Special Report

Infectious Agents And Cancer

How Bacteria, Viruses And Parasites Are Responsible For Many Forms Of Cancer And How To Protect Yourself with Glucanol®

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Infectious Agents and Cancer

Since the start of the 20th century, it has been known that certain infections play a role in cancer in animals. More recently, infection with certain viruses, bacteria, and parasites been recognized as causative agent or risk factor for several types of cancer in humans. Worldwide, infections are linked to about 50% of cancers. In the United States and other developed countries, less than 30% of all cancers are thought to be linked to infectious agents.

Some infections may cause long-term inflammation, suppress a person's immune system, or directly affect a cell's DNA. Any of these changes may lead to a higher risk of cancer. Even though the infections described here can raise a person's risk of certain types of cancer, some people with these infections never develop cancer. This is probably due to the strength of their immune system. The risk of developing cancer is also influenced by other factors. For example, infection with *Helicobacter pylori* (*H pylori*) bacteria may increase your risk of stomach cancer, but what you eat, whether or not you smoke, and your immune system also affect your risk. Remember, only about 18% of all cancers are genetic, while 82% are caused by environmental factors. Any activity that lowers the immune systems ability to fight the start of cancerous growths. A strong immune system is your best defense.

The infections that influence cancer risk are usually contagious, but cancer itself is not contagious. A healthy person cannot "catch" cancer from someone who has the disease.

Viruses

Viruses are very small infectious agents; most cannot even be seen with an ordinary microscope. They are made up of a small group of genes in the form of DNA or RNA surrounded by a protein coating. Viruses cannot reproduce on their own. They need to enter a living cell and "hijack" the cell's machinery to make more viruses. Some viruses do this by inserting their own DNA (or RNA) into that of the host cell. When the DNA or RNA affects the host cell's genes, it may push the cell toward becoming cancer.

Several viruses are now known or suspected of being linked with cancer in humans. Our growing knowledge of the role of viruses as a cause of cancer may lead to vaccines that prevent or treat certain human cancers in the future.

Human papilloma viruses (HPVs)

HPVs are a group of over 100 related viruses that can cause warts on the skin, mouth, genital organs, and larynx. They are spread by contact (touch), including through sex. HPV infections are very common in people who are sexually active. There are no effective treatments for HPV other than removing or destroying cells that are known to be infected. In most people, the body's immune system controls the HPV infection or gets

rid of it over time.
Certain types of HPV are the main cause of cervical cancer, which is the second most common cancer among women worldwide. Cervical cancer has become much rarer in the United States because women are getting the Pap test. This test can show pre-cancerous changes in cells of the cervix that might be caused by HPV infection. These cells can then be treated or removed, if needed. Treatment can keep cancer from developing. Nearly all women with cervical cancer shows signs of HPV infection, but most women infected with HPV will NOT develop cervical cancer. Even though doctors can test women for HPV, there is no treatment for the HPV infection itself. If the HPV causes abnormal cells to start growing, these cells can be treated. Women with HPV infection may be checked for abnormal cells more often than those who don't have it.
HPVs also have a role in causing some cancers of the penis, anus, vagina, and vulva. They have been linked to cancers of the mouth, throat, head, and neck, too. Again, although HPVs have been linked to these cancers, many people infected with HPV never develop cancer. Smoking and drinking, which are also linked with these cancers, may work together with HPV to increase cancer risk. Other genital infections may also increase the risk that HPV will cause cancer.
Two vaccines are now being used against the types of HPV that cause cancer. Gardasil® and Cervarix® have been shown to help protect against infection from the 2 main cancer causing HPV types. The vaccines are approved for use in females aged 9 or 10 and into their mid-20's. Because the vaccines are still fairly new, it is not yet known how well they will protect against cervical cancer. These vaccines and others like them are being studied further.

