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Parasites Introduction

More than two billion people worldwide suffer unnecessary parasitic infections. As far as can be determined, Americans play host to more than 130 different kinds of parasites, ranging from microscopic organisms to sizeable tapeworms. **Projections for the year 2025 suggest that more than half of the 8.3 billion people on earth at that time will be infected with at least one parasitic disease.** The CDC estimates that there are fifty million cases of food-borne illnesses alone, with thousands dying as a result.

Some parasites can remain in the body for more than thirty years. This was proven when WWII POW's were examined thirty years later. It was found that 15% were still infected with strongyloides acquired during that war. **More recently, when more than 500,000 American troops returned from Desert Storm, they were told not to donate blood because they had been exposed to Leishmania.** Without question, thousands of Viet Nam vets are still suffering from undiagnosed parasitic infections.

Medical parasitology includes study of parasites from four large phyla in the animal kingdom, namely, Protozoa (of the kingdom Protista), the Platyhelminthes (flatworms), the Nematodes (roundworms), and the Arthropoda (arachnids, crustaceans, insects, etc.). The worms and arthropods are multicellular organisms and often large enough to be seen with the naked eye. Some, like the tapeworms, may obtain lengths of several meters. Parasites, that live outside the body of a host are called Ectoparasites, which include fleas, mites, lice, ticks and leeches. Endoparasites live inside the body of a host,

and include amoebas, worms, and flukes.

Parasites are organisms which live in or on another living organism called a 'host,' benefiting in some way at the host's expense, particularly in their plunder of nutrients. A host will suffer some degree of damage, ranging from slight discomfort to death. **Most people are not aware that they have parasites until an autopsy is performed.** Others are more severely infected, causing disease.

It is also a common belief that intestinal worms are more active during the full moon cycle. **With a little knowledge, parasitic infestations can be controlled.** **Another grave concern is that the majority of western doctors have never seen a parasite infection, nor are they taught to do so.**

Limiting the idea that disease-causing parasites are found only in far away lands is dangerously idealistic. Widespread travel, immigration, pollution, increased use of day cares and other institutional settings, returning troops, increased popularity of household pets, the indiscriminate use of antibiotics and other immunosuppressive drugs, multiple sex partners with expanding anal/oral practices, and a general rise in population has seen to it that **almost all people can now expect to be faced with the possibility of harboring at least one parasite** at some point in their lives. Therefore, with the medical profession lagging behind in the awareness that millions of their own citizens are suffering, it is in the best interest of all to find out what can be done should such an occurrence happen closer to home.

Parasites vary significantly, both in size and

method of infection. Even though most do not cause any significant harm, others can burrow into or dissolve away tissues of the cornea, spinal cord, muscles, heart, kidneys, bone, and brain. The size and weight of parasitic cysts produces pressure effects on these organs and their surrounding tissue. Parasites are much more complex than viruses or bacteria because their individual reproductive cycle makes it difficult to formulate an accurate diagnosis common to many complaints. Parasites can cause fever, intestinal pain, poor absorption of nutrients, and many other symptoms, resulting in misdiagnosed conditions of bacterial infections and treatment with antibiotics. This only serves to tighten the parasite's grip.

Humans become hosts to parasites in several ways:

1. Via infected food or water (sources of roundworm, amoebas, and giardia). Contact with water can be internal (tap water, mountain streams, contaminated bottled water etc.) or external (hot tubs, saunas, swimming pools, or other water recreational areas). Not only are parasites contracted in this manner, but also bacteria, viruses, and fungi. Chlorine does not rid a water supply of many pathogens. Protozoa, fungi, viruses, and coliform bacteria have been found alive and flourishing in chlorinated tap water, as well as in swimming water. In addition, unless specified, most filtering systems are unable to prevent *Giardia lamblia* and *Cryptosporidium* from passing on through.

2. Via such vectors as a mosquito (carriers of dog heartworm, filaria, and malaria), fleas (carriers of dog tapeworm), houseflies (carriers of amebic cysts), and the sandfly (carriers of leishmaniasis). Close contact with animals, whether in the home or not, significantly increases the likelihood of parasite infections, especially children. When

both the animal and the human receive treatment, the problem is generally solved, but if only one receives treatment, the problem becomes chronic.

1. Via sexual contact with partners transmitting trichomonas, giardia, and amoebas, to name a few.
2. Via the nose and skin. Pinworm eggs and *Toxoplasma gondii* can be inhaled from contaminated dust; hookworms, schistosomes, and strongyloides can penetrate exposed skin, especially bare feet.
3. The airplane is considered another important pathway or vector, carrying parasites around the world at a much more rapid rate than ever before.

Less common parasites include *Cyclospora cayetanensis*, which is now being found in human feces, causing the disease cyclosporiasis. It first appeared after 1,000 people became ill after eating infected raspberries from Guatemala, where human waste had been used as fertilizer. **Symptoms include the following: diarrhea, cramps, headaches, weight loss, decreased appetite, vomiting, fatigue, flatulence, bloating, itching skin, fever, and muscle aches. It can also cause such chronic conditions as malabsorption, anorexia, depression, and fibromyalgia.**

However, some have no symptoms at all and are unaware they are carrying the parasite and passing it on.

Another less common parasite is *Dientamoeba fragilis*, found increasingly in the large intestine of humans. It is considered one of the most frequent parasitic infections of day care centers and crowded urban areas. It does not have a cyst stage, but lives in the intestinal tract, the cecum, and the colon as a larvae or trophozoite, similar to an amoeba. This form makes it difficult to detect in lab samples. Transmission is by direct ingestion of the larvae, but it can also be found within

the eggs of some worms, especially pinworms. Infection usually causes diarrhea and abdominal discomfort, with chronic infestation leading to autoimmune reactions.

Parasites Signs of Infection

Possible signs of **parasite infestation**:

AIDS: People with AIDS often have treatment-resistant *Candida albicans* because of the impaired immune factors caused by many parasites. A study done at the University of Virginia reported that an amoeba, *Entamoeba histolytica*, produces a substance that attacks the very immune defence cells that can inactivate the HIV virus. The *New England Journal of Medicine* drew a connection between AIDS and epidemic outbreaks of amebiasis two years prior to the San Francisco AIDS outbreak (Aug.7, 1986) As a result of the AIDS epidemic, the incidence of many parasitic diseases has increased -- Pneumocystis carinii pneumonia, cryptosporidiosis, and strongyloidiasis.

Allergy: Parasites can irritate and sometimes perforate the intestinal lining. This increases the possibility of large undigested molecules crossing the barrier into the bloodstream. It is these large molecules that irritate the immune system enough to cause such allergy symptoms as increasing the levels of eosinophils which, in turn, inflame tissues, resulting in allergy-type symptoms. Parasites can also trigger an increase in the production of immunoglobulin E (IgE). All this can result in many different types of food allergies or sensitivities.

Anal itching, especially at night. This is often a sign of pinworms, but can also be a symptom of any of a number of parasites.

