



The Carousel Network

**Chronic Neuroimmune Disease  
Information and Support for Sonoma County**  
122 Calistoga Road, #216  
Santa Rosa, CA 95409  
[www.cndsinfo.net](http://www.cndsinfo.net)

## **“Leaky Gut Syndrome” Intestinal Permeability**

A number of factors can damage the gut lining or otherwise inhibit the gut from doing its job, leading to malabsorption of nutrients as well as leaking particles through the gut lining where they cause inflammation, food sensitivities, and more.

*The Carousel Network (TCN) offers information on the various diseases and disorders associated with chronic neuroimmune diseases, such as chronic fatigue syndrome, fibromyalgia, multiple chemical sensitivity, autoimmune thyroid disease, etc. The information is intended to help patients and caregivers make informed decisions about the patient's health, diagnostic testing, and treatment in conjunction with their health care practitioners. TCN does not diagnose patients nor recommend specific medical or palliative treatments.*

**The Carousel Network is a 501(c)3 nonprofit supported by memberships and donations.  
Membership is \$20/year; make checks payable to The Carousel Network, POB 366, Fulton CA 95439-0366.**

M-4 / Rev. 09/04

# Intestinal Permeability

Simon Martin

First published in *BioMed Newsletter*, Issue No. 11, May 1995

[www.cordis.lu/biomed/src/newslet.htm](http://www.cordis.lu/biomed/src/newslet.htm)

Intestinal permeability, or 'leaky gut syndrome' is receiving increasing attention as the hard-to-deal factor in patients being treated for food intolerances. Hyperpermeability is also associated with Coeliac disease, alcoholism, Crohn's disease, atopic eczema, chronic giardiasis and intestinal candidosis. It has long been known that fibre in the diet is important for the maintenance of a healthy gut, but research shows that not all types of fibre have equally beneficial effects. In looking to repair the damaged intestine, an important new item can now be added to the standard prescription of anti-fungals, probiotics and butyrates. This is FOS, or fructo-oligo-saccharide.

## The Cycle of Inflammation

Leaky gut syndrome has been theoretically suspected as a major factor in a wide range of food and chemical sensitivities, arthritis, asthma, headaches, digestive problems of varying seriousness and chronic fatigue. It was quickly linked to many of the problems experienced in patients with severe *Candida albicans* overgrowths, since it was known that *Candida*, in its fungal form, can put down 'roots' into the gut wall, allowing comparatively large molecules to pass through into the bloodstream. Whether these are food molecules, bacteria or chemical toxins, the result would be the same: an immune response by the body, an attack by antibodies and the start of a cycle of immune response, inflammation and antibody-antigen reactions. Intestinal permeability is now respectable, thanks to the comparatively recent development of a urine-based diagnostic test.

One laboratory, Diagnos-Tech, uses two molecular markers - the sugars lactulose and mannitol. Based on recovery of these markers after a simple urine collection, Diagnos-Tech's data can allow permeability to be assessed independently of kidney or liver function, or intestinal transit time. The test shows intestinal absorptive capacity and how the mucosal intestinal lining is functioning. "This allows early detection of mucosal changes in the subclinical stage that precedes patho-histological changes," says Diagnos-Tech. The most common factors causing hyperpermeability to the marker sugars appear to be by defects in the mucosal barrier, particularly between cell walls, and by inflammation following exposure to allergens or sensitising agents.

According to Diagnos-Tech, "The hyperpermeability state encourages permeation of lipid insoluble macromolecules, polypeptides, polysaccharides, and haptens (incomplete antigens) from dietary or microbial origin. This may occur in food sensitivity conditions, or with intestinal Candidosis where yeast fragments are absorbed intact leading to detectable circulating *Candida* antigens."

Depending on the state of the owner's gut and on the precise type of the liberated molecules, the symptoms that result can range from local inflammation and smooth muscle spasm (as in asthma and irritable bowel syndrome) to systemic problems. Gut permeability and/ or intestinal derangement have now clinically been demonstrated and reported in standard medical literature in several conditions. These include:

- Coeliac disease
- Alcoholism
- Crohn's disease
- Food allergies
- Atopic eczema
- Chronic giardiasis
- Chronic intestinal candidosis

## New Disease of Civilization

The leaky gut syndrome is prevalent because of the 21st century lifestyle, says New York MD Dr Sherry Rogers, "and it can lead to the development of any number of symptoms and diseases. Unfortunately it is rarely looked for." In a review article for the *Townsend Letter for Doctors* (February/March 1995), Dr Rogers gives seven results of the preliminary inflammation of the gut.