Epstein-Barr virus (EBV)

EBV is another type of herpes virus. It is probably best known for causing *infectious mononucleosis*, also known as "mono" or the "*kissing disease*." In addition to kissing, it can be passed from person to person by coughing, sneezing, or sharing drinking or eating utensils. Most people in the United States are infected with EBV before the age of 20, although not everyone develops the symptoms of mono. As with other herpes viruses, the virus remains in the body throughout life, but after the first few weeks of infection most people never have any other symptoms.
EBV infects and stays in certain white blood cells in the body called B lymphocytes (also called B cells). Infection with EBV increases a person's risk of getting nasopharyngeal cancer (cancer of the area in the back of the nose) and certain types of fast-growing lymphomas such as Burkitt lymphoma. It may also be linked to Hodgkin lymphoma and some cases of stomach cancer. These cancers are more common in Africa and parts of Southeast Asia. Overall, some people who have been infected with EBV will ever develop these cancers. Again, a strong immune system will will lower your risk or completely protect you.

Hepatitis B virus (HBV) and hepatitis C virus (HCV)

HBV and HCV are 2 viruses that cause viral hepatitis, a type of liver infection. Other viruses can also cause hepatitis (hepatitis A virus, for example), but only HBV and HCV can cause long-term infections that increase a person's chance of developing liver cancer. In the United States, about 60% of liver cancers are linked to HBV or HCV infection. This number is much higher in certain other countries, where both the infections and liver cancer are much more common.

HBV and HCV are spread from person to person in much the same way as HIV (see section on HIV below) -- through sharing needles, unprotected sex, or childbirth. They can also be passed on through blood transfusions, but this has rarely happened in the United States because the blood products used have been tested for these viruses.

Of the 2 viruses, infection with HBV is more likely to cause symptoms, such as a flu-like illness and yellowing of the eyes and skin (jaundice). Most people recover completely from HBV infection within a few months if their immune system is adequate. Only a very small percentage go on to become chronic carriers. These people have a higher risk for liver cancer. HCV is less likely to cause symptoms. But most people with HCV develop chronic infections, which are more likely to lead to liver damage or even cancer. This means that many of the estimated 3.2 million people in the United States who have chronic HCV infection do not know they have it and are at risk for liver cancer.

There are drugs that can be used to treat people with hepatitis B or C. A vaccine is available to prevent HBV infection, but there is none for HCV. In the United States, the HBV vaccine is recommended for all children and for adults who are at risk, such as health care workers and injection drug users. A strong immune system is your best defense against a chronic infection and its consequences.

Human immunodeficiency virus (HIV)

HIV, the virus that causes acquired immune deficiency syndrome (AIDS), does not appear to cause cancers directly. But HIV infection increases a person's risk of getting several types of cancer, especially some linked to other viruses such as HHV-8 (see section below) and HPV.

HIV is spread through intimate contact with blood, vaginal fluids, breast milk, or semen from an HIV-infected person. Known routes of spread include:

- Unprotected sex (oral, vaginal, or anal) with an HIV-infected person
- Injections with needles or injection equipment previously used by an HIV-infected person
- Prenatal and perinatal (during birth) exposure of infants from mothers with HIV
- Breast-feeding by mothers with HIV
- Transfusion of blood products containing HIV (blood has been tested since 1985)
- Organ transplants from an HIV-infected person (donors are now tested for HIV)

HIV is not spread by insects, through water, or by casual contact such as talking, shaking hands, hugging, coughing, sneezing, sharing dishes, sharing bathrooms or kitchens, sharing phones, or sharing computers.

HIV infects and destroys white blood cells known as helper T cells, which weakens the

body's immune system. When the body is less able to fight off infections, other viruses such as HPV may be able to cause more damage to the cells. This damage may trigger cancer.

Scientists believe that the immune system is also very important in attacking and destroying newly formed cancers. So a weak immune system may allow new cancers to survive long enough to become a serious, life-threatening tumor.