Anemia: Some intestinal parasites attach themselves to the mucosal lining of the

intestines, leeching nutrients from the host. If the numbers are large enough, they can create enough blood loss to cause iron deficient or pernicious anemia.

Breasts that become sore and swollen, but not related to menstruation.

Chest pains or heartburn, that is not to be confused with impending heart attacks.

Chronic fatigue: Parasites cause physical, mental, and emotional symptoms which include the following: tiredness, flu-like complaints, apathy, depression, impaired concentration, and faulty memory. Extreme fatigue is often the result of malnutrition brought on by the malabsorption of proteins, carbohydrates, fats, and especially Vitamins A and B12, caused by parasites blocking absorption sites in the intestines.

Constipation: Because of their size and shape, some worms can obstruct the intestine making elimination difficult.

Diarrhea: Certain parasites (mainly protozoa) produce prostaglandin, which creates a loss of certain electrolytes. Diarrhea is the result of parasitic action and not necessarily the body's attempt to rid itself of the organism.

Digestive complaints: Parasitic invasion are often mistaken for vague digestive problems, including the following: flu-like symptoms, colitis, gas, bloating, indigestion, feeling full all the time, stomach aches or burning sensations, nausea, unexplained vomiting, etc. There can also be a weight loss while still having a vigorous appetite. Other digestive problems can include the following: difficulty in gaining or losing weight, uncontrolled chronic yeast problems, plus numerous and varied food allergies or sensitivities, as well as environmental intolerances. More than 50% of those suffering from irritable bowel syndrome

and chronic fatigue syndrome were considered "cured" of their disease when the parasite infestation was treated.

Elimination changes: Stools that are foul-smelling and greasy, becoming worse in the afternoon and evening, are often symptoms of parasitic infestations, particularly that of *Giardia lamblia*. Other symptoms include the following: alternating periods of soft or watery stools and constipation, abdominal cramps, abdominal rumblings and gurglings different from periods of hunger and eating. Other changes can include bedwetting, blood in stools, and dysentery (different from simple diarrhea).

Gas and Bloating: Some parasites live in the upper small intestine, where inflammation can produce these symptoms. They can be magnified when such hard-to-digest foods as beans and raw fruits and vegetables are eaten. Persistent abdominal distention is a frequent sign of parasite invasion. Symptoms can persist intermittently for months or years if the parasites are not eliminated entirely from the body.

Gingivitis: Without proper care of the mouth, the normal bacterial flora can be altered, allowing for pathogens and parasites to take over. As cysts enter the mouth and travel throughout the body, a weakened area, as the mouth, will easily become a target.

Granulomas: Tumor-like masses that encase destroyed larva or parasitic eggs are called granulomas. They develop most often in the colon or rectal walls, but can be found in the lungs, liver, peritoneum, and uterus.

Immune dysfunction: Parasites depress immune system function by decreasing the secretion of IgA. Their presence continuously stimulates the immune system response, and, over time, can exhaust this line of defense,

leaving the body open to an influx of other parasites, as well as bacterial and viral infections. Unexplained disorders can include the following simple complaints: itchy skin/ears/nose/anus, joint and muscle aches and pains, low back pain, rashes, etc., to more serious autoimmune disorders including Crohn's disease, ulcerative colitis, arthritis, rheumatoid arthritis, chronic fatigue syndrome, etc.

Irritable bowel syndrome: Parasites can irritate, inflame, and coat the intestinal wall, leading to a variety of gastrointestinal symptoms and malabsorption problems, particularly of fatty foods, leading to bulky stools and steatorrhea (excess fat in the stools).

Joint and muscle aches and pains: Parasites can migrate to joint fluids. Worms can encyst, that is, become enclosed in a sac, within the muscles. When this happens, the pain is diagnosed as arthritis or rheumatism. Inflammation will be real because their presence will stimulate the body's immune system to respond to their presence, but being microscopic, will not be a suspect.

Mental changes that include the following: depression, impaired thinking, bursts of anger, confusion, restlessness, anxiety, and nervousness are often the result of systemic parasite infestation. Parasitic metabolic wastes and toxic substances can serve as irritants to the central nervous system, causing these symptoms.

Other health complaints: Parasites are the missing diagnosis of many health problems including the following: chronic fatigue, hypoglycemia, hypothyroidism, hypoadrenalism, dysgonadism (a protein dysfunction in the genito-gonadal area), chronic upper respiratory ailments,

depressive manifestations, depressed libido, and endometriosis.

Respiratory problems, including the following: coughing and wheezing, shortness of breath, often with flu-like symptoms, and excessive nose picking. Parasites are known to migrate to the upper respiratory tract, causing irritation.

Skin conditions: Intestinal worms can cause the following: hives, rashes, weeping eczema and other skin lesions. Cutaneous ulcers, swellings, sores, papular lesions and itchy dermatitis can all result from protozoan invasion.

Sleep disturbances: Restlessness with multiple awakenings during the night, particularly between 2 and 3 AM, can be caused by the body's attempt to eliminate toxic wastes via the liver. According to Chinese medicine, these hours are governed by the liver. Sleep disturbances are also caused by nocturnal exits of certain parasites through the anus, creating intense discomfort and itching.

Teeth grinding: Bruxism is the abnormal grinding, clenching, and gnashing of the teeth, often observed in cases of parasitic infection. This is more noticeable in children, especially at night, and may be a nervous response to an internal foreign irritant. In "conventional" medical material, they still maintain that the cause of this remains unknown and controversial.

Parasites Avoiding Parasites

A healthy intestinal tract is a key to **preventing attacks by various pathogens.**

Parasites can be fought with high doseages of such probiotic substances as *Lactobacillus acidophilus*, *L. bulgaricus*, and bifidobacteria.

Treatments need to last for several months, however. The health and number of organisms making up the normal flora of the bowel needs to be strong in order to compete against potential pathogens. Intestinal parasites and yeasts can ravage the intestinal flora, preventing the vital manufacture and absorption of nutrients, causing the whole body to breakdown in some fashion.

Intestinal worms develop when the immune system is compromised in some way, whether from another illness or from a poor diet. It is noted that when the diet improves, the worms die off. Garlic is a natural antiparasitic as well as an antibacterial, antifungal, and antiviral -- a cheap all-purpose medicine.

Onions, figs, and pumpkin seeds also create an uninhabitable environment for worms, and increased nutrients forces worms out of the body. Since absorption in the intestines is impaired by infestations, the body requires large amounts of nutrients.

Parasites do not like the following: unrefined carbohydrates, raw green vegetables, bitter melons, tomatoes, black pepper, raw carrots and their tops, fresh horseradish, onions, vegetable proteins, high fiber, radishes, kelp, raw cabbage, ground almonds, blackberries, figs, and alkaline diets. In addition, roundworms can be expelled with rose hip tea, and raisins soaked in senna tea makes for faster elimination of parasites in children. However, a heavy intake of raw fruits and vegetables, as well as that of Calli or Fortune Delight iced tea drinks, cause the intestines to contract, trapping toxins rather than releasing them.

