Welcome

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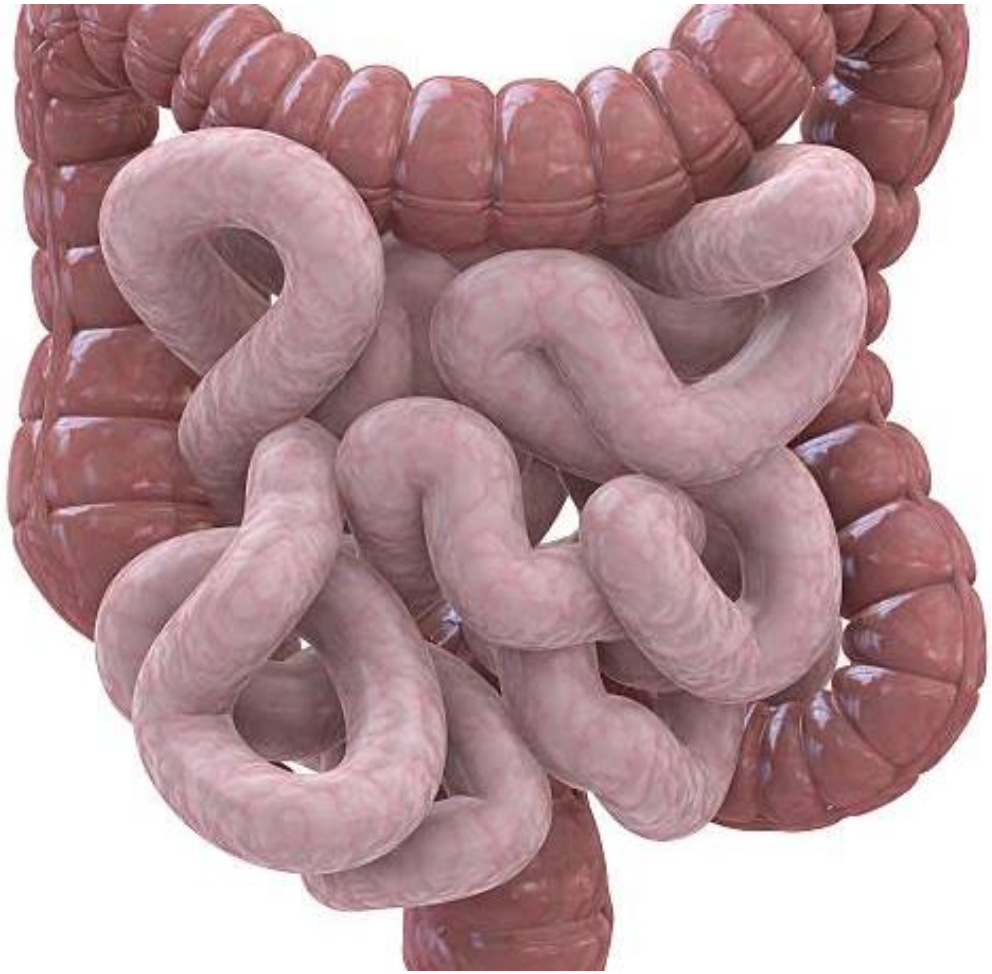
Enzymes and Intestinal Health

Leyla El Moudden



"It's not just what you eat. It's what you digest."

About Enzyme Science UK

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- Strict quality standard adherence for all ingredients in our finished product
- Ingredients are derived from natural sources produced under strict cGMP-controlled environments
- No artificial fillers and binders
- Enzyme Science continually verifies product quality including purity, efficacy, and safety by evaluating products via our on-site laboratory and through accredited third-party facilities

MOTE MARINE LABORATORY
ROSKAMP INSTITUTE
BETTER SCIENCE. REAL DISCOVERY.
RESCUE+FREEDOM PROJECT
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Green Mountain Energy
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SAFE PLACE AND RAPE CRISIS CENTER
Saving Lives Today and Tomorrow
SELAHFREEDOM
Bringing Light into the Darkness of Sex Trafficking

Therapeutic Enzyme Blends

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Pure vegan enzymes are blended to address various conditions

Major categories include enzyme blends focused on:

- Overall Digestive Support / Digestive Health
- Multiple Food Intolerances
  - i.e. Gluten, Lactose, Casein, Phenols, etc.
- Indigestion, Acid Reflux, GERD
- Many non-digestive / Therapeutic uses (away from food)
- Absorption

K PARVE

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Leyla El Moudden
BA, Dip Herb, Dip Nat mANP

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- Director of Education for Enzyme Science & Enzymedica UK
- Naturopath at Surrey Holistic, Godalming
- Metabolic Balance Coach
- Contributing Editor IHCAN