HIV infection has been linked to a higher risk of developing *Kaposi sarcoma* and *invasive cervical cancer*. It is also linked to certain kinds of *lymphoma*, especially non-Hodgkin lymphoma and central nervous system lymphoma. Anti-HIV drugs may be used to reduce the risk of Kaposi sarcoma and cervical cancer.

Other types of cancer that may be more likely to develop in people with HIV infection include:

- Invasive anal cancer
- Hodgkin lymphoma
- Lung cancer
- Cancer of the mouth and throat
- Skin cancers (basal cell, squamous cell, and Merkel cell)

Human herpes virus 8 (HHV-8)

HHV-8, also known as *Kaposi sarcoma–associated herpes virus* (KSHV), has been found in nearly all tumors in patients with Kaposi sarcoma (KS). KS is a rare, slow growing cancer that often appears as reddish-purple or blue-brown tumors just underneath the skin. KS has been known to exist in central Africa and the Middle East for some time, but was rare in the United States until it started appearing in patients with AIDS in the early 1980s. The number of people with KS has dropped in the US since peaking in the early 1990s, most likely because of better treatment of HIV infection.

HHV-8 is transmitted sexually and appears to be spread by other means as well. Blood tests show less than 10% of the US population is infected with this virus. HHV-8 does not appear to cause disease in most healthy people. In the US, almost all people who develop KS have other conditions that have affected their immune system, such as infection with the HIV or immune suppression after an organ transplant.

HHV-8 is related to other herpes viruses, such as the viruses that cause cold sores and genital herpes, Epstein-Barr virus (EBV), and cytomegalovirus (CMV). But these other viruses are not the same as HHV-8 and do not cause KS. Like other herpes virus infections, HHV-8 infections never go away, even when there are no signs of disease.

Researchers are not yet sure how HHV-8 contributes to the development of KS. Because many more people are infected with HHV-8 than ever develop the disease, it is likely that other factors are also needed for KS to develop. Having a weakened immune system appears to be one such factor. For more information, see the American Cancer Society document, *Kaposi Sarcoma.*

HHV-8 infection has also been linked to some rare blood cancers, such as primary effusion lymphoma. The virus has been found in many people with multicentric Castleman disease, an overgrowth of lymph nodes that acts very much like lymphoma.

Human T-lymphotrophic virus-1 (HTLV-1)

HTLV-1 has been linked with a type of lymphocytic leukemia and non-Hodgkin lymphoma called *adult T-cell leukemia/lymphoma* (ATL). This cancer is found mostly in southern Japan, the Caribbean, Central Africa, parts of South America, and in some immigrant groups in the southeastern United States. In addition to ATL, the virus also causes a form of degenerative nerve disease called *tropical spastic paraparesis* (TSP), which is most common in Japan and in the Caribbean basin.

HTLV-1 belongs to a class of viruses called retroviruses. These viruses use RNA (instead of DNA) for their genetic code. To reproduce, they must go through an extra step using an enzyme called *reverse transcriptase*. This allows them to change their RNA genes into DNA. Some of the new DNA genes can then become part of the chromosomes of the human cell infected by the virus. This can change the genes (cause genetic mutations) in human cells that normally control how often the cell divides. This change sometimes causes cancer. Retroviruses have long been known to cause leukemia in some animals.

HTLV-1 is something like HIV, since it is another human retrovirus. But HTLV-1 cannot cause AIDS. In humans, HTLV-1 is spread in the same ways as HIV:

- Unprotected sex with an HTLV-1-infected partner
- Injection with a needle or injection equipment after an infected person has used it
- Blood transfusion from an infected donor (blood donations are now tested for this virus in developed countries)
- From infected mother to child during pregnancy, childbirth, or breastfeeding

Not everyone exposed to the virus becomes infected. For example, mothers infected with HTLV-1 have about a 10% to 30% chance of passing on the virus to their children.

A survey of people coming to donate blood in several locations around the United States showed that, overall, about 1 out of every 4,000 people had HTLV-1 (about 0.025%). Around 2% to 10% of people who use intravenous drugs or who have gotten multiple transfusions become infected with HTLV-1. Screening all blood donated in the United States has greatly reduced the chance of infection through transfusion and has helped control the potential spread of HTLV-1 infection.