In Mexico, fresh pineapple and papaya are used to cure worm infestations, and the seeds are often chewed to eliminate parasites.

Parasites do like a diet high in meat and dairy, sugar of any kind, acid-forming foods, and constipation, where they are allowed to flourish.

Having enough hydrochloric acid in the stomach is important to warding off parasitic attacks. This is why most children are susceptible to parasites as their digestive systems are not yet mature. The habitual use of antacids, as well as the practice of using them to obtain calcium, is also setting an individual up for such an attack.

A proper balance of alkaline foods to acidic foods helps to discourage parasites.

The ideal ratio of alkaline to acidic is 4:1. Alkaline foods include the following: figs, most fruits, green leafy vegetables, root vegetables, herbs and spices, olives, sprouted soybeans, cucumbers, spinach, real maple syrup, beets, avocados, , carrots, soaked chestnuts, potatoes, cantaloupe, lettuce, pineapples, cocoanuts, baked beans, cabbage, cherries, sprouted nuts, seeds and grains (they become alkaline through the sprouting process). Un-sprouted Soy products should be eaten sparingly, if at all since they leave a residue, on which parasites thrive.

Just because a fruit tastes acidic does not mean that it is.

Acidic foods that you should avoid include the following: egg yolk is the most acidic, most grains except millet and buckwheat, most carbohydrates (like pastas), wheat germ, chicken, beef, liver, lamb chops, cod fish, coffee, processed sugar, alcohol, cola drinks, catsup, cocoa, flour products, mustard, and dairy products. Fruits such as prunes, cranberries, plums and their juice are acidic.

All food with added sugars become acidic. Alcohol, drugs, aspirin, and tobacco are acid-

forming. White vinegar is very acidic, but balsamic and rice vinegars are low in acid.

In addition, all forms of sugar, including juices, honey, etc, affect the immune system. When the immune system is lowered, parasites, as well as other pathogens, have the environment needed to encourage their growth.

Sweeteners can reduce white blood cell (WBC) production by at least 50%, lasting over a five-hour period. This leaves the body vulnerable to attacks from bacteria, viruses, and parasites. Doing this several times a day leaves the immune system chronically depleted, as does the consistent eating of allergy-causing foods, which impair the immune system. Caffeine, as well, dramatically reduces the immune system by reducing the levels of immunoglobulines in the serum necessary for immune response.

Iron plays an essential role in carrying oxygen throughout the body, but it also is required by bacteria, fungi, protozoa, and tumor cells for their growth. **The internal heat caused by fever accompanying an infection helps keep bacteria from multiplying by preventing the germ from using the host's iron stores.**

Alcohol tends to increase iron levels, which accounts for more parasitic infestations found in alcoholics. Malnutrition, on the other hand, understandably lowers iron levels. Famine victims, when given an improved diet including iron supplements, had an increase in, and a greater severity of, infections, including malaria and tuberculosis.

Sunrider Fruit & Vegetable Rinse is a great fungi and parasite killer or you may try freshly squeezed lemon juice complete with rind, in a gallon of water is also a good food wash. Soak vegetables about fifteen minutes

in Sunrider Fruit & Vegetable Rinse and then rinse thoroughly and dry carefully. Wrap in clean tea towels. Do not store in plastic bags without inserting a paper towel to retain some of the moisture as this shortens their shelf life. Sunrider Fruit & Vegetable Rinse is cleansing for the whole system and will help eliminate worms in children by killing the parasites before the child can ingest them.

Grapefruit seed extract has been proven to be effective against over 800 strains of viruses and bacteria, 100 strains of fungi, plus a great number of single-celled parasites.

No other antimicrobial can make such claims. Despite destroying harmful intestinal parasites, it does not significantly harm the normal bowel flora. For some time in foreign countries, grapefruit seed extract has been used as a broad spectrum antibiotic, antifungal, antiprotozoan, antiviral, antiseptic, disinfectant, and as a preservative in cosmetics. In South America, it has long been used instead of chlorine in swimming pools and sewage treatment plants as well, as in treating drinking water, since chlorine does not kill a variety of pathogens, including Giardia. In Peru, it is used to disinfect agricultural products.

The FDA is finally acknowledging that it is as effective as any other amebicide now available and perhaps more effective, without causing the side effects that chlorine is known to cause.

When traveling abroad, including Mexico, it is proving to be an exceptional and simple alternative to the more harsh methods of killing parasites and other harmful organisms. Animals also respond well to grapefruit seed extract since it does not cause the side effects common in chemical de-wormers.

The extract should never be used full strength when applied to the skin. The standard dilution is 33% extract and 67% glycerin. For some applications, it is best used with almond, olive, sesame, or avocado oils instead of water. Keep it away from the eyes. A few drops can be added to household cleaners and soaps for a germ-free cleanser. By using eight drops to a gallon of water, it makes a safe and effective food wash that increases the shelf life of fruits and vegetables by as much as 400%.

The extract should not be used full strength when taken internally. Start with a drop dissolved in glycerin, and then mixed with a glass of water or fruit juice. Slowly increase according to your reactions. Work up to about eight drops (or a corresponding number of pills) in a full glass of water two or three times a day until symptoms disappear. When the organisms you are trying to kill begin to die, the toxins are released, leading you to feel some discomfort or tiredness.

If the symptoms become too uncomfortable, reduce the extract a little and begin to increase it again when you are feeling better. Since grapefruit seed extract can be very bitter, the debittered powder used in capsules may be a preferable choice.

For children, a capsule can be opened and the powder mixed into juice. In pill form, it can take 100-300 mg. per day to be effective for adults. One or two drops in a glass of water once or twice a day can act as a preventative against traveler's diarrhea. The extract is nontoxic and environmentally friendly.

Caution should be used if there is a sensitivity to citrus. The extract is not absorbed into the intestinal tissue, so can be safely taken for long periods of time, as in the cases of Giardia and yeast infections where it may take months to eliminate.

Pumpkin seeds (*Cucurbita pepo*) is a traditional remedy for worms, used for both animals and humans. Seeds of several varieties of the species *Cucurbita* have long held the reputation for paralyzing, but not killing, worms. However, the viable substance that affects the worms varies even in seeds of the same species, causing reliability to vary too much to be accurate.

We believe that you should take Sunrider's Slim Caps to help the natural process eliminate and move the worms out of the digestive system before they regain function.

With the Pumpkin seed it is important to leave the fine inner skin beneath the shell intact. Children are given ten to fifteen seeds a day, and adults, twenty to thirty seeds a day for about two weeks, increasing the number of seeds if tapeworms are a problem.

Follow this with a Sunrider's Slim Caps every day you are doing this to help eliminate. The cleansing process can be repeated as often as necessary without any harmful side effects -- as long as the **Sunrider's Slim Caps** are not taken over a lengthy period of time. When dealing with tapeworms, it is important that the entire worm be expelled, or else it will grow back. Daily consumption of pumpkin seeds may help to prevent parasites from taking up residence in the first place. Another suggestion is for pumpkin seeds and watermelon seeds to be ground to a powder and mixed with a little Calli tea and taken on an empty stomach every morning.