1. The gut does not properly absorb nutrients, leading to fatigue and bloating.

2. The absorption of large food particles creates new food sensitivities and new symptoms with potential new targets for the storage of antigen antibody complexes such as in the lungs (asthma) or the joints (arthritis).
3. Damage to the proteins whose job it is to carry minerals across the gut wall, causing potentially, multiple nutrient deficiencies.
4. Damage to or breaching of the gut wall's detoxification capability, leading to new chemical sensitivities and potential overload of the liver.
5. Interference to the gut's protective coating of immunoglobulins, resulting in decreased defence against bacteria, protozoa, viruses and yeasts.
6. Spread of infection due to the 'escape' of bacteria and yeast from the intestine.
7. Formation of auto-antibodies due to leaking of body tissue look-alike antigens: with the possibility of rheumatoid arthritis, lupus, multiple sclerosis etc have their genesis this way.

As Dr Rogers has said, the 21st century lifestyle has predisposed many of our patients towards the development of leaky gut syndrome. If the cause is inflammation, then we have to suspect the existence of leaky gut in patients with suspicious ecological dietary or drug profiles. In ecological terms, we are referring to the ecology of the colon and its resident bacteria - an estimated 400 different bacterial species so numerous that they outnumber the amount of tissue cells. Any sign of abnormal flora suggests an imbalance that could be causing inflammation: whether this is candida, parasites or food poisoning organisms such as giardia.

Dietary factors ringing alarm bells include a long-term eating pattern high in sugars such as those in refined foods and a regular intake of caffeine, the so-called "soft drinks" and alcohol. Some individuals may also end up with inflammation by following practices they think are health-promoting such as the regular intake of concentrated "fresh" fruit juices, while others may suffer from food additives or unsuspected sensitivities to the common allergens such as wheat and the lactose in dairy products.

There is a case for treating anyone with known food or chemical sensitivities as if they have leaky gut syndrome. On the drug front, it is by now axiomatic among many practitioners that any patients who have been treated with antibiotics will have unbalanced intestinal flora, whether or not they are yet exhibiting the symptoms. One result of the therapeutic destruction of the helpful bacteria along with the harmful, is that the potentially pathogenic bacteria flourish and, by doing so, can directly cause inflammation of the gut wall.

Another class of drugs suspected of causing gut inflammation is the ironically titled "anti-inflammatories", NSAIDs, or non-steroidal anti-inflammatory drugs. Used in cases of chronic back pain, osteo and rheumatoid arthritis, for migraine, gout, dysmenorrhoea and in premenstrual syndrome, these drugs are fast becoming ubiquitous pain-relievers. Unfortunately, many NSAIDs are non-prescription drugs freely available over the counter, and as well as aspirin, they have recently been joined by the more powerful and heavily advertised ibuprofen-based products. Irritation of the stomach and/or the intestine is a standard effect of NSAIDs - while relieving the symptoms of inflammation elsewhere in the body, *they directly contribute to leaky gut syndrome as they interfere with prostaglandin production*, so affecting the gastrointestinal mucus and leading to acid and enzymatic attacks on the gut wall.

### **A new healing factor**

While treatment of leaky gut syndrome must concentrate on removing the root causes, on re-establishing internal ecology with antifungals and probiotics, it is obviously essential that something is done to encourage the gut wall to heal. The role of butyrates has already been established. DGL - glycyrrizinated licorice extracts - and the sulphur-derived "vitamin U" (Cabagin) can also be used, and there is now an additional factor that can work from within. As a specific food for health-enhancing intestinal bacteria, it encourages the proliferation of active endogenous bacteria and leads to the formation of butyrate on site. FructoOligoSaccharide (FOS) is a natural food substance with the properties of a natural fibre. It occurs in fruits and vegetables.