Overview

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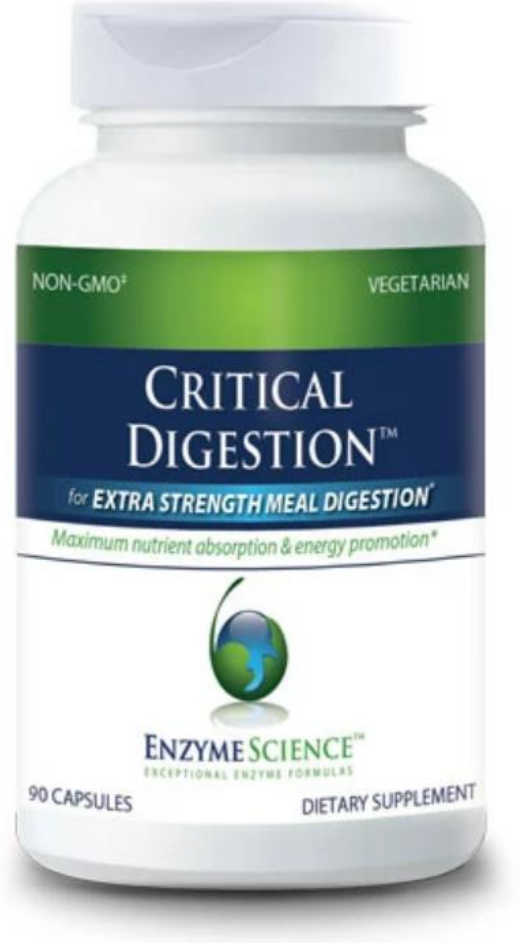
- Food Sensitivity Reactions
- Candida
- SIBO
- LPS
- Leaky Gut
- Microbiome
- Histamine
- Q&A



Rapid impact

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Systemic and Digestive

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- Systemic enzymes enter the bloodstream intact, then travel to tissues and then onto available cells – these are often protease enzymes
- Most enzymes can reach the circulation where their benefits continue
- Protease enzymes trim and prune proteins such as those that contribute to and result from inflammation:
  - Fibrinolytic enzymes
    - Serrapeptase
    - Nattokinase

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Serratiopeptidase, A Serine Protease Anti-Inflammatory, Fibrinolytic, and Mucolytic Drug, Can Be a Useful Adjuvant for Management in COVID-19

Charu Sharma, [1] Niraj Kumar Jha, [2] M. F. Nagoor Meeran, [3] Chandragouda R. Patil, [4] Sameer N. Goyal, [5] and Shreesh Ojha [3,*]

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Introduction

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The COVID-19 pandemic, which is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), is a public health emergency with high mortality and disability rates. Given its high mortality rate, there is a serious need for possible effective medications to eliminate the virus, limit the severity, and improve the prognosis (Altay et al., 2020). The management of COVID-19 has continued to rely on drugs repurposed based on their pharmacological effects, including antiviral, antibiotic, anti-inflammatory, and or immunomodulatory, along with availability of numerous vaccines against SARS-CoV-2 in past few months (Fan et al., 2020). Repurposing of drugs has gained enormous attention over identifying novel drug candidates, due to known safety, potency, and multi-targeted pharmacological action as an immunomodulatory, anti-inflammatory, and antimicrobial agent. Studies report that after fever, cough is one of the major symptoms in about 76% patients and sputum production in 28% patients along with 55 and 44% of patients showing dyspnea and myalgia, respectively (Huang et al., 2020). In a study determined the prevalence of asymptomatic cases of COVID-19 and characterized the symptoms of patients with mild COVID-19 report that of the 213 individuals with COVID-19, 19.2% were asymptomatic until admission (Kim et al., 2020). Among the remaining patients with mild COVID-19, cough (40.1%) was the most common symptom followed by hyposmia (39.5%) and sputum (39.5%). In individuals with hyposmia, 90% had accompanying symptoms such as hypogeusia, nasal congestion or rhinorrhoea (Kim et al., 2020). Sputum or productive cough seem a significant symptom in asymptomatic as well as symptomatic (Kim et al., 2020). Cough was observed most common symptom followed by hyposmia and sputum, while fever (>37.5°C) was only observed in 11.6% (Kim et al., 2020). Another study reported that nasal congestion (62%) was the most common symptom in individuals with mild COVID-19 (Chang et al., 2020).

