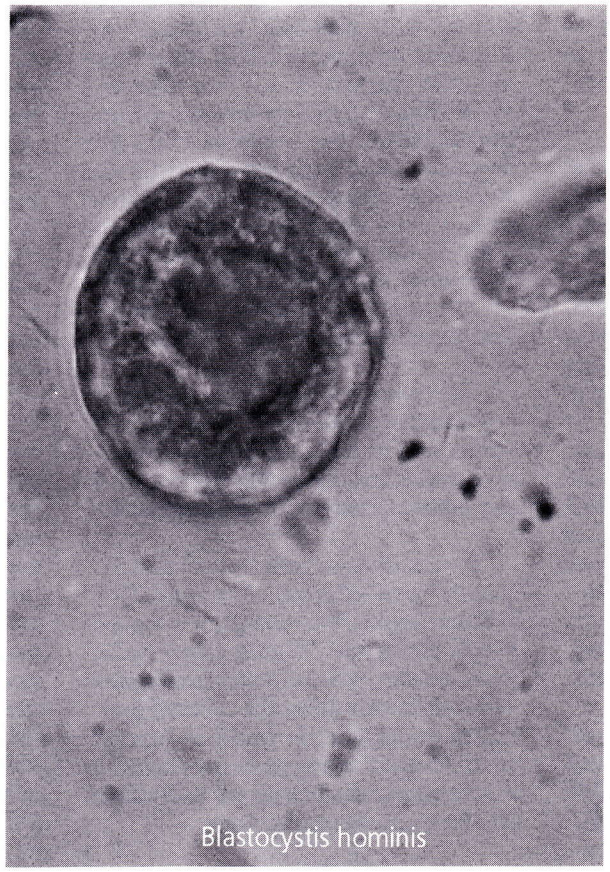
Relationships in Parasitology: Part I of II

Recognizing the temporal and spatial relationships between parasitic infections and physical and psychological trauma is parasitology viewed through a gestaltic perspective. Those relationships may, in many cases, be operative at the sub-clinical level since early childhood years. Progressive or sudden overt disease may occur later on in life. The reactivation of infection is usually associated with depressed immune status. Age, hormonal changes, and physical or psychological stresses are important contributors to immune system suppression. Compromised immunity in adults renders the body wide open for many opportunistic infections that may become established in the adult stage and not only during earlier years of life. Inter-relationships of this nature have not been the usual preoccupation of the traditional scientific or academic community. Rare exceptions, however, exist: The impact of major parasitic diseases on the immune system as well as the subsequent effects of the latter on other parasitic infections have been recently considered by Kirszenbaum.[20] Short term studies on the direct impact of acute parasitic infections on human or animal health are, however, more frequently reported in the literature. In addition, the inter-relationship between host immune system and concurrent parasitic infections needs to be more seriously considered. For instance, suppressed cell mediated immunity in patients with invasive amebiasis makes it possible for the opportunistic *Candida albicans* to develop frequently in those patients.[13,14]


Blastocystis hominis

My particular interest in "holistic parasitology" is one facet of my overall philosophy on RELATIONSHIPS which has its roots in Zen Buddhism. We have come, of late, to recognize that it is not the nature of the beast that matters but rather how that beast interacts with other beasts. Observe for instance the working relationships in quantum mechanics. Einstein recognized the nature of atomic behavior and relationships as did Heisenberg in his initial work on the Principle of Uncertainty; see Capra[5] for interesting perspectives on these concepts. Capra[4] also coined this paradigm shift in physics in his eloquent exposition of the relationship between physics and Taoism. Paradigm shifts have also been recently recognized in such fields as psychiatry, diplomacy, and health care.

I am fortunate to have been associated with a group of wonderful homeopathic physicians whose concerns extend well beyond treating the symptoms of diseased organs. Few in the clinical field recognize that a malfunctioning organ does not exist in a void but also interacts with the total physical, mental, emotional and intuitive entities of the patient.

