

NDS

Nutrient Delivery System

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Leaky gut Unwelcome Breakdown of the Intestinal Barrier



*Leaky gut—what is it,
what are its consequences,
what factors can cause it, and
how can it be treated?*

What is leaky gut?

Our digestive tract is a long, winding tube going from mouth to bottom. The length of the digestive tract in an adult human is close to 8 metres. The small intestine is approx. 6.5 m long, and the large intestine adds additional 1.5 m. Their surface area is just about the size of a football pitch. It is in this tube that we put food, beverages, medicine, supplements, and where environmental factors that accompany such intake follow.

The digestive processes that take place in the mouth, stomach, small and large intestine break down nutrients into smaller and smaller constituent parts, until they can finally be absorbed, or detoxified and excreted. Depending on the amount of fibre in our diet, the process normally takes between 1 and 3 days. It is hard to imagine that the barrier that prevents the contents of our bowels from spilling into our body is a membrane that is just as thin as the eye membrane. The barrier of the gut consists of a single layer of closely-packed cells and a mucous membrane containing a number of immunoprotective substances.

Over 70 % of our immune defences are located in and around our gut system. Whatever food and microorganisms are in the gut are 'outside' us. The contents of our gut do not 'enter' us until we absorb them through this single layer of cells. The gut's microorganisms, referred to as microbiota, and the gut's immune defences, comprised of sIgA, B and T lymphocytes, etc. can be compared to doorkeepers that decide who has the right ID card and can be allowed in and who should be denied access.

Approx. 85% of the nutrients we ingest are absorbed in the upper part of the small intestine. This sorting process relies on the cells of the gut being intact and closely-packed, with the spaces between them sealed by protein compounds, referred to as tight junctions. When we absorb fully-digested nutrients, this takes place through the control arrangements of the cells of the gut (transcellularly). The idea is that we should be able to absorb small, fully-digested nutrients. Healthy gut cells in the small intestine have many protuberances, called microvilli, whose purpose is to provide the digestive system with a very large surface that allows us to absorb fully-digested nutrients.

If we have leaky gut, then the barrier functions of the gut are degraded. Leaky gut can also be referred to as intestinal permeability or leaky intestine. There are many names used to designate the same problem. People with leaky gut can also absorb large indigestible and harmful substances from the gut. This activates the immune system.



Normal intestinal mucous membrane with tight junctions

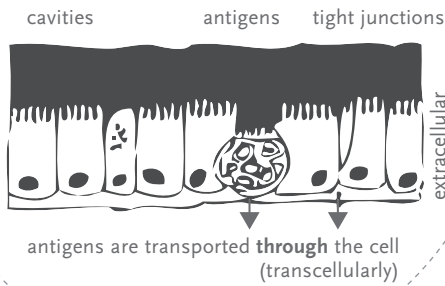
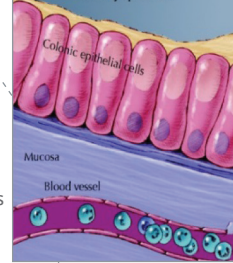


Illustration of a complete and healthy intestinal mucous membrane with intact intestinal cells with microvilli, intact tight junctions and immune protection. Dietary nutrients are absorbed between the cells' protective functions. This is called transcellular absorption.

Leaky gut

results in greater absorption of food that is not fully digested, toxins as well as undesirable microorganisms and their metabolites.

This causes inflammation, food allergies and autoimmune diseases.

This also affects our nervous system and our mental state.

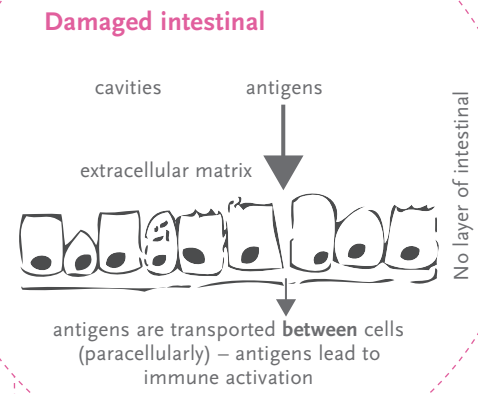
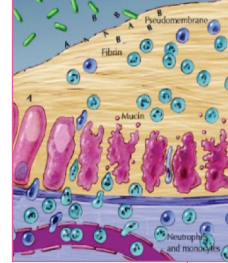


Illustration of a damaged intestinal mucous membrane with intestinal cells with damaged microvilli, decomposed tight junctions and impaired immune protection. Here, the nutrients from food are absorbed between the cells' protective functions. This is called paracellular absorption.