Once infected with HTLV-1, a person's chance of developing adult T-cell lymphoma can be up to about 5%, usually after a long time with no symptoms (20 or more years).

Viruses with uncertain or unproven links to cancer in humans

Simian virus 40 (SV40)

SV40 is a virus that usually infects monkeys. Some polio vaccines prepared between 1955 and 1963, which were produced from monkey cells, were found to be contaminated with SV40.

Some recent studies have raised the possibility that infection with SV40 might increase a

person's risk of developing mesothelioma (a rare cancer of the lining of the lungs or abdomen), as well as some brain cancers, bone cancers, and lymphomas.
Scientists have found that intentional infection of some lab animals, such as hamsters, with SV40 causes mesotheliomas to develop. Researchers have also noticed that SV40 can cause mouse cells grown in the lab to become cancer, and asbestos increases the cancer-causing effect of SV40 on these cells. Other researchers have studied biopsy specimens of certain human cancers and found fragments that appear to be SV40 DNA. But not all researchers have found this, and fragments much like these can also be found in human tissues that show no signs of cancer.
So far, the largest studies looking at this issue in humans have not found any increased risk for mesothelioma or other cancers among people who got the contaminated vaccines as children. For example, the recent increase in lung mesothelioma cases has been seen mainly in men aged 75 and older, most of whom would not have received the vaccine. Among the age groups who were known to have gotten the vaccine, mesothelioma rates have actually gone down. And even though women were just as likely to have had the vaccine, many more men continue to be diagnosed with mesothelioma.
Recent findings have suggested that the number of people exposed to SV40 may have been underestimated in earlier studies. Some of the oral polio vaccine that was made in Eastern Europe and used throughout the world may have contained SV40 up until the late 1970s. Research into this important topic is still under way.

Merkel virus

The Merkel virus was newly discovered in 2008. It was found in tissue samples from several cases of a rare and aggressive type of skin cancer called *Merkel cell cancer*. It is not yet known how this virus is transmitted, but it has since been found in a number of human tissues including normal skin. One study found the virus in the noses and breathing tubes (bronchi) of children with respiratory symptoms, which suggests that it can be picked up in early childhood. The possible link between the Merkel virus and the cancer is still being studied.

Bacteria

Helicobacter pylori

Stomach cancer is fairly rare in the United States, but it is the fourth most common cancer worldwide. Long-term infection of the stomach with *Helicobacter pylori (H pylori)* may cause ulcers. It can also inflame and damage the inner layer of the stomach. These changes will lead to cancer over time, especially cancer in the lower part of the stomach. *H, pylori* infection is also linked with some types of lymphoma of the stomach.
More than 90% of all cases of stomach cancer are thought to be linked to *H pylori* infection. Still, most people who have these bacteria in their stomachs never develop cancer.

About 1 in 3 adults has evidence of infection with *H pylori*, and the rate of infection is higher in older age groups. Researchers aren't exactly sure how *H pylori* may be spread from one person to another, but a likely route of spread is through a fecal-oral route, such as through contaminated water sources. In fact, contaminated well water has been linked to *H pylori* infection in the United States. Because the bacteria's DNA is found in saliva, it may also be transmitted from mouth to mouth.
Other factors also play a role in whether or not someone develops stomach cancer. For example, nitrites are substances commonly found in cured meats, some drinking water, and certain vegetables. They can be converted by certain bacteria, such as *H pylori*, into compounds that have been found to cause stomach cancer in animals.
Antibiotics and other medicines can be used to treat *H pylori* infections. It is not yet known if people with chronic *H pylori* infection of their stomach lining but no symptoms should be treated for this infection. Some doctors believe that patients with *H pylori* who are at high risk of stomach cancer should be treated whether or not they have symptoms. These issues are still being studied.
Doctors have given antibiotics to patients who have had superficial stomach cancers removed in order to get rid of *H pylori* infection. This along with immune system therapy seems to have prevented new stomach cancers in those patients.