While parasites can adversely impact host's immunity, a compromised immune system often issues an open invitation for increased parasitic invasion and invasiveness. In my recent practice in the Phoenix area, those relationships, ex., between chronic fatigue and parasitic infection, were clearly evident. In immune compromised patients, certain intestinal parasites, e.g., *Blastocystis hominis*, were observed to be associated with marked gastro-enteric symptoms. Immune competent patients may not experience such pathologies.

Health is an expression of balance between one's physical, mental, emotional, and intuitive entities; see Ouspensky.[28] When that balance is disturbed by pressures, e.g., acute or chronic parasitic infections, it needs to be restored. Homeopathic physicians understand these relationships. They also respect parasites. I now realize why I developed such an appreciation for this community of physicians. To me, it is the 20th century expression of what I always related to intuitively, i.e., the native doctor of the tribal culture that understood and dealt with the body and soul, of his patient, as one.

I have been trained to research and publish in hard core scientific journals with readership not extending beyond the specialized professionals. One of the major features of the new paradigm shift in the sciences is the enlargement of the scope of coverage and treatment to include the non-specialized professional and the public. See for example recent popular works by Steven Hawking, e.g. *A Brief History of Time*.[15] Certain relationships in the parasitological field need to be more fully explored, e.g. those between parasitic infections and host physical-mental-emotional states as well as environmental sources. The latter include direct or indirect animate (human, wildlife, or domestic animals) and inanimate sources. Here one should stress again the fact that behavior of the same parasite species will vary depending on host innate and external variables.

This article is my first on parasites in the non-specialized parasitological literature. I will attempt to explore some of the above mentioned relationships based, in part, on the limited observations made on the first 188 patients seen at my new

Diagnostic and Educational Laboratory. In this lab we run diagnostic parasitological tests on fresh and mailable fecal samples (using mostly sugar flotation and formalin-ether sedimentation) as well as on blood samples (using stained thin blood films). My initial training and continuing research in wildlife parasitology in various parts of the world has been very helpful in establishing diagnostic relationships with environmental and animal sources. I require patients to provide information on environmental exposure, foreign travel, and animal and food associations.

It is extremely important to note that the patients that I see come to my lab because they are not well. Most have gastroenteric symptoms. Some also experience fatigue, skin conditions, weight loss, central nervous system or related imbalances. My clients, thus, represent a population at risk and extrapolation to other populations or to the general public should not be made.

Data on major intestinal infections diagnosed in 188 patients mostly from the Phoenix area are summarized in Table 1 *(below)*. Rarely encountered intestinal parasites and blood parasites are treated in the text. A few patients were concurrently infected with as many as four or five parasitic species. Parasites will, however, be treated individually at this time.

Blastocystis hominis was the most prevalent parasite encountered; it was found in half the tested patients *(Table 1)*. Infections were considerably more frequent in adult males and in immune-compromised patients with chronic fatigue syndrome than in others. The greater prevalence in adults compared to children suggests that repeated or long term exposure may be necessary to establish infection. *Blastocystis hominis* is becoming more recently recognized as an invasive parasite associated with various intestinal pathologies including inflammatory bowel disease (IBD). These associations are more readily evident in patients with severe gastroenteritis that are infected with that yeast alone. *Blastocystis hominis* produces an Immuno-suppressive lectin which may underlay the fact that it was observed more frequently in immune compromised patients than in others. It has also been associated with infective arthritis, abdominal cramps, vomiting, sleeplessness, nausea, weight loss, and dizziness. A few healthy controls tested positive for *B. hominis* but suffered no symptoms. This supports the suggestion that an asymptomatic carrier state may exist.

There is clearly sufficient evidence to propose that *B. hominis* should be considered and treated as an invasive intestinal parasite. Treatment with iodoquinol or metrodinazole has been found successful.[25]

The amoebas were the second most frequently identified group of parasites. They included largely *Entamoeba histolytica* and *E. coli*, and a few *Dientamoeba fragilis, Iodoamoeba butschlii,* and *Endolimax nana.* All usually infect the colon of individuals throughout the world, and except for *E. hostolytica* are generally regarded as nonpathogenic commensal; exceptions have been, however, reported.