Digestive Enzymes - Key Objectives

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- The role of digestive enzymes in functional GI disorders, including:
  - GERD, IBS, SIBO, Intestinal Permeability (Leaky Gut), and Malabsorption
- How Digestive Enzymes influence the microbiome
- Understanding Biofilm & how Digestive Enzymes help
- Enzymes as a large part of the solution to multiple health conditions
- Identifying and addressing Enzyme Deficiencies
- The use of Digestive Enzymes for multiple food intolerances
- Practical guidance on selection and dosage of Digestive Enzymes

Adverse reactions

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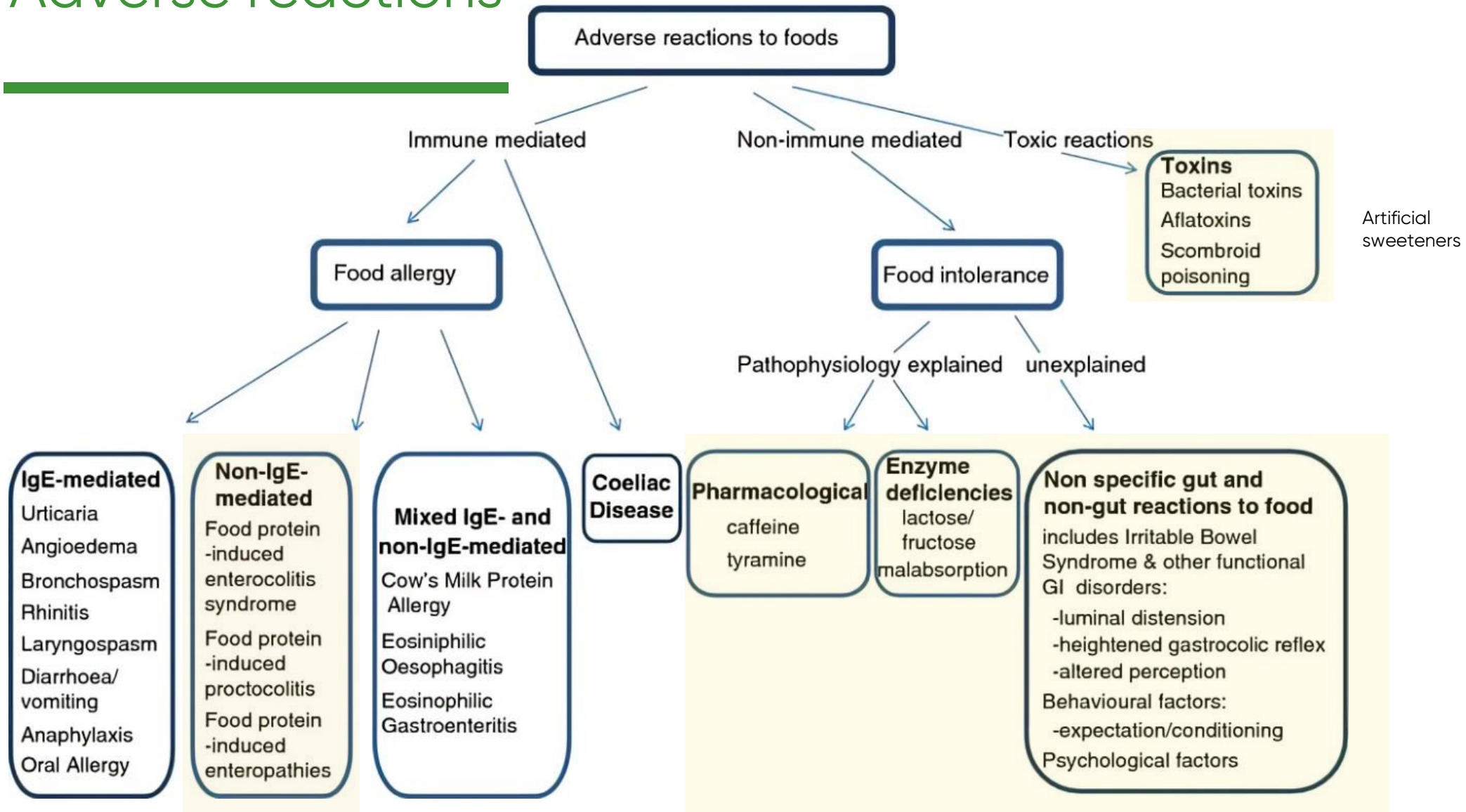