Parasites Worms

Worms (Helminths) are soft-bodied, elongated, naked invertebrates of the phyla Annelida (leeches), Acanthocephala, (thorny

or spiny headed worms), Aschelminthes(roundworms), and Platyhelminthes (flatworms). It is a common belief, that intestinal worms are more active during the full moon cycle. Worms most often develop when the immune system is compromised in some way, whether from another illness or from a poor diet. Since absorption in the intestines is impaired by infestations, the body requires large amounts of nutrients. **Animals, as well as humans, that are fed diets deficient in protein and vitamins A and B become infested with several types of parasites. This describes the Standard American Diet to a "T".**

It is noted that when the diet foods improves, by feeding it live whole plant foods on a regular basis the worms die off. Some specific live foods you can feed yourself in addition to other foods are:

Garlic is a natural antiparasitic as well as an antibacterial, antifungal, and antiviral -- a cheap all-purpose medicine.

Onions, figs, and pumpkin seeds also create an uninhabitable environment for worms. Increased nutrients forces worms out of the body.

Acidophilus is especially helpful for amebic dysentery, as well as all intestinal infestations. Sufficient stomach acid destroys parasites contained in the food eaten.

There are three main groups of these multicellular eukaryotes known simply as intestinal worms:

1. **Cestodes are tapeworms:** class Cestoidea; phylum Platyhelminthes; subclass Cestoda. They have a head (scolex) and segments (proglottides). The adults are

endoparasites found in the alimentary tract but their larvae can be found in various organs and tissues. Cestodaria is the unsegmented subclass of tapeworm which affects various fish and some reptiles. Examples include: *Dipylidium caninum* (dogs), *Diphyllobothrium latum* (fish), *Hymenolepis nana* (dwarf tapeworm), *Taenia saginata* (beef), *Taenia solium* (pork).

2. Nematodes are roundworms: class Nematoda; phylum Aschelminthes; in some classifications, it is sometimes known as Nemathelminthes or a class of that phylum. There are about 12,000 classified species, but an estimated 200,000 plus are known to exist. Examples include: *Ancylostoma caninum* (hookworm), *Anisakis simplex* (fish roundworm), *Ascaris lumbricoides* (giant intestinal roundworm), *Dirofilaria immitis* (dog heartworm), *Enterobium vermicularis* (pinworm or seatworm), *Eustrongylides spp.* (fish roundworm), *Necator americanus/Ancylostoma duodenale* (hook worm), *Strongyloides stercoralis* (thread worm), *Toxocara canis/cati* (dog and cat roundworms respectively), *Trichinella spiralis* (pork roundworm), *Trichostrongylus* (herbivore roundworm), *Trichuris trichiura* (whipworm).

3. Trematodes are flukes: class Trematoda; phylum Platyhelminthes. Important ones affecting man belong to the genera *Schistosoma*, *Echinostoma*, *Fasciolopsis*, *Gastrodiscoides*, *Heterophyes*, *Metagonimus*, *Clonorchis*, *Fasciola*, *Dicrocoelium*, *Opisthorchis*, and *Paragonimus*. Some specific examples include: *Clonorchis sinensis* (liver), *Fasciolopsis buski* (intestinal), *Nanophyetus spp.* (fish flu flukes), *Paragonimus westermani* (lung), *Schistosoma spp.* (blood).

1. Parasites Cestodes

Cestodes are tapeworms: class Cestoidea; phylum Platyhelminthes; subclass Cestoda.

They are specialized flatworms, looking very much like a narrow piece of adhesive tape. Tapeworms are the largest, and among the oldest, of the intestinal parasites that have plagued humans and other animals since time began. Found all over the world, tapeworms exist in many different forms, but they have no close relatives living outside of animal hosts. Tapeworms do not have a mouth like the fluke, nor do they have a head or a digestive tract with digestive enzymes. The ends differ, but neither has any organs or sensors that could be associated with what is commonly thought of being a "head." However, through a segment called a scolex, they are able to absorb predigested food.

The scolex attaches to the intestinal wall by hooks or suckers. The body contains hundreds of segments (proglottids), and each is a sexually complete unit that can reproduce, if necessary. Some tapeworms have reached lengths of more than ten meters (thirty feet) with a lifespan, inside a host, of thirty years or more. Cestodaria is the unsegmented subclass of tapeworm affecting various fish and some reptiles.

Tapeworms are dependent on two hosts for their development, one human and the other animal.

Larvae are found in animal hosts, while the adult worm is found in humans. Have you ever wonder why you are told to make sure your meat is cooked, and in the case of pork cooked well done?

Human infection comes as a result of eating insufficiently cooked meat (especially beef, pork, and fish), where the larvae are buried in the tissues of the

animal involved. The fleas of both dogs and cats can also transmit tapeworm larvae. Rice-shaped particles that resemble pumpkin seeds in the stool can be a sign of a dog tapeworm, which can easily be mistaken for pinworms. It is important to deflea household animals frequently.

Some of the conditions and symptoms that tapeworms can cause include the following: mineral imbalances, abnormal thyroid function, intestinal gas, blood sugar imbalances, bloating, jaundice, fluid buildup, dizziness, fuzzy thinking, hunger pains, poor digestion, allergies, sensitivity to touch, weight changes, and symptoms of pernicious anemia.

Treatment can take months before the entire worm is expelled. It is suggested that long periods of fasting not be undertaken since tapeworms cannot be starved, but will only leave the person feeling weak and nauseated. **It is better to eat foods that tapeworms do not like, as onions and garlic.** This weakens the worm so that it loses its grip. Then it is easily dislodged and can be expelled.

Another unusual tapeworm is the gnathostomes worm, which attaches to the stomach wall of animals and humans. It eventually passes the eggs of a tiny one-eyed bug called a "cyclops". **Fish, frogs, or snakes** later eat these infected bugs, which ultimately infect that animal. **As it moves up the food chain, humans become infected.**

There are five types of tapeworms that can infect humans.

Taenia saginata is the **beef** tapeworm that is transmitted to humans after the ingestion of undercooked or raw beef. The worm can grow to a strand of 1,000 to 2,000 segments. Each segment is known as a proglottid, and contains both male and female reproductive

organs, capable of bearing fertilized eggs. Tapeworms thrive on the diet of the host, and is dependant on their carbohydrates, but also utilizing the tissues to obtain proteins.

Despite its length, it usually does not produce any marked symptoms. Therefore, it can be quite surprising when it passes out of the body. If there are symptoms, they will include diarrhea, abdominal cramping, nervousness, nausea, and loss of appetite.

Taenia solium is the **pork** tapeworm, and the one capable of causing the greatest harm to the human host. It is similar to the beef tapeworm, but shorter, having fewer than 1,000 proglottids. When a tapeworm egg is ingested, the shell around the egg is dissolved in the stomach, and a living embryo called an "oncosphere" is released.