What are the consequences of leaky gut?

When you have leaky gut, your bowel loses its healthy sorting function, the ingredients in the intestine are absorbed into the space between the intestinal cells (paracellularly), which permits food that is not fully digested, toxins and undesirable microorganisms and their metabolites to penetrate into our system. This causes inflammation, food allergies and autoimmune diseases. Our immune system is primed to react to anything that gains unauthorised access to our body, in much the same way as when a virus slips through our mucous membranes.

Any damage to the intestinal cells causes inflammation, not only locally in the intestine, but throughout our bodies. Inflammation leads to pain, warmth, redness, swelling and reduced mobility of affected tissues.

Examples of inflammatory conditions include the sequelae of injuries after falls, sprains or surgeries, the symptoms experienced after getting a burn, menstrual pain or pain caused by excessive exercise. Chronic inflammatory disorders include, among other things, rheumatoid arthritis, inflammatory bowel diseases, eczema, psoriasis and myalgia.

Examples of allergic reactions include allergy to bee stings, pollen or hazelnuts, asthma and allergic eczema, delayed allergic reactions to food, e.g., to dairy products or other food groups.

Autoimmune disorders include, among other things, rheumatoid arthritis (RA), psoriasis, myasthenia gravis (MG), Crohn's disease (CD), multiple sclerosis (MS) and insulin-dependent type 1 diabetes.

An ever-increasing number of studies that link the set of leaky gut problems to a host of physical and mental illnesses and imbalances are being published. Our intestine and our nervous system are in constant communication. As a result, any digestive problems we experience also affect our mental state. We are all born with a leaky gut. The small intestine

in a healthy newborn is much more permeable and permits direct absorption of even extremely large molecules. This is of immense importance, as it helps protect infants against infections via the breast milk's immune components until they begin to form immunoglobulins and other protective factors themselves. An infant's intestinal system heals within the first months or first year of life, depending on the physical and mental nourishment received by that infant.

If you search for leaky gut or intestinal permeability on Pub Med, you can find more than 11,600 studies. To find out if you have leaky gut, you can resort to a lactulose-mannitol test or a test that involves the ingestion of 5 different short and long-chain sugars (mono and polysaccharides). This test is referred to as Intestinal Permeability and Absorption (IPA). Both tests are available for purchase via Nordic Laboratories.

What factors can cause leaky gut?

■ **Gluten-containing grains** cause leaky gut in all of us, but some have the ability to self-repair faster than others. The entry of gluten into our intestinal system stimulates the production of zonulin, which causes tight junctions to degrade.

■ **Dysbiosis** is the proliferation of undesirable bacteria, fungi, viruses or parasites, for example, after antibiotic therapy. Dysbiosis causes damage to the tight junctions between the single layer of barrier cells. This layer is the only thing that separates the contents of our bowels from the cardiovascular and lymphatic pathways situated right on the other side of it. Such cells normally determine, using active processes, which nutrients must be given permission to enter (transcellularly) and which must remain in the intestinal cavity. In the event of damage to the tight junctions, toxic substances and bacteria may contaminate the bloodstream by pouring into it through the damaged barrier. After these undesirable substances pass

through the cell layer (paracellularly), they cause an additional increase in intestinal permeability (leaky gut). This leads to a myriad of symptoms and disorders and ultimately results in blood poisoning (sepsis), unless the body's other detoxifying organs are able to neutralise the toxins.