The FructoOligoSaccharide (FOS) group of compounds is particularly rich in plants such as Jerusalem artichokes and dandelions. Like other forms of fibre, FOS passes through the stomach and small intestine largely undigested. However, unlike other fibre supplements, FOS is an essential growth factor for beneficial intestinal bacteria. Once in the colon, FOS is selectively hydrolysed and fermented by

bifidobacteria to produce acetate and L(+) lactate. The lactate is then further metabolised by other bacteria to produce butyrate and propionate. According to BioMed review by Dr Torben Neesby (Feb 1990), research suggests that the production of butyrate in the colon could be essential for a healthy and functioning colonic mucosa.

In two reports published in 1981, one group of researchers showed that in patients with ulcerative colitis, their colonic mucosa were not able to absorb butyrate at the same rate as those in healthy people, while the other researchers suggested that low production of butyric acid in the colon might be a causative factor in the onset of colitis in susceptible people. Although FOS tastes sweet it does not encourage the growth of yeasts. Its natural sweetness makes it a welcome addition to strict anti-candida diets, for example, and as a result scientists are looking at ways to incorporate it into nutrient-fortified 'functional foods'.

## **Diet**

The diet for healing a leaky gut should be derived from foods that are well tolerated by the individual. Any known allergenic foods should be avoided in the initial stages, especially wheat, rye, barley, rice, rice syrup, soya, oats, bran, sugar and alcohol. Highly spiced foods should be excluded from the diet: chillies, curries, vinegar, pepper, mustard and any other irritant to the mucus membranes that exacerbates inflammation. Many herbs recommended for intestinal health, such as cayenne, pau d'arco and sometimes even goldenseal can actually aggravate inflamed membranes lining the gut. The diet is best based upon fresh fruits and vegetables, low in animal fats and red meats. Use oily fish, chicken and other sea foods as a source of animal protein. Vegetables high in soft fibre such as carrots, beetroot, broccoli and swede are useful as well as apricots, bananas, paw paw, pears, cherries and mangoes. Drink filtered and bottled water, and herbal tea as a substitute for coffee, ordinary tea and drinking chocolate.

## **Dietary supplements**

Dietary supplements can be used to increase the healing process of the intestinal membranes along with the necessary changes in diet. Specific nutrients are known to exert a positive physiological effect upon the intestinal membranes. Nutrients such as those mentioned previously like FOS, butyric acid (as serine butyrate). Vitamin U and DGL licorice extracts are helpful. Other factors such as N.A.G. (N-Acetyl Glucosamine), Zinc ascorbate, magnesium ascorbate and vitamin A have a direct role in helping to heal the intestinal membranes. Supplementing with GLA has an anti-inflammatory action which aids the activity of the other nutrients. Acidophilus, Bifido bacteria and *L. casei* are microorganisms that can help in the overall health of the intestinal tract and increase the production of essential 'on-site' nutrients which are required by the mucosal barrier.

## **Time to heal**

The time it takes for the gut to repair itself and establish normal function is variable from one individual to the next. Some practitioners, however, feel that a minimum of three months is necessary for healing to take place effectively. Dr Elias Ilyia, Laboratory director of Diagnos-Tech Laboratories believes that all the essential factors necessary to manage gut permeability (leaky gut) are already available to the practitioner. Dr Ilyia has performed numerous assays for physicians to determine the presence of leaky gut and over the past ten years has found the condition to be on the increase. He reasons this increase to be predominantly associated with environmental and dietary factors. He has, however, actually seen cases of leaky gut made worse by some treatments and natural products that are marketed as 'wonder products' for the gastrointestinal tract. Aloe vera, for example, is a bitter herb that can gripe sensitive inflamed tissues when taken as a concentrated liquid. This he sees as an unfortunate experience as it detracts from a serious subject and further helps increase the skepticism of nutritional medicine by orthodox medicine.

## **Summary**

Gut permeability can be classified as a proven medical condition, for which a clinical test now exists. Leaky Gut Syndrome can be a major factor in a wide variety of disease conditions ranging from auto-immune diseases to chemical and food sensitivities, irritable bowel and digestive disorders. FOS is the fibre of choice in leaky gut syndrome. It is a growth food source for Bifido bacterium which is not available to fungi such as candida albicans or other yeasts organisms in the gut. Other adjunctive supplements are: Serine butyrate, DGL licorice extract, N.A.G., Zinc ascorbate, Magnesium ascorbate, Vitamin A and GLA. Careful selection of food groups is essential during the healing process.