After about sixty to seventy days, these oncospheres become mature bladder worms called cysticerci or "cysts" that attach to the intestinal, using a head composed of four suckers and eight hooks. When its wastes are absorbed by the host, it produces toxic effects, as well as intestinal obstruction as the worm swells. **This worm can remain in a human host for twenty-five to thirty years, reaching lengths of two and one-half to three meters (eight to ten feet).**

Humans become infected after eating undercooked pork or smoked ham or sausage where cysts are imbedded in the tissue. Unlike the beef tapeworm, pork tapeworm infestation is usually caused by multiple worms rather than just one. Infection with the adult stage of the pork tapeworm is called taeniasis, which is not a serious health threat. However, the eggs can still be carried under the fingernails of those preparing foods or be on their skin or clothes. Eggs will appear in the stool eight to twelve weeks after eating infected pork, but eggs from a carrier can take

several days to ten years to develop in another person. Infectiousness remains as long as the worm is in the intestines. Twenty to thirty thousand eggs every day can be shed into the feces of a carrier. On the other hand, **the larval stage causes a much more serious condition, known as cysticercosis, producing seizures and brain deterioration that is often misdiagnosed as epilepsy.**

Over time, the tapeworm can riddle the brain with its grape-sized bladders, causing progressive brain deterioration to the point of death. The larvae can also develop and spread through the CNS into the muscles, heart, and eyes.

Amazingly, this parasitic worm does not alert the immune system. It secretes a substance that suppresses the inflammatory response to its presence, and also controls the amount of fluid passing across its membranes from the brain. **Not until the death of the worm, does the body begin to respond to the "foreigner" in its midst, when these once-protective substances are no longer produced by the worm.**

Diphyllobothrium latum is the **fish** tapeworm, and is the largest parasite found in humans, with its length reaching 4,000 proglottids. It is commonly found in Scandinavia, Russia, Japan, Australia, the Great Lakes of Canada, and Alaska.

It is usually picked up after eating raw or lightly cooked freshwater fish or such species of migratory fish as Alaskan salmon, perch, pike, pickerel, and American turbot. In the intestine, **a fish tapeworm can consume 80 to 100% of the host's vitamin B12.** It is this deficiency (pernicious anemia) that is the most debilitating effect. **After it has been eliminated from the body, it can take up to a year for B12 levels to return to normal.**

Digestive disturbances that include pain and fullness in the upper abdomen, nausea, and anorexia are common symptoms.

Dipylidium canium is the **dog** tapeworm. It is transmitted to humans by infected dog fleas. Children are the most frequently affected. By kissing a dog or having it lick the face, an infected dog flea can easily be swallowed. Called the "pumpkin seed" tapeworm, the first hint of infection may be finding seed-like particles in the stool or undergarments. These particles are actually the egg-bearing segments of the tapeworm. After the flea is swallowed, the larvae is liberated, reaching maturity in about twenty days. Symptoms are vague, but include restlessness and persistent diarrhea.

Hymenolepis nana is the **dwarf** tapeworm. Although it is the most prevalent in the southern US, it does occur worldwide, requiring an intermediate host. It is a short worm, growing only about one and one-half inches, complete with about 200 segments. The head is small with a ring of hooks and four sucker cups. The tapeworm infects humans only when the eggs are ingested. **Eggs can be transmitted by infected food handlers, grain beetles and other insects that infest grains, as well as rodent contamination of foods.** Mild infestations are usually without symptoms, but if enough are present, symptoms of diarrhea, itching, abdominal pain, headaches, and other vague digestive complaints occur, especially in children.

In severe cases, symptoms will include the following: general body weakness, weight and appetite loss, insomnia, abdominal pain, with or without diarrhea, vomiting, dizziness, allergies, nervous disturbances, and anemia. The eggs in fecal samples are easily identified, displaying two membranes enclosing an embryo with six hooklets. White

blood cells may also be elevated, especially the eosinophils.

A similar tapeworm called *Hymenolepis diminuta* can infect humans after infected mice and rats contaminate grains, flours, and baked goods with their feces, leaving meal worms and flour beetles.

2. Parasites Nematodes

Nematodes are roundworms: class Nematoda; phylum Aschelminthes; in some classifications, it is sometimes known as Nemathelminthes or a class of that phylum. There are about 12,000 classified species, but an estimated 200,000 plus are known to exist. Nematodes commonly include such worms, other than tapeworms (*Cestodes*) or flukes (*Trematodes*), as the roundworm, pin worm, hookworm, etc. They are multicellular organisms and larger than Protozoa.

The adult worm multiplies by producing eggs called larvae, which become infectious in soil or in an intermediate host before infecting humans. Usually, a person will show no symptoms unless there is a heavy infestation of worms, with both coexisting until the worms grow in numbers that creates an obstruction. The following are some of the more common nematodes, except for the roundworm. Because it is a large section, it will be dealt with separately.

Hookworms (*Necator americanus* and *Ancylostoma duodenal*) are found worldwide in warm moist soil, where the larvae penetrates the skin of those usually walking barefoot. The larvae then travel through the bloodstream to the lungs, into the alveoli, and up the trachea to the throat, where they are swallowed, ending up in the small intestines about seven weeks later.

When the larvae passes through the lungs, bronchitis may develop. **The teeth-like hooks of the larvae attach to the intestinal mucosa, where it injects an anticoagulant to prevent the blood from clotting. It robs the body of large amounts of blood, extracting an estimated seven million liters of blood each day from 700 million individuals around the world -- which explains its name -- *Necator americanus* "American murderer".**

Although, not all infections cause disease since it usually takes more than twenty-five adult worms to do that, but so much blood can be taken from an infestation to cause anemia. They are most likely to infect those who have a poor diet and, thus, compromised immune systems.

The first sign of a hookworm infection is itchy patches of skin, pimples or blisters known as ground itch or dew itch. The skin itches for a few months until the worm dies. Other symptoms include the following: itching at the site of entry, nausea, dizziness, pneumonitis, anorexia, weight loss, and anemia.

A heavy infestations will produce the following: anemia, protein deficiency, dry skin and hair, edema, distended belly, stunted growth, delayed puberty, and mental dullness. Treatments include improving nutritional status with special attention to the anemia. Adult worms are small, cylindrical, and grayish-white, with a head that is often curved in a direction opposite that of its body giving it the "hooked" appearance.

Both species infect humans, but only one possesses four sharp structures like teeth, while the other has cutting plates. They are the only worms known to have teeth. **These worms can live up to fifteen years in the human body, extracting .2 to .3 ml. of blood every day. This amount can be**

considerable since the females are known to release 10,000 to 20,000 eggs every day. Hookworm affects about 900 million people worldwide, causing 60,000 deaths, yet world agencies have spent less than a million dollars on hookworm research.