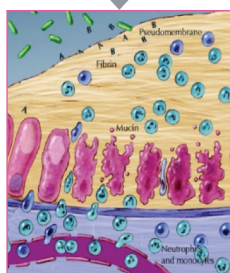
■ **Lipopolysaccharides (LPS)** are endotoxins excreted by gram-negative bacteria (dysbiosis) from, e.g., the intestinal microbiota. Under normal circumstances, only a small amount of LPS penetrate the epithelial tissue of the intestine. Any absorbed endotoxins are usually removed quickly by the monocytes stationed in the liver's Kupffer cells. If the intestinal mucosa is too permeable (perforated bowel/leaky gut), the number of LPS penetrating the intestinal barrier will be too high, which will cause inflammation and will activate the immune system.

■ **A Western diet** high in animal fat and starchy carbohydrates, but low in fibre increases the number of LPS endotoxins in the plasma by 71%.

■ **Physical or mental stress.** Prolonged periods of stress generate cortisol, which changes the quantity and composition of microorganisms in the intestine. It makes the intestinal environment more dysbiotic and causes it to generate more toxins. Moreover, it reduces the production of digestive enzymes, which leads to more dysbiosis and more undigested food left in the intestine. This leads to an intestinal process of either fermentation or rot, which boosts the inflammation and wreaks damage to the intestinal cells and mucosa.

■ **Painkillers,** e.g., acetyl-salicylic acid, paracetamol, ibuprofen and other intestinal irritants, e.g., excessive intake of coffee and alcohol, etc.

Gluten, dysbiosis, LPS, food reactions, painkillers, stress, saturated fat and low fibre intake, reduced or altogether absent sIgA, intestinal irritants, etc.



Inflammation, allergy, food and autoimmune reactions. Our nervous system and mental state are affected, as well.

■ **Food reactions.** Intake of foods, e.g., dairy products, GMO, sugar, etc. causing immune activation in certain individuals.

■ **Reduction in or lack of sIgA** (secretory immunoglobulin A). This is the antibody that should be present in all of our mucous membranes, acting as our first line of defence against the penetration of unwelcome foreign substances.

How can leaky gut be treated?

Such a treatment necessitates the removal of any substances which are not tolerated or which break down the intestinal barrier and the addition of any substances which are required for its repair.

■ **Probiotics,** including bacteria that are especially selected to repair leaky gut, such as, e.g., those in NDS® Probiotic Leaky-G®. Eating fermented food, e.g., lactic acid-fermented cabbage, Kimchi, etc. is recommended, as well.

■ **Type II collagen peptides,** for example, the peptides featured in NDS® Probiotic Leaky-G® as well as slow-cooked bone broth from, e.g., chicken bones. Getting enough proteins in your diet, for example, vegetable protein from beans, lentils and chickpeas and easily digestible fish and poultry protein. If you feel heavy, tired and bloated when you consume protein, you can facilitate your protein digestion with lemon juice, fresh pineapple and papaya prior to eating meals that contain protein. Glutamine, glucosamine, cysteine, glutathione, proline and arginine are amino acids that are essential to collagen formation. These should hopefully be obtained from a protein-rich diet.

■ **Essential fatty acids,** from e.g., flaxseed, fish, fish oil, Vectomega®, NDS® BioGrown® Omega Balance 3, 6, 7 & 9 as well as coconut oil.

■ **Zinc and other antioxidants,** e.g., NDS® BioGrown® Zn+ Zink, a zinc tablet that contains 15 mg of zinc, along with 1.5 mg of beta carotene, 2 mg of vitamin B6, 3 mg of vitamin E and 1 mg of manganese. Blueberries and other brightly coloured berries. All sorts of cabbage. Vegetable soups and smoothies.

■ **Prebiotic fibre.** Digestible and indigestible fibre and polysaccharides from, e.g., whole-grain products, almonds, nuts, seeds, kernels, various vegetables, e.g., onions, Jerusalem artichokes, root vegetables, cabbage, apples, pears, oats, quinoa, brown rice, psyllium husks and legumes. We have gone over from believing that "You are what you eat" to believing that "You are what your bacteria eat". Intake of prebiotic fibre help probiotics multiply. The consumption of saturated fat and animal meat products also needs to be reduced, as it raises the amount of LPS.