Entamoeba histolytica infects an estimated 400 million people in all continents. It is an invasive protozoan that causes serious pathology. It feeds on intestinal bacteria, mucosal tissue, and RCBs that may be readily seen in in its protoplasm. *Entamoeba histolytica* may cause diarrheal illness, bloody stool, abdominal pains, distention and bloating, occasional constipation, weight loss, mucus in the stool, and fatigue. Less frequent clinical syndromes associated with *E. histolytica* infections include toxic megacolon, chronic nondysenteric colitis, fulminant colitis with perforation, perianal ulceration, liver abscess which may be complicated by peritonitis, lung abscess, brain abscess, and genitourinary disease.[19] *Entamoeba histolytica* is a fecal-oral filth disease that is transmitted from person to person through the cyst stage directly or indirectly via food or drink. Most patients that tested positive had history of travel to endemic areas, e.g., Mexico, or were more often exposed to common sources of infections beginning with unsanitary food handling on the farm. Areas with low standards of sanitation and those in which night soil is commonly used as fertilizers show the highest prevalence of human infection. Contamination of water supplies is not uncommon under these circumstances. Cyst passing asymptomatic carriers or chronic patients are most important in transmission. Acutely ill patients with invasive amoebiasis are not significant transmitters as they usually pass the noninfective trophozoites in their diarrheic feces. Flies and roaches are mechanical vectors that aid transmittance. Cysts can also be transmitted by oral-anal sex rendering amoebiasis prevalent in homosexual populations.[25] Other factors associated with increased incidence of *E. histolytica* infections include being institutionalized

TABLE I: Prevalence of major intestinal parasites* infecting 188 patients examined at the Diagnostic and Educational Laboratory, Phoenix, Arizona, June-July 1994.

	Patients	Male	Females	Children	Adults	I C P**	Non-ICP
Intestinal Parasites	188	70	118	14	174	27	161
Blastocystis	53%	68%	32%	35%	55%	70%	51%
Amoebas	26%	36%	21%	28%	26%	37%	24%
Giardia & relatives	14%	14%	14%	35%	13%	26%	12%
Cryptosporidium	8%	9%	8%	7%	3%	11%	7%
Roundworms	19%	24%	16%	35%	18%	22%	18%
Tapeworms	12%	9%	13%	14%	11%	11%	11%

* See text for other parasites.
** Immune compromised patients including mostly those with chronic fatigue syndrome whose immune system has been suppressed from physical-psychological trauma.

or having had colonic irrigation using improperly sterilized equipment.

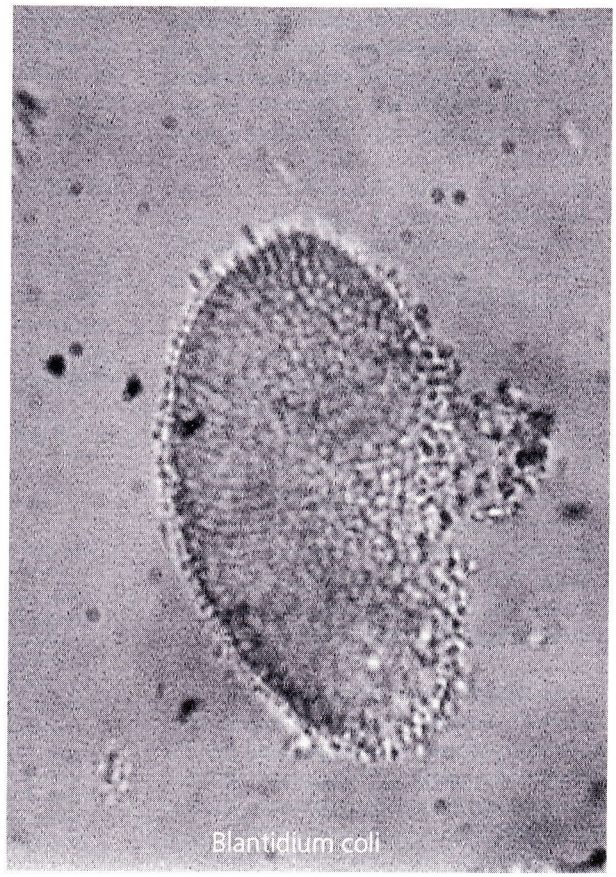
The distribution of *E. histolytica* in fecal material is not homogeneous. This makes the microscopic examination of multiple stool specimens a must to confirm diagnosis; as many as 7 stool specimens may be necessary to confirm a positive case. Occasionally intervals of many days may intervene between amoebic "runs." Trophozoites are usually found in liquid or very soft stools while the more readily identifiable cysts occur more frequently in formed stools. The occasional presence of RCBs in *E. coli* trophozoites and the usual lack of visibility of nuclei in both *E. coli* and *E. histolytica* trophozoites make it difficult to separate the two.