Leaky gut syndrome is an increasing problem due to '21st Century Diet' and the use of commonly prescribed drugs such as antibiotics and NSAIDs.

## References:

1. Castro GA, Arntzen CJ. Immunophysiology of the gut: a research frontier for integrative studies of the common mucosal immune system. *Am J Physiol*; 265 (Gastrointest Liver Physiol. 28):G599-610, 2. Castro GA Immunophysiology of Enteric Parasiticism. *Parasitology Today* 1989;5- 1: 11-19.
3. Zhang ZJ et al. Suppression of diabetes in nonobese diabetic mice by oral administration of porcine insulin. *Proc Nat Acad Sci USA* 1991;88:10252-6
4. Weiner HL, Mackin GA, Matsui M, et al. Double-blind trial of oral tolerization with myelin antigens in multiple sclerosis. *Science* 1993;259:132-4
5. Ciprandi G et al. Pharmacological treatment of Adverse Reactions to Foods: A comparison of different protocols. *Ann Allergy*. 1987;58:341.
6. Howard PJ, heading RC. Epidemiology of gastro-esophageal reflux disease. *World J Surg*
7. Walker-Smith J.A., Ford P.K., Phillips A.D. The Spectrum of Gastrointestinal Allergies To Food. *Ann Allergy* 1984;53:629-636
8. Saavedra-Delgado A.M., Metcalfe D.D. Interactions Between Food Antigens and the Immune System in the Pathogenesis of Gastrointestinal Diseases. *Ann Allergy* 1985;55:694-700.
9. Ciprandi G., Canonica, G.W. Incidence of digestive diseases in patients with adverse reactions to foods. *Annals of Allergy* 1988;61:334-336.
10. MacDonald T.T., Spencer J. Evidence that Activated Mucosal T Cells Play a Role in the Pathogenesis of Enteropathy in Human Small Intestine *J. Exp. Med.* 1988;167:1341-1349
11. Jenkins HR, Pincott JR, Soothill JF, Milla PJ, Harries JT. Food allergy: the major cause of infantile colitis. *Arch Dis. Chil.* 1984;59:326-329
12. Moon A, Kleinman RE. Allergic gastroenteropathy in children. *Ann Allergy* 1995;74:5-15
13. Hill Sm, Milla PJ. Colitis caused by food allergy in infants. *Arch Disease in Childhood*.1990; 65:132-140
14. Hill Sm, Phillips AD, Mearns M, Walker-Smith JA. Cow's milk sensitive enteropathy in cystic fibrosis. *Arch Disease in Childhood*. 1989;64:1251-1255
15. Lothe L, Lindberg T. Jakobsson I. Cows milk formula as a cause of infantile colic: A double-blind crossover study. *Pediatrics* 1983;71:268-271
16. Harmatz PR, Bloch KJ. Transfer of dietary protein in breast milk. *Ann Allergy* 1988;61-2:21-24 17. Jakobsson I, Lindberg T. Cow's milk proteins cause infantile colic in breast-fed infants: a double-blind crossover study. *Pediatric* 1983;71:286