The pinworm (*Enterobius vermicularis*) is the most common of all worms in the US, and the bane of a mother's existence. Over 80% of children between the ages of two and ten will be affected at one time or another. It has infested people to the tune of over 200 million worldwide, with over 40 million in the US alone. It is found in both warm and cold climates and shows no socioeconomic boundaries. Pinworms are about the size of fine silk threads a fraction of a centimeter long, but some can reach lengths of thirty cm (twelve inches).

Transmission occurs through contaminated food, water, and household dust, as well as person-to-person contact. The adult female pinworm moves outside the anus, during the night, to lay her eggs. These eggs are then transferred to fingernails during scratching, and then, into the mouth where the cycle begins again. One female pinworm can deposit over 15,000 eggs that become infective immediately or within a few hours.

Children can easily transmit the eggs to the entire family via the bathtub, toilet seat, and bedclothes. The eggs can stay viable for weeks on carpets, walls, sheets, and clothes. Perianal itching is the most classic sign of pinworm infestation. These threadlike ¼-inch worms have been connected to an enormous range of neurological and behavioral symptoms. Eggs are seldom found in the feces, but are laid around the anus at night.

It is often necessary to treat the entire family simultaneously, repeating the process in about two weeks since reinfection is

extremely common. A study published over forty years ago by Pediatrician Leo Litter, documented his ten-year study of 2,000 children, where he was able to link some unusual conditions not previously associated with parasitic infections. Some of his findings included abnormal EEG's that often mimic that of a brain tumor. **Symptoms in children range from poor appetite, teeth grinding, hyperactivity, nervousness, irritability, insomnia, bed wetting, stomach aches, nausea and vomiting to more severe forms including epileptic seizures, vision problems, mental disturbances, appendicitis, and anorexia.**

Strongyloides (*Strongyloides stercoralis*) is a unique nematode. Sometimes called a threadworm, the mature adult can reproduce entirely in the human host or can grow freely in soil. In humans, they produce autoinfections and can remain in the body for more than thirty years. Extremely difficult to diagnose, strongyloides are found mainly in southeast Asia, the Middle East, South America, and the southeastern part of the US.

The life cycle and pathology is similar to that of the hookworm, except that the eggs hatch into larvae inside the intestines before passing in the feces. The larvae enter the human body by penetrating the skin, or through pores and hair follicles. Most often penetration is between the toes or at the bottom of the feet.

The larvae then travel to the intestines, where they reach maturity. If the larvae invades lung tissue or the intestinal wall, a fatal condition called disseminated strongyloides, sometimes develops.

Pulmonary disorders, abdominal pain and bloating, along with greasy-stool diarrhea are the primary symptoms, with infections lasting a lifetime. The pulmonary disorders often show up in AIDS victims. The parasite seems to be relatively harmless if the immune system

is functioning properly.

More severe infections are characterized by abdominal pain and bloating, nausea, vomiting, alternating diarrhea and constipation, and greasy stools. The liver and pancreas ducts, the entire small bowel, colon, heart, lungs, and CNS may all be involved in mal-absorption caused by the worms. With a heavy infestation, a person may complain of heartburn and tenderness, often aggravated by food intake.

A peptic-ulcer like pain associated with an elevated eosinophil count on blood tests often indicates a *Strongyloides* infection. Lab tests will find the parasite in blood samples, since eggs are rarely found in stool samples, except after a violent purge of diarrhea.

Guinea worm (*Dracunculus medinensis*) is one of the more serious discomforts of India, Africa, and Asia. Humans become infected by drinking impure water containing copepods (small crustaceans) infected with the larvae of the guinea worm. Following ingestion, the copepods die, releasing the larvae, which penetrate the stomach and intestinal wall of the host, thereby entering the abdominal cavity. The female can be over a meter long, but the male is only about two or three centimeters (about an inch).

After maturation, the worms copulate and the males die. About a year after the initial infection, the female migrates towards the surface of the skin, usually on the lower extremities, **where it will settle down just under the skin to look like a coiled varicose vein.**

Symptoms begin with vomiting, diarrhea, and dizziness as the worm makes its way through the body. The area produces a blister, and the patient, seeking relief, turns to bathing the area. When the lesion comes in contact with

water, the female worm emerges, rupturing the blister and discharging a milky white fluid containing thousands of larvae into in water. Only water will cause her to deposit her eggs.

Upon release, the eggs go on to be ingested by a crustacean called a 'cyclops' (a copepod), and, two weeks later, the cycle begins again. In an October, 1995, *People Magazine* article, the guinea worm was reported to have emerged from the back of a child's head and from under the tongue of a man who eventually starved to death because the area was too painful to permit eating. Native medicine men remove the worms slowly by winding them onto a stick. It is a long process, requiring only a turn or two a day. It is not uncommon to see people walking around with a stick taped to their legs and good-sized worms coiled around them. If the procedure is not done properly, bacterial infections develop.

After serious efforts towards hygiene and purified water, the disease is being eradicated. Where once several million people were affected, the numbers are now fewer than 200,000.

Parasites Roundworms

The Roundworm *Ascaris lumbricoides* is the most common intestinal parasite in the world, infecting an estimated one billion people. It is also the largest of the round worms, reaching an average of forty cm (sixteen inches) in length. It can be as thick as a pencil and weigh almost as much. It is pink with bright red "speed stripes." The female grows in the intestines, producing an enormous number of eggs estimated to be about twenty-seven million in her lifetime of a year or so.

The eggs expelled in the feces can live

outside the body for up to seven years in warm soil. Food, water, and soil contamination are the means of infection for humans. However, humans are not a viable host for the mature worm, but the immature form is the one that causes the disease. When the larvae hatch, they travel to various parts of the body like the lungs, liver, brain, or eye. They can enlarge the liver, cause abdominal pain, and often pneumonitis, as well as anemia as evidenced by a high eosinophil count. Children are more prone to contracting the worm since they often play in dirt and then put their hands into their mouths.

It is estimated that fifty-five million American children are infected with some type of worm. An infected person may have vague symptoms, with the most unusual being a full, pale upper lip with white lines around the mouth.

Symptoms in children that are typical of parasite infestations include the following: nervousness and irritability, colic, poor or ravenous appetites, failure to thrive, allergic reactions, dry or wheezing cough, and restlessness at night. Other symptoms of this parasite often include the following: convulsions or spasms, twitching in various parts of the body, itching or irritation of the nose or anus, oral pallor, as well as a lactose intolerance.

Children also frequently pick their nose. Malnutrition is a characteristic of a heavy ascaris infection because the worms compete for the nutrients. Ascaris inhibits absorption of proteins, fats, and carbohydrates as well as other nutrients. Treatment is not usually rendered because it is a common childhood complaint, but if there is a community wide infestation, then steps are usually taken that include mass therapy every six months, along with an improvement in sanitation facilities, diet, and hygiene.

Adults can exhibit vague symptoms including the following: abdominal pain, edema of the lips, allergic reactions, insomnia, anorexia, and weight loss.

Commercial blast-freezing is the most effective way to kill Anisakine larvae.