Artificial sweeteners

Foods as structures

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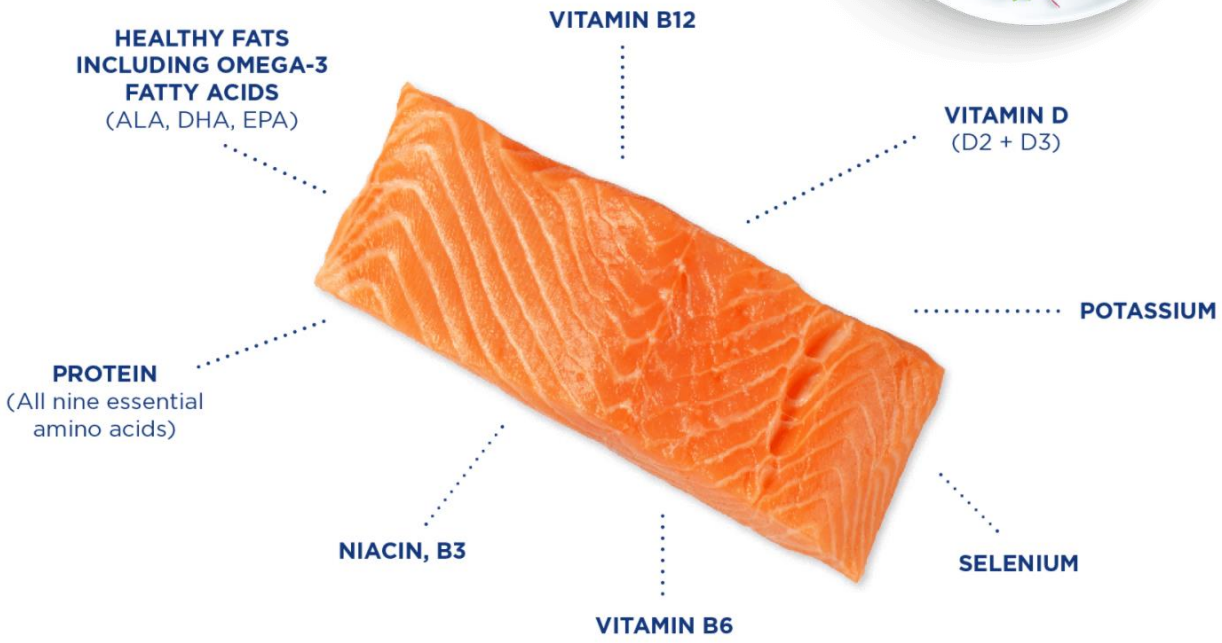
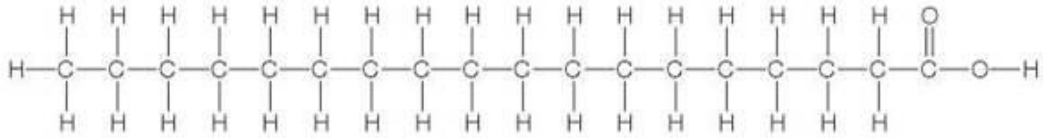
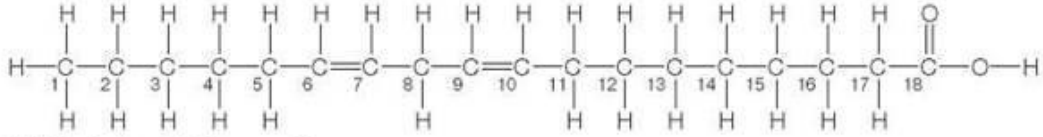
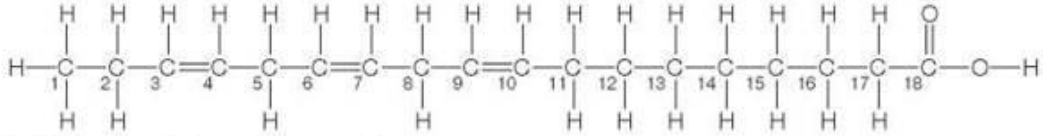




(a) Stearic acid



(b) Linoleic acid (omega-6)



(c) Alpha-linolenic acid (omega-3)

Foods as structures

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- Red meat
- Liver
- Eggs
- Fish
- Dairy
- Fortified plant-based
- Nutritional yeast
- Fortified non-dairy milk and grains

- Mackerel
- Salmon
- Herring
- Oysters
- Chia seeds
- Linseed
- Hemp seeds
- Walnuts

- Fats

- Kelp one
- Rice bran
- Nuts
- Parsnip
- Potato
- Banana
- Leafy green vegetables

- Liver
- Chicken breast
- Tuna
- Turkey
- Salmon

- Anchovies
- Pork
- Ground beef
- Peanuts
- Avocado

- Herring
- Brazil nuts
- Seafoods
- Milk
- Brown rice
- Meats

Enzymes and biological molecules

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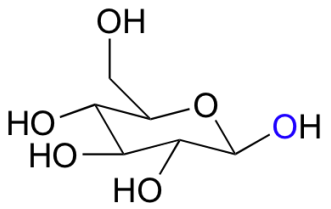
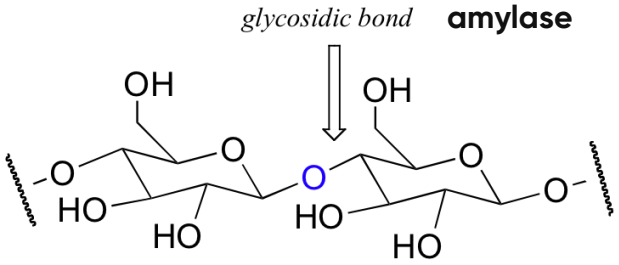
Example Amino Acid Structure:

A-A-A-A-B-B-C-C-A-A-A-A-B-B-C-C



glucose



a glucose-glucose linkage in cellulose

Some enzymes break one type of bond:

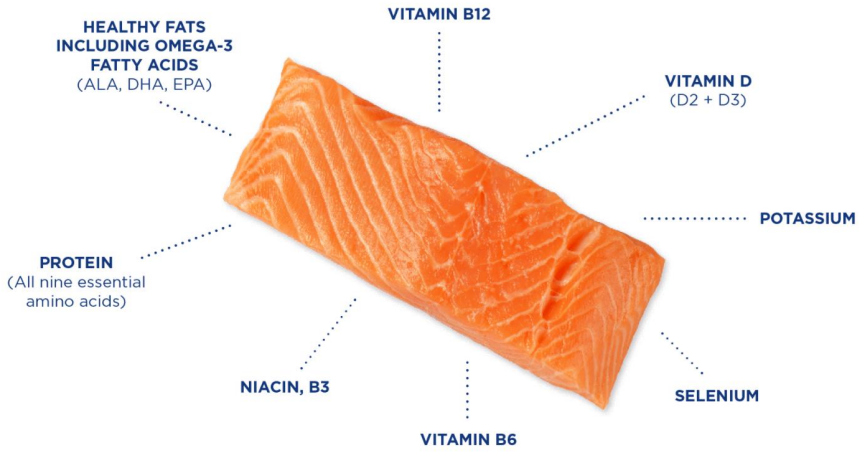
A-A-A-A B-B C-C-A-A-A-A B-B

C-C A-A-A-A B-B C-C -A-A-A-A B-B C-C

Some enzymes breaks duplicate type bonds

A-A-A-A B-B C-C A-A-A-A B-B

C-C A-A–A- A B-B C-C A-A-A-A B -B C- C



Pathogens as structures

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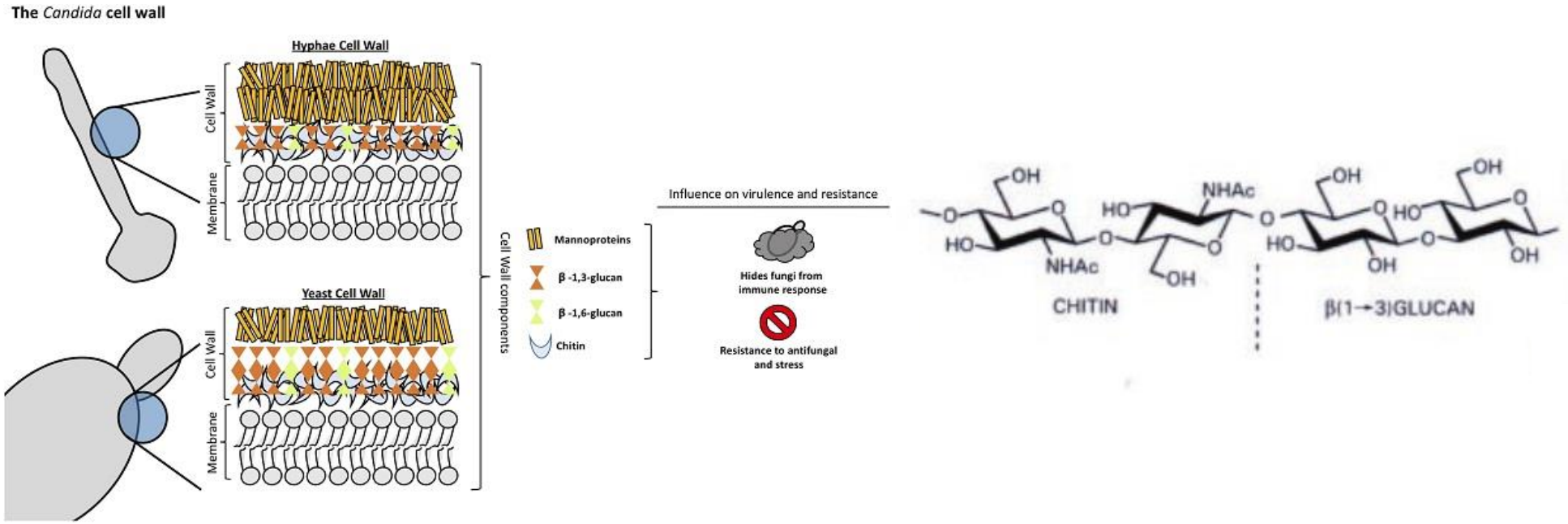
- Candida
- Bacteria
- Biofilms