PREBIOTIC FIBRE	
Raises:	Reduces:
Insulin sensitivity	Fatty liver (Hepatic Steatosis)
Muscle mass	Blood lipids
Leptin sensitivity	Blood sugar
The intestinal barrier	Adipose tissues
Bifidobacteria	Weight
	Food intake
	Plasma LPS
	Inflammation
	Cancer cell division and development

■ **Butyrate (butyric acid)** is a short-chain fatty acid (SCFA), a metabolic product of bacterial digestion of fibre and an important source of energy for the lower part of the small intestine and the large intestine. This short chain acid can repair and regenerate damaged cells. Consuming sufficient amounts of prebiotic fibre propagates a friendly microbiota that itself produces butyrate/butyric acid.

■ **Getting rid of dysbiosis**, e.g., using NDS® Olive Leaf Extract, garlic, oregano, etc.

■ **Reducing physical or mental stress.**

■ **Slippery elm (NDS® Ulmus Rubra)**, Aloe Vera and flaxseed decoction can also heal leaky gut.

Collagen peptides

Thirty per cent of the proteins in the body are deposited in collagen, which is found as a binding agent in the connective tissue of our skin, cartilage, tendons, muscles, bones, blood vessels and gastrointestinal tract. Connective tissue is the tissue that supports, provides structure and shape. Collagen glues together cells and tissues. Collagen is made up of long polypeptide chains that consist of amino acids such as glycine, glutamine, proline, hydroxyproline and arginine extracted from proteins broken down and absorbed in the course of digestion. Several of these chains wrap around each other like braided ropes, thus creating structure and flexibility in our connective tissue. There are some 28 different types of collagen. However, it is, in particular, type II collagen that is found in our gut, cartilage, joints, bones and our immune system. The collagen peptides contained in NDS® Probiotic Leaky-G® are type II collagens. After the age of 20-29, our own collagen production declines by about 1% per year.

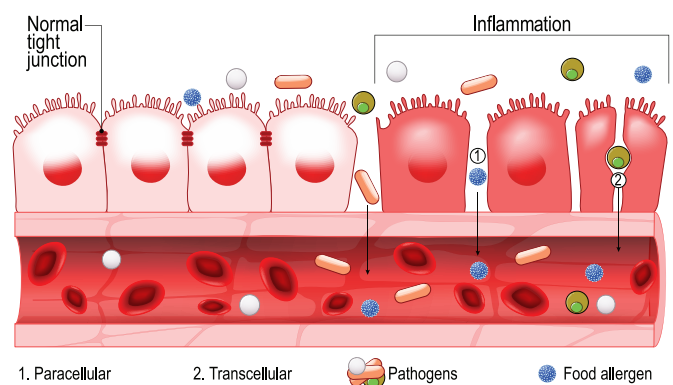
Type I and III collagens (90% of the body's collagen):	Type II collagens:
Skin, hair, nails, muscles, tendons, ligaments, bones, teeth and gums, eyes and blood vessels.	Gut, joints, cartilage, bones and immune system.

Some of the multitude of roles probiotics play in our body are presented below:

- Preserving tight junctions/protecting against leaky gut
- Preserving intestinal barriers
- Digestion and absorption of dietary nutrients, in particular, in the upper part of the small intestine
- Production of vitamin B12, folate, niacin B3 and vitamin K
- Fermentation of non-digestible fibre
- Production of short-chain fatty acids (SCFA), e.g., butyrate, which is an important fuel for both the brain and the intestine, as well as acetate, which is involved in the regulation of appetite
- Metabolism of calories—affects the ability to lose weight
- Primary role in metabolism
- Impacts gene expression (turns our genes on and off)
- Development and regulation of the immune system
- Regulation of cytokines causing inflammation
- Protects against overstimulation of the immune system, e.g., in connection with allergies and autoimmune disorders
- Produces natural antibiotics
- Protects against pathogens by outcompeting undesirable and participating in beneficial ones
- Produces our neurotransmitters, e.g., dopamine, serotonin, GABA and acetylcholine.