Dog and cat roundworms, *Toxocara canis* and *T. cati*, are the cause of a disease called 'visceral larva migrans' first recognized in 1952 and found mainly in children. More than half of all dogs are infected with at least one parasite: hookworm, roundworm, tapeworm, or heartworm. ALL puppies are born with the dog roundworm *Toxocara canis*, which is often the reason for their distended bellies, diarrhea, and lackluster coats.

Both puppies and kittens are continually infected with larvae from their mother's milk. Puppies from three weeks to three months of age present the greatest hazard because they excrete large numbers of roundworm eggs. Consequently, the most susceptible are young children. Roundworm eggs are deposited everywhere a child often plays -- playgrounds, back yards, parks, beaches, sandboxes, etc. The eggs are very hardy and can survive for years in all kinds of weather. There are no known chemicals that will kill them in the soil.

A dog with a mild roundworm infection can pass at least 10,000 eggs a day from just one of the several hundred worms that usually infect its system. Multiply this by the number of dogs in the country and the number of parks, etc., to which they have access, and it is easy to see where there would be an enormous health hazard to both humans and animals if owners do not properly take care of the feces left behind in public areas. Another must is the deworming of animals. This should begin when puppies are two to three weeks old and kittens about six weeks old. This should be repeated every three months during

the first year of life, and then twice a year after that.

The disease is characterized by flu-like symptoms, continual abdominal pain, inability to gain weight, blood changes, cough, rash, and enlargement of the spleen and liver, where they can create severe tissue irritation and allergic reactions. The larvae can also migrate through the lungs, muscles, brain, liver, and eye. In the more serious cases involving the eye, tumors can appear, producing a condition called 'ocular larva migrans.'

This condition is the result of the larvae becoming trapped in the retina of the eye. Symptoms include eye pain, strabismus (the inability to focus both eyes at the same time), and loss of vision. This syndrome may be misdiagnosed as 'malignant retinoblastoma,' resulting in an unnecessary removal of the eye.

Roundworms: *Wuchereria bancrofti*, *Brugia malayi*, *Onchocerca volvulus*, *Loa loa*, *Mansonella streptocerca*, *M. perstans*, *M. ozzardi* are all microscopic filaria of which there are eight species known to infect humans. They are transmitted by bloodsucking insects, including flies and mosquitoes *Culex*, that ultimately produce diseases endemic to tropical Africa, Southeast Asia, and the South Pacific.

The lymphatic filariae (*W. bancrofti* and *B. malayi*) invade the bloodstream and lymphatic system with pronounced effects, ranging from simple fever and lymph node infection to such deformities as elephantiasis of the legs, arms, scrotum, and breasts. Together, river blindness and elephantiasis infect more than 100 million people worldwide. Elephantiasis is the more dramatic of the two, causing swelling of immense proportions resembling that of an elephant. **These deformities are the result**

of the reproductive activity of the three- to four-inch long female worm that lies coiled in a lymph gland or duct.

Everyday she pumps out thousands of offspring in the form of tiny threadlike larvae called 'microfilaria.' Over time, these organisms clog the lymph ducts, causing the lymph fluid to back up, which, in turn, causes the tissues to swell in certain areas of the body depending, on which lymph gland or duct is affected.

O. volvulus causes dermatitis, subcutaneous nodules, and eye lesions. In some areas of West Africa, almost 30% of all adults become blind as a result of infections from this parasite. All three species of the *Mansonella filariae* cause a type of itching dermatitis.

In West Africa, a tiny roundworm causes river blindness (onchocerciasis). The parasite is transmitted through the bites of black flies, and often live as a tangled mass in nodules under the skin, where females can release 200 to 300 offspring (micro filariae) everyday. These micro filariae migrate through and under the skin, causing itchy red patches that eventually turn to white leathery areas. When they reach the eyes, blindness results.

The dog heartworm, *Dirofilaria immitis*, is most endemic to areas of the US along the Mississippi River Valley and the Atlantic and Gulf Coasts. Man is not a viable host for the mature worm but only for the larvae, which is the cause of infections. The parasite is transmitted by an infected mosquito, and usually remains in subcutaneous tissue. The larvae rarely complete their life cycle, but, if they do, they migrate to the lung, where they become localized in a coin-like lesion that can be misdiagnosed on an X-ray as lung cancer, leading to unnecessary surgery. The symptoms are generally mild, with an occasional cough.

The roundworm *Trichinella spiralis* can masquerade as at least fifty or more common diseases, ranging from flu to generalized, as well as, specified areas of aches and pains.

The most familiar of the diseases is "trichinosis."

Most roundworms are transmitted through the soil, but the exception is the spiral-shaped trichinella, which is found in animal muscle that is ingested by humans.

These roundworms become enclosed in cysts found in the tissue of a variety of such animals as bears, pigs (most often), walrus, etc.

If the meat is not thoroughly cooked before being eaten, the cysts, which are not affected by digestive juices, mature and travel to the muscles, where they become encased. Eventually, the worms can burrow into the larynx, chest, diaphragm, abdomen, jaws, and upper arms, where they calcify, causing severe muscle soreness accompanied by fever. The worms have been known to survive in a human body for as long as thirty-one years when pathologists found as many as 1,200 of them in a single gram of tissue.

They can range in size from a fraction of a centimeter to more than three meters (ten feet). The symptoms of trichinosis change according to the progression through the body. Incubation period is seven to fourteen days. During the first week of infection, acute diarrhea, nausea, vomiting, and colic occur as the larvae penetrate the first part of the small intestine. Then, when the larvae migrate to muscle tissue, about two to four weeks after ingestion of infected meat, severe muscle pain is experienced. When the larvae finally encyst themselves in muscle fiber, extreme dehydration and toxic edema can appear. Edema of the lip, face, or eyelids, difficulty breathing or speaking, chewing problems, enlarged lymph glands, meningitis, and encephalitis can take place. Brain damage,

pneumonia, pleurisy, and nephritis are further complications. Blood counts will remain normal for quite some time, however.

Known since ancient times, trichinosis was avoided by abstaining from eating pork. Found in the Mosaic law. This method is hailed as being the first step toward preventative medicine. It was not until the middle of the 19th century that it was discovered that thoroughly cooking pork could prevent an infestation. Salting, smoking, and pickling are also preventative methods -- but trading safety from this organism for other health concerns. Roundworms eggs are not found in stool samples until sixty to seventy-five days after initial infection. By this time, they have gone through their pulmonary phase, creating symptoms of coughing, wheezing, bronchial spasms, and increased mucus. Symptoms related to the intestinal phase can mimic those of a peptic ulcer, or ulcerative colitis, but require an entirely different treatment regimen.

The roundworm *Anisakis marina* causes an infection called anisakiasis. The larvae burrow into the stomach wall, producing severe inflammation and pain with the symptoms mimicking appendicitis, gastric ulcers, or cancer. Surgical removal of the worms is often required, but this also means removing sections of the intestine -- a common procedure in Japan where raw fish is a staple. **Humans become infected by consuming raw, pickled, smoked, or undercooked fish.** With the increased use of microwaves for cooking, the risk increases since this method distributes heat unevenly.

