts has been shown to improve identification and appropriate management of such clients/patients/residents on re-admission. VRE colonized/infected clients/patients/residents should be educated to notify healthcare providers of their positive status. A process should be in place to ensure that patients discharged from hospital receive communication regarding positive culture results. The receiving healthcare setting, family physician, or the physician most responsible for their care should be notified of the screening results. Electronic flagging is the responsibility of the hospital generating the specimen report. VRE have been isolated from various healthcare surfaces including door handles, hydrotherapy tubs, gowns and linens, hospital furnishings, client/patient/resident charts, tourniquets, call bells, telephones, computer keyboards, faucets, and medical equipment such as glucose meters, blood pressure cuffs, electronic thermometers, and intravenous fluid pumps. Widespread contamination of VRE is likely to occur in the rooms of clients/patients/residents who have diarrhea, and VRE may survive on surfaces for days or weeks.

Incontinent faeces or diarrhoea: In addition, wipe over all surfaces with a solution containing 500 ppm of sodium hypochlorite, leave for 10 minutes, rinse the surfaces with clean warm water and leave to dry.

Hospital grade disinfectants are effective against VRE and general routine cleaning and disinfection methods are adequate for dealing. However, routine cleaning may not be adequate to remove VRE from contaminated surfaces. Studies have shown that surface cultures for VRE remain positive when a cloth is dipped back into a cleaning solution after use and re-used on another surface; when supplies in the room are re-used after discharge; when there is insufficient contact time between the disinfectant solution and the surface being cleaned; and when surfaces are sprayed and wiped, rather than actively scrubbed. There has also been reported success in ending an outbreak of VRE using intensive environmental disinfection with twice-daily cleaning. Current disinfecting

protocols will be effective if they are diligently carried out and properly performed using friction (scrubbing) and conscientious cleaning of patient-care surfaces, such as bed rails, and frequently touched surfaces, such as hallway handrails, at least once daily. Processes for cleaning and disinfection should include sufficient contact time for disinfectants, appropriate strength of solutions used, use of damp dusting, working from clean to dirty areas and eliminating the practice of dipping a cloth into the cleaning solution after use and reusing it on another surface.

Patient Care Equipment Where possible, will not be shared between patients is recommended for patients known to be colonized or infected. Reusable equipment that has been in direct contact with one patient should be appropriately reprocessed before use by another patient. Items that are routinely shared should be cleaned between patients. Equipment that is visibly soiled should be cleaned immediately. Commodes, like toilets, should be cleaned regularly and when soiled. Bedpans should be reserved for use by a single patient and labeled appropriately. Procedures should be established for assigning responsibility and accountability for routine cleaning of all patient care equipment. Soiled patient care equipment should be handled in a manner that prevents exposure of skin and mucous membranes and contamination of clothing and the environment. Personal care supplies (e.g. lotions, creams, soaps) should not be shared between patients. Nail polish, cuticle conditioner used in hand/foot care should not be shared.

VANCOMYCIN RESISTANT ENTEROCOCCUS (VRE)
Information Sheet for Clients/Patients/Residents and Visitors should be prepared.

Always tell your physician, paramedics, nurses, or other care providers that you have VRE. This helps prevent spread to others.

Risk Factors for VRE People at risk for colonization or infection with VRE are usually hospitalized and have an underlying medical condition, making them susceptible to infection. These conditions include clients/patients/residents with: Recent hospitalization in healthcare facilities. Critical illness(es) in intensive care units. Severe underlying disease or weakened immune systems. Urinary catheters.

Admission screening for VRE shall be completed: Check for previous history of VRE, or high risk for VRE, using the admission screening tool. If the client/patient/resident has been a contact of a VRE case in the past, screening specimens

shall be obtained. If the client/patient/resident is considered to be at risk for VRE based on the results of the screening tool, screening specimens shall be obtained. Notify the Infection Control Professional (ICP) or delegate to discuss the infection control management of client/patient/resident activities.

Treatment of infection

Cephalosporin use is a risk factor for colonization and infection by VRE, and restriction of cephalosporin usage has been associated with decreased VRE infection and transmission in hospitals. *Lactobacillus rhamnosus* GG (LGG), a strain of *L. rhamnosus*, was used successfully for the first time to treat gastrointestinal carriage of VRE. In the US, linezolid is commonly used to treat VRE.

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AlcoMop™ is a perfumed disinfectant cleaner for floor and hard surfaces. Smart action formula with two active ingredients viz. Benzalkonium Chloride, kills the bacteria and other microbes leaving the surface squeaky clean and Ethanol, a good cleanser for hard tiles leaves no residue making the surface look glossy. **AlcoMop™** spreads a distinctive aroma throughout the room adding to its fresh appeal.



Composition: 74 % v/v Ethyl Alcohol IP, 4 % w/v Benzalkonium Chloride IP, Perfume.

Features	Benefits
Perfumed disinfectant	Kills bacteria and other microbes, leaving a long lasting freshness.
Benzalkonium chloride + Alcohol	Quickly cleans hard floor and surfaces with a lasting shine.
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Application Areas:

Hospital: Corridor, Waiting room, General ward, Doctors chamber, etc.
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Highlights of the coming issue