18. Lynn RB, Friedman LS. Irritable Bowel Syndrome. *N. ENG. J Med* 1993;329:1940-5
19. Brostoff J. Irritable Bowel Syndrome. *N Engl J Med* 1994; May 12:1390
20. Jones A.V., McLaughlin P. Shorhouse M. et al. Food intolerance: a major factor in the pathogenesis of irritable bowel syndrome. *Lancet* 1982;2:1115
21. Jones AI, Shorhouse M., Workman E. et al. Food intolerance and irritable bowel. *Lancet*
22. Nanda R. et al: Food Intolerance and the irritable bowel syndrome. *Gut* 1989;30:1099-104.
23. Pagnellii R. et al Intestinal Permeability in irritable bowel syndrome... *Annals of Allergy* 64; 377-380
24. Iacono G. Et al Chronic Constipation as a Symptom of Cow milk Allergy. *Jour Pediatrics*
25. Gardner MLG. Evidence for, and Implications of, Passage of Intact Peptides Across the Intestinal Mucosa. 1983 *Biochem. Soc Trans* 11; 813.
26. Reinhardt M.C. Macromolecular Absorption of Food Antigens in Health and Disease. 1984 *Ann Allergy*.53:597-601.
27. McNeish, A.S. Enzymatic Maturation of the Gastrointestinal Tract and its Relevance to Food Allergy and Intolerance in Infancy. 1984 *Ann Allergy* 53: 643.
28. Bienstock J. Mucosal barrier functions. 1984 *Nutr reviews* 42:3 105-116.
29. Coombs RRA, McLaughlan P. *Ann Allergy* 1984;53:592.
30. Yates VM, Watkinson G, Kelman A. Further evidence for an association between psoriasis, Crohn's disease and ulcerative colitis. *Br. J Dermat* 1982;106:323-330
31. Gardner ML Absorption of intact proteins and peptides. *Biol Rev* 1984;59:289-331
32. Gardner M.L. Gastrintestinal Absorption of Intact Proteins 1988 *Ann Rev. Nutrition* 8:329
33. Walker W.A. Pathophysiology of intestinal uptake and absorption of antigens in food allergy. *Ann Allergy* 1987;59,II:7-16
34. Kleiman RE, Bloch KJ, Wlaker WA: Gut induced anaphylaxis and update of a bystander protein: an amplification of anaphylactic sensitivity. *Pediatr Res* 1981:15:598
35. Schrandner JP, Dellevoet MD, Arends JW, et al. Small Intestinal mucosa IgE plasma cells and specific anti-cow milk IgE in children with cow milk protein intolerance. *Ann Allergy* 1993; 70:404 36. Castro GA, Powell D.W. The Physiology of the Mucosal Immune System and the Immune-Mediated Responses in the Gastrointestinal Tract. *Physiology of the Gastrointestinal Tract* . Ed. Johnson R. 1994: 709-750 Raven Press NY.
37. Van Der Meer, S.B., et al. Small Bowel Permeability to Cr-EDTA in Children With Recurrent Abdominal Pain. *ACTA Pediatr. Scand.*, 1990;422-426.