Acute fulminating amebiasis is often treated with metronidazole (Flagyl) followed by iodoquinol. Asymptomatic carriers are treated with iodoquinol, diloxanide furoate, or paromomycin. Emetine hydrochloride, dehydroemetine, chloroquine, diidohydroxyquin (Diodoquin), diloxanide furoate (Furamide), or tetracyclines[25] are also used depending on the severity of the illness, location and dissemination of the infection. In hepatic amoebiasis, *E. histolytica* is not usually seen in stool specimens.

Some evidence suggests that cure of amoebic colitis or liver abscess may be followed by resistance to subsequent invasive amoebiasis. This may be mediated by intestinal mucus and complement, and possibly by serum and secretory antibodies.[7] The considerably high prevalence of infection with *E. histolytica* observed among immune compromised patients compared to others (Table 1) suggests a relationship between *E. histolytica* infection and suppression of the immune system. Such a relationship has been experimentally documented at the humoral and cellular levels.[6,27] Suppressed cell mediated immunity in patients with invasive amoebiasis appears to pave the way for opportunistic fungi to invade the body and cause disease. For example, infection with *Candida albicans* was observed to develop frequently in invasive amebiasis patients.[13,14]

Giardia lamblia (= *G. intestinalis*) and other intestinal flagellates ranked the third in prevalence in the tested population. *Giardia* represented most infections in this group. Other flagellates included *Chilomastix mesnili* found only in a few patients and *Entromonas hominis* only in one. The latter two species are regarded as nonpathogenic.

Giardia lamblia is perhaps one of the four most prevalent human intestinal parasites in the world; the other three being *Blastocystis hominis*, *Entamoeba histolytica*, and *Cryptosporidium parvum*. *Giardia lamblia* has a higher incidence in younger individuals, homosexual males, and immune compromised patients; see also Table 1. *Giardia* outbreaks have also been associated with water supply contamination, travel to Russia, wilderness camping, day care nurseries, and homes for the aged. Beavers, muskrats, dogs, and sheep have been implicated as natural reservoirs. Food (fresh vegetables and fruit) and water contaminated with cysts from human feces serve as the primary vehicle of transmission. Seventeen percent of filtered drinking water sample collected from 66 surface water-treatment plants in 14 states and one Canadian province were found contaminated with *Giardia* cysts.



Attachment of *Giardia lamblia* trophozoites to the mucosal surface of the upper intestine causes shortening of the villi, inflammation of the crypts and lamina propria, and lesions on mucosal cells. This attachment has been attributed to *Giardia*'s secretion of the protein Vinculin[26] and perhaps accounts for false negatives in all stool test procedures. The overall recovery of diagnostic materials is better in soft formed stool than in watery stool.[1,36]

The mechanical and chemical pathology results in the malabsorption syndrome and the diarrheal episodes characteristic of giardiasis. Additional symptoms include abdominal distention, nausea, weight loss, as well as jaundice and colic when the bile duct and bladder become involved. In the latter cases, "relapses" may occur for years. Various authors (see Walterspiel[37]) have demonstrated associations between *Giardia* infections and reactive arthritis, urticaria, and ophthalmic changes. Infant carriers of *Giardia* were not more susceptible to symptomatic rotavirus infections. Patients with AIDS were not at a higher risk for severe protracted disease in spite of their depressed anti response to acute *Giardia* infection.[37]