Most often, this Eustrongylides worm infection has been the result of eating homemade sushi dishes rather than from restaurant preparations, where chefs are well-trained to spot the larvae. The custom of sampling such ethnic dishes as homemade sausage or

gefilte fish for seasonings can also transmit trichinosis and fish worms into humans.

Pacific rockfish (red snapper) and Pacific salmon are most frequently infested with anisakid worms, but they have also been found in such other Atlantic fish as herring, cod, and haddock.

The fish roundworm , *Anisakis simplex* is acquired by eating raw or undercooked fish, including any pickled, marinated, and salted marine life. They are large, bright red worms that can be seen with the naked eye in the flesh of any type of fish -- freshwater, marine, or brackish water. They can remain very active, even after the death of the fish. The larvae normally mature in wading birds, especially after they eat minnows. It takes only one larva to cause an infection in humans. Misdiagnosis is common since it mimics such other diseases as acute appendicitis, Crohn's disease, gastric ulcers, or gastrointestinal cancer. Some chronic cases have lasted a year. Some have had a tickling sensation in the throat and have coughed up the worm and manually removed it before being swallowed again. Symptoms of nausea can persist after the expulsion of the worm (no doubt after something like that!) because the parasite can leave lesions containing remnants of the worm. If the parasite is able to penetrate the intestinal wall, peritonitis can result, leading to death.

Some suggested natural methods for ridding the system of roundworms include the following:

1. eating raw whole food carrots, beets and as much raw garlic as possible for several days . Chew well;
2. boil some garlic, horseradish, and onions in water and drink it slowly, as hot as possible;
3. sit in a milk bath sufficient for covering the rectal area. Worms "smell" the milk and crawl

out. Remain in the warm bath for about an hour until all the worms are out;

4. extracts of garlic, onion, pomegranate rind, turmeric, and various citrus rinds possess anti-worm properties. Bromelain, papain, and other proteolytic enzymes are useful in dissolving the outer layer of the worms. Figs are a good laxative.

Antiparasitic drugs have not proven to be very effective. The symptoms may diminish for a couple of months and then return. In addition, one lesser known side effect of the drugs is that it can drive a parasite out of one organ and into another, where it could cause even more damage. A typical example is finding *Ascaris* in the bile duct or liver. These worms do not commonly leave the intestinal tract unless the patient has taken a drug that is toxic, but not lethal, to the parasite, or there happens to be a GI disorder that alters the normal digestive process.

3. Parasites Trematodes

Trematodes are flukes of the class Trematoda; phylum Platyhelminthes. Important ones affecting man belong to the genera *Schistosoma* (blood fluke), *Echinostoma* (intestinal fluke), *Fasciolopsis* (liver fluke), *Gastrodiscoides* (intestinal fluke), *Heterophyes* (intestinal fluke), *Metagonimus* (intestinal fluke), *Clonorchis* (Asiatic liver fluke), *Fasciola* (liver fluke), *Dicrocoelium* (liver fluke), *Opisthorchis* (liver fluke), and *Paragonimus* (lung fluke).

Man usually becomes infected after ingesting insufficiently cooked fish, crustaceans, or vegetables that contain their larvae. The cycle begins when larvae are released into freshwater by infected snails. The free-swimming larvae can then directly penetrate the skin of humans while swimming or be ingested after encysting in or on various edible vegetation, fish, or

crustaceans.

The oval-shaped fluke (sometimes called a flatworm) has a tough outer body layer called a tegument that covers layers of circular, longitudinal, and diagonal muscles that protects it from the human digestive tract. Some can inhabit the liver, bile duct, or lymph vessels. They can be several inches long, an inch or so wide, and only thick enough to hold themselves together. Below are just a very few examples of the thousands known.

Blood flukes: *Schistosoma japonicum*, *S. mansoni*, *S. haematobium* are three species of blood flukes (schistosomes) that cause the disease schistosomiasis, which infects about 200 million people worldwide. One of the three types of disease, *S. japonicum* is found in Asia; *S. mansoni* occurs in Africa, the Eastern Mediterranean, the Caribbean, and South America; the third, *S. haematobium* is found in Egypt. Freshwater snails play intermediate host in the life cycle development of these blood flukes. The snails release larvae into the water, where they can penetrate the skin of swimmers or bathers. The parasites burrow into the skin, and then are carried into the bloodstream to be taken to the liver, intestines, or bladder. **There are two forms of schistosomiasis. With one, inflammation begins when the worms lodge in the lining of the intestine or liver.**

With the other form, the bladder and urinary tract can become fatally infected by worms as they lodge in the walls. **Travelers to Africa**, especially, are warned not to bath, wade, or swim in fresh water because of possible infestations blood flukes. Infection causes fever and chills, but also elevates the number of white blood cells (eosinophils), as well as producing abdominal pain resulting from enlargements of the liver and spleen. Often, these symptoms do not show up for four to eight weeks after exposure, and, therefore,

may not be associated with the possibility of parasite infestation while on vacation.

Liver fluke: *Clonorchis sinensis* is common in the Orient and Hawaii, and **is transmitted through the ingestion of raw, dried, salted, pickled, or undercooked fish.** Snails, carp, and forty additional fish species have been known to play the intermediate host to this fluke. In humans, it inhabits the bile ducts of the liver, causing it to enlarge and become tender, as well as producing chills, fever, jaundice, and a type of hepatitis.

Oriental lung fluke: *Paragonimus westermani* is found mainly in the Far East, where it enters the body, producing the disease called paragonimiasis. Humans acquire the fluke ingesting infected crabs and crayfish that have not been sufficiently cooked or are served raw. **The adult worms go to the lungs, and, sometimes, the brain, where seizures similar to epilepsy can occur.** Symptoms include an occasional mild cough, producing a peculiar rusty brown sputum. **The lung fluke can perforate lung tissue and deplete oxygen supplies to the entire bloodstream. Symptoms often resemble those of pulmonary tuberculosis.**

Sheep liver fluke: *Fasciola hepatica* is more common in Central and South America, parts of Africa, Asia, and Australia. Infection is usually acquired from eating the larva worms encysted on such aquatic vegetation as watercress. **Worms migrate to the liver and bile ducts, where they produce upper right quadrant abdominal pain, liver abscesses, and fibrosis.**

Intestinal fluke: *Fasciolopsis buski* is more common in Southeast Asia, Australia, and Latin America. Transmission occurs when individuals bite into the unpeeled outer skin of plants that harbor encysted larvae. Such plants can be water chestnuts, bamboo

shoots, and lotus plant roots because they are often cultivated in ponds and streams infected by animal waste. Adult flukes live in the duodenum (the shortest and widest part of the small intestine) and jejunum (connects the duodenum and the ileum, which opens into the large intestine), where they cause ulceration. Symptoms include the following: diarrhea, nausea, vomiting, abdominal pain, as well as facial and abdominal edema.

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