38. Bjarnson I, Williams P, So A. et al Intestinal Permeability and inflammation in patients with Rheumatoid Arthritis; effects of non-steroidal anti-inflammatory drugs. *Lancet* 1984;ii:711-4
39. Bjarnson I, Zanelli G, Smith T et al. Non-steroidal anti-inflammatory drugs induced inflammation in humans. *Gastroenterology* 1987;93:480-9
40. Draper LR, Gyure LA, Hall JG, Robertson D. Effect of alcohol on the integrity of the intestinal epithelium. *Gut* 1983;24:399-404
41. Bjarnson I, Ward K, Peters TJ. The leaky gut of alcoholism. Possible route for entry of toxic compounds. *Lancet* 1984;:179-82
42. Peters TJ, Bjarnson I. Uses and abuses of intestinal permeability measurements. *Can J Gastroenterol*
43. Unsworth DJ, et al IgA anti-gliadin antibodies in Celiac disease. *Clin Exp Immunol.* 1981:
44. Keiffer M, et al Wheat gliadin fractions and other cereal antigens reactive with antibodies in the sera of celiac patients. *Clin Exp Immunol.* 1982;50:651-60
45. Kelly CP Case records of the Mass General Hosp 30-1994 *NEJM* 1994;331-6:383-9.
46. Ciclitira PJ, et al Secretion of gliadin antibody by coeliac jejunal mucosal biopies cultured in vitro. *Clin exp. Immunol.*1986;64:119-24
47. O'Farrelly C. et al alpha-Gliadin antibody levels: a serological test for coeliac disease. *Br. med Jour*
48. Bjarnson I, Peters TJ A Persistent Defect in Intestinal permeability in Co on the integrity of the intestinal epithelium. *Gut* 1983;24:399-404
49. Bjarnson I, Ward K, Peters TJ. The leaky gut of alcoholism. Possible route for entry of toxic compounds. *Lancet* 1984;:179-82
50. Peters TJ, Bjarnson I. Uses and abuses of intestinal permeability measurements. *Can J Gastroenterol*
51. Unsworth DJ, et al IgA anti-gliadin antibodies in Celiac disease. *Clin Exp Immunol.* 1981:
52. Keiffer M, et al Wheat gliadin fractions and other cereal antigens reactive with antibodies in the sera of celiac patients. *Clin Exp Immunol.* 1982;50:651-60
53. Ciclitira PJ, et al Secretion of gliadin antibody by coeliac jejunal mucosal biopies cultured in vitro. *Clin exp. Immunol.*1986;64:119-24
54. O'Farrelly C. et al alpha-Gliadin antibody levels: a serological test for coeliac disease. *Br. med Jour*
55. Bjarnson I, Peters TJ A Persistent Defect in Intestinal permeability in Coeliac Disease demonstrated by a 51Cr EDTA absorption test. *Lancet* Feb 12 1983:323-325
56. Mulder CJJ, Tygat GNJ. Celiac disease and related disorders. *Netherlands Jour Med*
57. Homes GKT, Prior P, Lane MR, Pope D, Allan RN. Malignancy in celiac disease -effect of a gluten-free diet. *Gut* 1989;30:333-8.
58. Braegger C.P., MacDonald T.T. Immune mechanisms in chronic inflammatory bowel disease. *Ann Allergy* 1994;72:135-141
59. Voigt AJ, Echave V, Feller JH, et al. Experience with elemental diet in the treatment of inflammatory bowel disease. Is this primary therapy? *Arch Surg* 1973;107:329-33
60. Rocchio MA et al Use of Chemically Defined diets in the Management of Patients With Acute Inflammatory Bowel Disease. *Am Jour Surg.*1974;127:469-475
61. O'Morain C, Segal AW, Levi AJ et al Elemental diet as a primary treatment of acute Crohn's Disease; a controlled trial. *Br. Med J* 1984;288:1859-62
62. Morin CI et al Continuous elemental enteral alimentation in the treatment of children and adolescents with Crohn's disease. *J Parent Nutr* 1982;6:194-199
63. Saverymuttu S, Hodgson HJF, Chadwick VS. Controlled trial comparing prednisolone with an antibiotic in active Crohn's disease. *Gut* 1984;26:994-998
64. Teahon K., Bjarnason I., Pearson A.J., Levi A.J. Ten years experience with an elemental diet in the management of Crohn's disease. *Gut*,1990,31;1133-1137
65. Frieri et al. Preliminary investigation on humoral and cellular immune responses to selected food proteins in patients with Crohn's
66. Knicker W. Non-IgE Mediated and Delayed Adverse reactions to Food or Additives. *Handbook on Food Allergies*, Ed Breneman J.C.; Marcel Dekker Inc. N.Y. 1985.
67. Rowe, A.J. Allergic toxemia and migraine due to food allergy. *Calif West Med*, 33:785,1930.
68. Randolph T.G. Allergy as a Causative factor in fatigue, irritability, and behavior problems in children. *Pediat*, 31:560,1947.
69. Speer, F. The allergic-tension-fatigue syndrome. *Pediat Clin N. Amer*, 1:1019,1954.
70. The allergic-tension-fatigue syndrome: *Allergy of the Nervous System*. Charles C. Thomas Pub.
71. Landay AL., Jessop C., Lennette ET., Levy JA. Chronic fatigue syndorme: clinical condition associated with immune activation. *Lancet*;338(1991): 707-711.
72. Gupta, S. Vayuegula, B. A Comprehensive Immunological Analysis in Chronic Fatigue Syndrome. *Scand J. Immunol* 33,319-327 1991.
73. Strauss S.E., Dale J.K., Wright RN, Metcalfe D.; Allergy and the chronic fatigue syndrome. *J. Allergy Clin Immunol*;81:5,1; 791-795;1988.
74. Strauss S. History of the Chronic Fatigue Syndrome *Reviews of Inf. Disease* 13: sup 1; Jan-Feb '91
75. Bak P., Kan C., Self-Organized Criticality. *Sc American* Jan '91;46-53.