The unique malabsorption phenomenon in *Giardia* infections affects protein vitamins A and B_{12}, and D-xylose.[33,35,39] Decreased intestinal absorption extends to oral antibiotics such as ampicillin, erythromycine, and penicillin, among others.[8] This was observed during clinical failures of oral antimicrobial therapy in children.[37]

Milk and duodenal fluid were found to be lethal to *Giardia*.[16] Whether dietary factors might influence *Giardia* infections in humans is unknown. In gerbils, a high fiber diet decreased *Giardia infections*.[22] Antigiardiasis agents include quinacrine hydrochloride (Atabrine) for adults and furazolidone suspension for children, as well as metronidazole (Flagyl). A promising new antigiardial agent is albendazole. This is a wide spectrum remedy that is also effective against various helminth parasites including a number of nematode and cestode species.[29]

Cryptospridium parvum has been recognized as an important widespread cause of diarrheal illness (DI) in humans since 1982. It may cause a short term (3-20 days) self-limited DI in immune competent persons. In immune compromised patients, however, it often causes life-threatening prolonged cholera-like illness. Extra-intestinal infections suggest that *C. parvum* may be an under-reported cause of biliary and respiratory tract dis-

ease, especially in immune compromised patients.[9] Transmission is of zoonotic nature involving calves as well as rodents, puppies, and kittens as reservoirs and potable water as a vehicle of transmission. Twenty-seven percent of filtered drinking water samples collected from 66 surface water treatment plants in 14 states and one Canadian province contained *C. parvum* oocysts.[21] Person to person transmission is not uncommon.

The prevalence of *C. parvum* infections varies between 0.6 to 4.3% in North America and Europe (seroprevalence of 25 to 35%) and 3 to 20% in South America.[9] Four large outbreaks were reported in Carrolton, GA in 1987 (13,000 estimated illnesses making up 40% of exposed population), Jackson County, OR in 1992 (15,000, 9%), Milwaukee, WI in 1993 (37,000, 23%), and Oxfordshire, Scotland in 1989 (55,000, 11%).[34]

At the Phoenix Diagnostic and Educational Laboratory, more children and fatigued patients tested positive for *C. parvum* than others. This agrees with the national and international trends. In Sao Paulo, Brazil, the prevalence of *C. parvum* was 25.6% in stool specimens of AIDS patients attending Santos Reference Center, but it was not demonstrated in presumed immune competent individuals.[30]

Spiramycin has been used for treatment of cryptosporidiosis with some success. Paromomycin sulfate (Humatin) appears to be a good drug of promise; confirming experiments in calves validate its eficacy.[12] Supportive therapy is a basic and necessary intervention. Discontinuation of immune suppressive chemotherapy, permitting restoration of immune functions, resulted in the complete resolution of intestinal cryptosporidiosis in several patients.[9] Ultraviolet radiation appears to affect disinfection of drinking water enriched with known numbers of *C. parvum*.[23]

Balantidium coli (a ciliated protozoan), *photo on previous page*, was the only other unicellular organism found. It was diagnosed in two adult females and one male, one of whom suffered chronic fatigue syndrome. The parasite inhabits the large intestine and is transmitted via food and water contaminated with pig, and occasionally monkey, feces. Person to person transmission usually involves food handlers. Infection is rather rare in humans but may reach 100% in pigs where it is nonpathogenic.

Infections with *B. coli* are usually asymptomatic and self-limited. Symptoms in overt cases include colitis, diarrhea, and mucosal ulceration which may extend to the liver causing secondary balantidiosis. Secondary bacterial infections superimposed on mucosal ulcerations have been reported. Occasional *B. coli* may be transported by the blood into the spinal fluid.[25]

Treatment of balantidiosis consists of the oral administration of oxytetracycline., iodoquinol, diidohydroxyquin, or metronidazole.[2,25] Prevention and control are generally similar to those used for amebiasis.

Part II will address Helminth Parasites.

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