Leaky Gut



Probiotics

We have over 10 times as many bacteria in and on us as human cells. Most of them are found in our gastrointestinal tract. These bacteria determine, in cooperation with our immune system, what to react to, what form this reaction should take (allergic or autoimmune) and what should be permitted to approach the barriers on our skin, the mucous membranes in our body and in our intestinal system. The barrier that prevents food and microorganisms in our intestinal system from penetrating into us is an intestinal mucosa that only consists of a single layer of closely-packed cells. Our immune defence is constantly making decisions as to the kind of food and microorganisms in our intestines it should react to, whether such a reaction should take the form of an allergy or autoimmune reaction or whether there should be no reaction whatsoever. Should the immune system choose to react

to the content of our intestine or to anything that comes close to any of our other mucosa, it will always cause an inflammation, characterised by heightened TNF α , IL-1 β and IL-6 levels and high CRP, causing damage to all of our cells.

Inflammation causes redness, warmth, pain, swelling and reduced mobility in the intestinal tissue, as well. The bacteria in NDS® Probiotic Leaky-G® have been developed to reinforce the intestinal barrier function and balance its immune defences, in order to thereby suppress the generation of inflammatory mediators, e.g., TNF α , IL-1 β and IL-6, and reduce high CRP levels. Beneficial microbiota, collagen, essential lipids and antioxidants such as vitamins C and E and zinc also protect against damage from inflammation. A recently published study, involving a 30-day intake of probiotic supplements, showed a 42% reduction in dysbiotic LPS.





The NDS® probiotic range includes these specific multi-strain products:

NDS® Probiotic Panda® 1 & 2 are used in the prevention and treatment of allergies in both children and adults. Also suitable for pregnant or breastfeeding women who are worried that their child may develop an allergy.

NDS® Probiotic Classic® for excess growth of unwanted bacteria, fungi or parasites in the gastrointestinal tract.

NDS® Probiotic I.L.D.® for use in inflammatory gastrointestinal diseases such as Crohn's Disease, Ulcerative colitis and other related diseases.

NDS® Probiolax® for constipation/sluggish bowel in people of all ages (children + 1 y old).

NDS® Probiotic Barrier® for the healing of the intestinal mucosa in many kinds of stress, hypersensitivities, mood disorders, depression.

NDS® Probiotic Performance® for balancing intestinal function in exercise- and sport-related stress/loose stools/diarrhoea, sensitivities with diarrhoea and e.g. medical treatments that provoke diarrhoea.

NDS® Probiotic S-60-Nrg® as an aid in cases of serious stress.

NDS® Probiotic W8-Control® as an aid to balancing the intestinal flora for enhanced metabolic energy and weight loss.

NDS® Probiotic A.A./D® for diarrhoea and other problems caused by treatment with antibiotics. Overgrowth of Clostridium difficile and Pseudomembranous colitis.

NDS® Probiotic Sib-X® in the event of overgrowth of unwanted intestinal flora in the small intestine, often with pain, tightening, cramps and sickness, possible greasy/yellowish excretion.

NDS® SkinActive® reduces the appearance of wrinkles, fine lines and cellulitis. Better skin. Improves protection of the skin against the sun's harmful rays.

NDS® Leaky-G® for inflammation, allergies or autoimmune disease caused by leaky gut, intestinal permeability and leaky intestine.

NDS® OsteoCare® – prevention of osteopaenia and osteoporosis, or for treatment of said bone diseases. For broken bones and predisposition to osteoporosis.

NDS® EZY Move® – prevention and treatment of pain, swelling, tenderness and joint stiffness, as well as osteoarthritis with articular cartilage degradation, and inflamed tissue.

NDS® ProteXimun® – prevention and treatment of loss of muscle mass, along with training. In the event of sickness, ageing and weakening with reduced gripping strength, weak muscle strength generally, reduced walking speed and difficulty in getting up without help.

NDS® PeptinXImun® – strengthens the skin barrier and the extra-cellular matrix between the cells, whereby inflammatory process are regulated, with retention of immunocompetence. Reduces tissue damage in connection with immuno-inflammation and moderates tissue damage.



It is all about biology

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