Chlamydia trachomatis

Chlamydia trachomatis is a relatively common kind of bacteria that can infect the female reproductive system. It is spread through sex. Although infection may cause symptoms in some people, more than 2 out of 3 women have no symptoms. This means that most women with chlamydia do not know they are infected unless samples taken when they have a Pap test are also studied for this type of bacteria. It is very common in younger women who are sexually active, and may persist for years unless it is detected and treated.
Some studies suggest that women whose blood test results show past or current chlamydia infection are at greater risk for cervical cancer than are women with a negative blood test. Studies have not shown that chlamydia by itself can cause cancer. But it may work with HPV in some way that promotes cancer growth. One possible explanation suggested by 2 recent studies is that chlamydia may affect how long cancer-promoting HPV stays in the cervix. Researchers found that women who had chlamydia along with HPV were more likely to still have HPV when they were re-tested later than the women who had not had chlamydia. Although further studies are needed to confirm these findings, there is already good reason to avoid this infection and to have it treated with antibiotics when it is found. Long-term chlamydia infection is known to be a cause of pelvic inflammation that can lead to infertility. Like other sexually transmitted diseases that irritate or ulcerate the genital area, chlamydia can also increase the risk of becoming infected with HIV during exposure to an HIV-infected sexual partner.

Other bacteria

Chlamydia psittaci is being studied as a possible cause of cancer. It is best known for

causing a mild infection which is sometimes called *"parrot fever*." The germ is inhaled from dried bird droppings or feather dust. (It is not like the type of chlamydia discussed above and is not sexually transmitted.) A few studies have suggested that *Chlamydia psittaci* bacteria may be involved in a rare cancer of the eyes known as *ocular adnexal mucosa-associated lymphoid tissue (MALT) lymphoma*. Some patients with this lymphoma started to improve when given an antibiotic to treat the bacteria, but this did not happen in others. And studies around the world have had mixed results so far, with many studies finding no trace of the bacteria in people with the cancer. Further research is going on to learn whether a link might exist between the bacteria and the cancer.
Other studies have suggested that infection with *Borrelia burgdorferi* (the bacterium that causes Lyme disease) may be linked with MALT lymphoma of the skin. And *Campylobacter jejuni* may be linked with MALT lymphomas of the digestive tract. More research is needed to clarify these links.
C*hlamydia pneumoniae* is a type of bacteria that can cause lung infections (pneumonia). In several studies, more people with lung cancer had evidence of previous infection with this germ than those who did not have lung cancer. Even though it looks like there may be a link, these types of studies do not show that the bacteria caused the cancer. Studies are exploring the chance that this germ can increase the risk of lung cancer.

Parasites

Certain parasitic worms that can live inside the human body can also raise the risk of developing some kinds of cancer. While these organisms are not found in the United States, they can be a concern for people who live in or travel to other parts of the world.
Opisthorchis viverrini and *Clonorchis sinensis* are liver flukes (a type of flatworm) that have been linked to increased risk of developing *cancer of the bile ducts* (the tubes that connect the liver to the intestines). These infections come from eating raw or undercooked freshwater fish. This disease is found mostly in East Asia and is rare in other parts of the world.
Schistosoma haematobium is a parasite found in the water of developing countries of Africa and Asia. Infection with this parasite (an illness called *schistosomiasis*) has been linked to *bladder cancer*. Possible links to other types of cancer are now being studied as well.

How To Protect Yourself

The importance of a strong immune system can not be over emphasized. For more information on how Glucanol®, a pharmaceutical grade compound can provide you with proven clinical trial benefits visit our website www.clinicalimmunity.com. At this site, you can monitor the FDA sanctioned clinical trials that are

ongoing, see the benefits of Glucanol® when used during chemotherapy and radiation to mitigate the side effects of these therapies

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