Quick Recap - Protein

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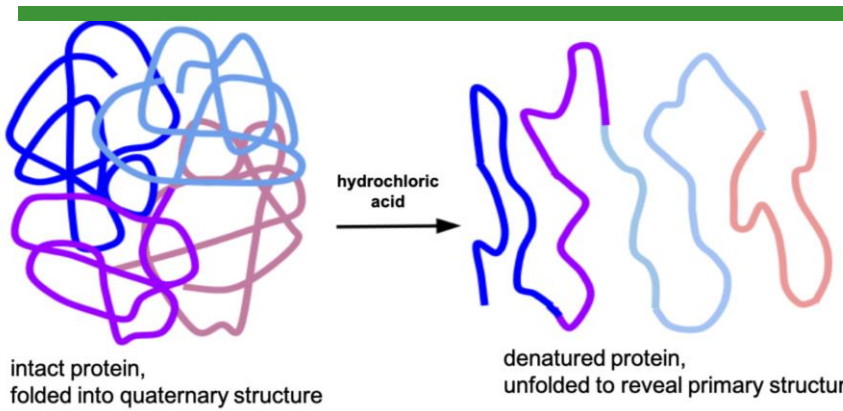

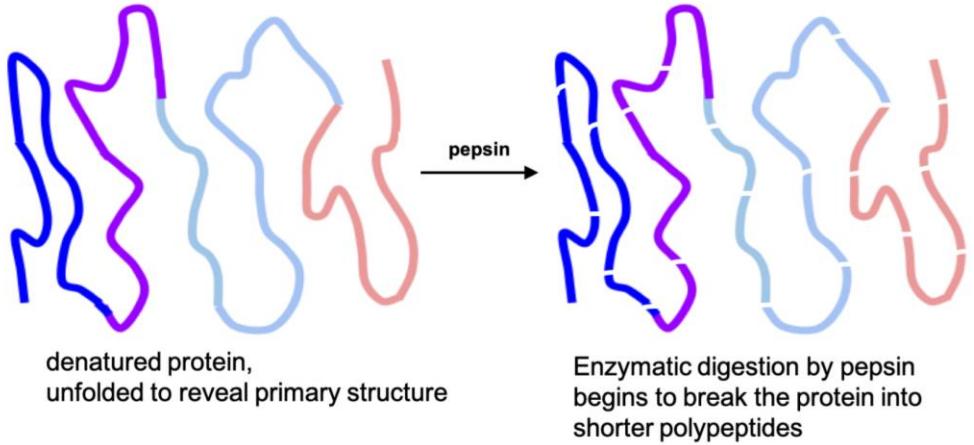

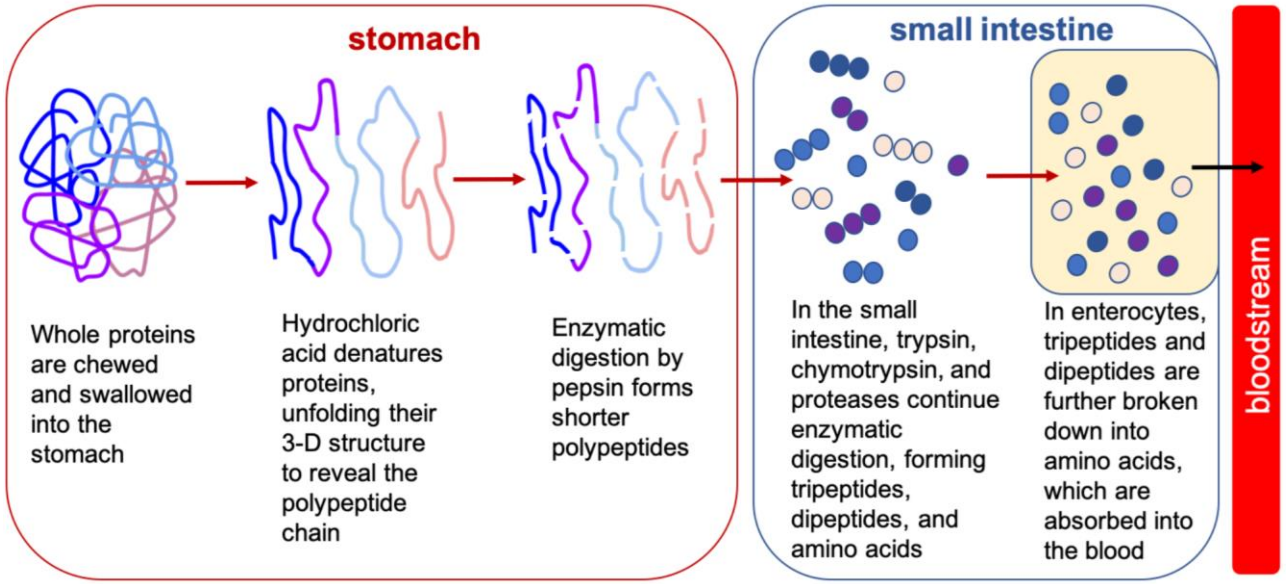

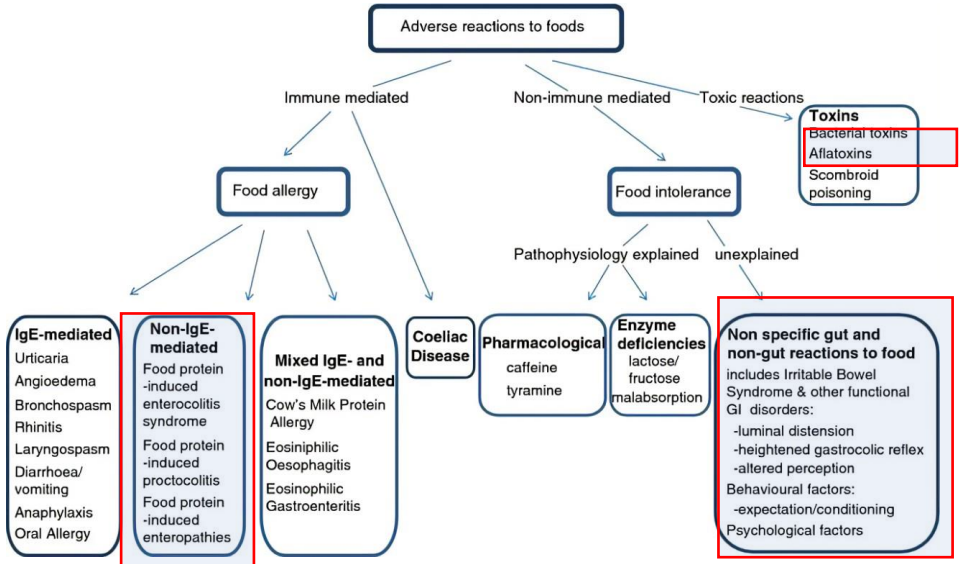

Quick Recap- Intact protein effects

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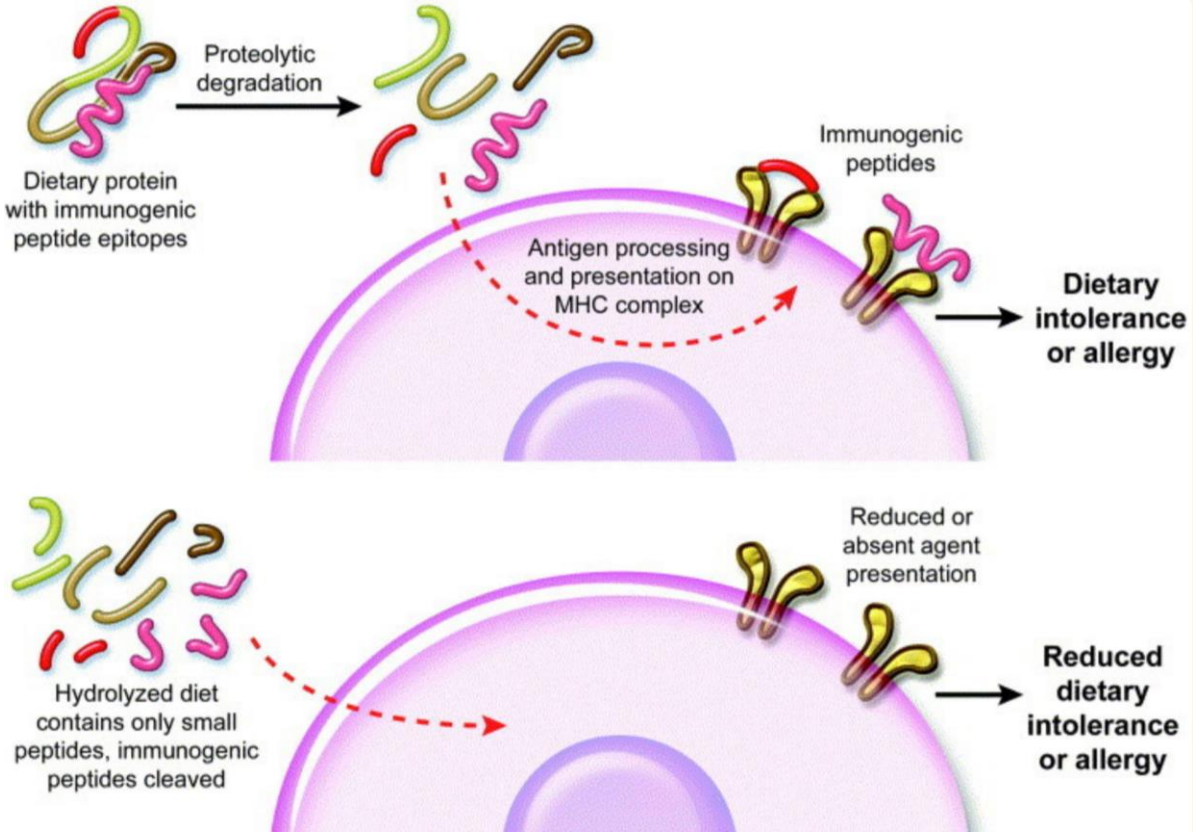
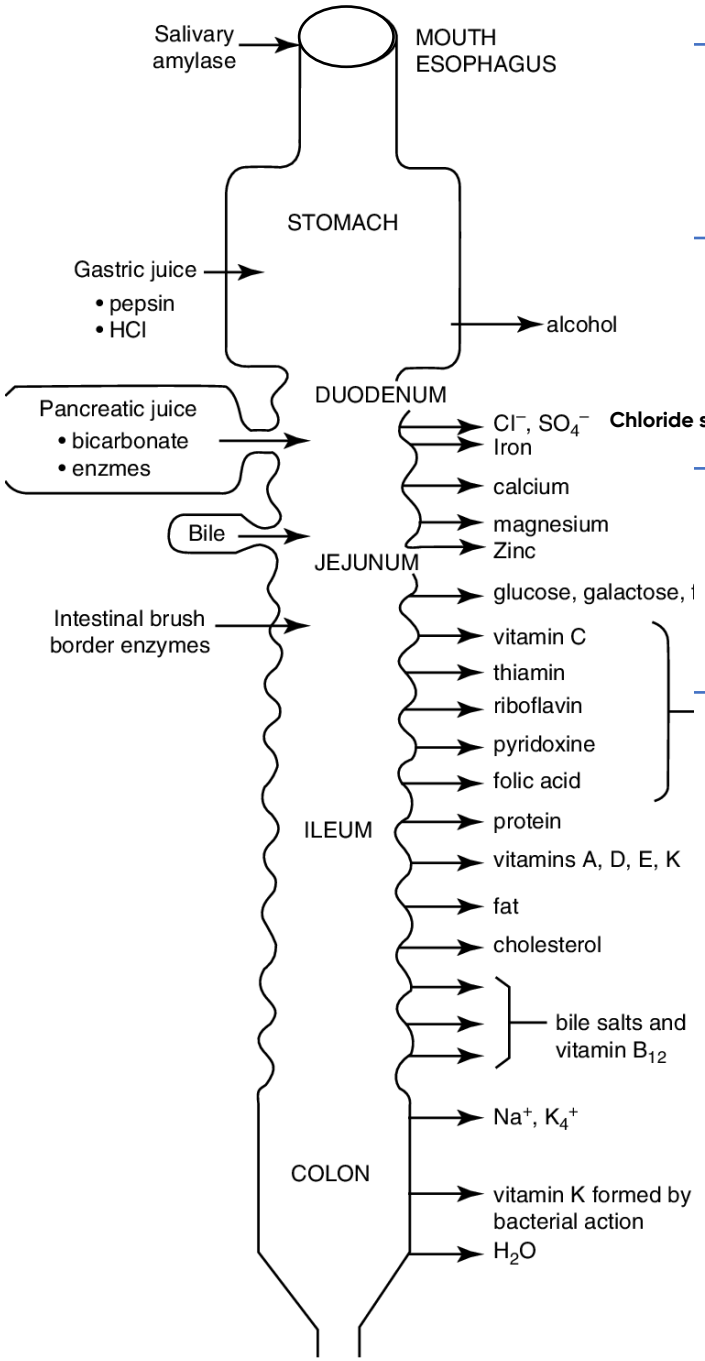


Antigen processing cells in the gastrointestinal mucosa and presented on the major histocompatibility complex (MHC), leading to immune reactions, dietary intolerances, or allergy. In the partially hydrolyzed diets (lower panel), the dietary protein has been partially degraded before consumption, with the proteins broken down into small peptides that are not processed and presented as effectively, thus reducing immune response against the diet.

Protein

The effects of protein on the GI tract are subtle and often less clinically obvious than that of fat or CHO, but they are crucially important to disease treatment because the amino acid glutamine is the primary source of respiratory fuel for enterocytes.5 The presence of a protein meal in the GI tract increases lower esophageal sphincter pressure, is a potent stimulus for secretion of GI hormones, including gastrin and pancreatic hormones, and increases gastric emptying and intestinal transit.1,

However, intact protein reaching the distal small intestine and colon will increase bacterial ammonia production, alter bacterial numbers and species, and may contribute to colitis or colonic hypersensitivity.6



Salivary amylase breaks down starch into disaccharides

Stomach pepsin breaks down large proteins into large peptides

Pancreas assists small intestine with:
Amylase to continue the breakdown of starch
Trypsin to continue the breakdown of protein
Lipase to break down fat

Small intestine releases:
Maltase, sucrase and lactase to break down remaining disaccharides into monosaccharides

Peptidase breaks down dipeptides into amino acids

Small Intestine – Site of Absorption

Where is the vulnerability?

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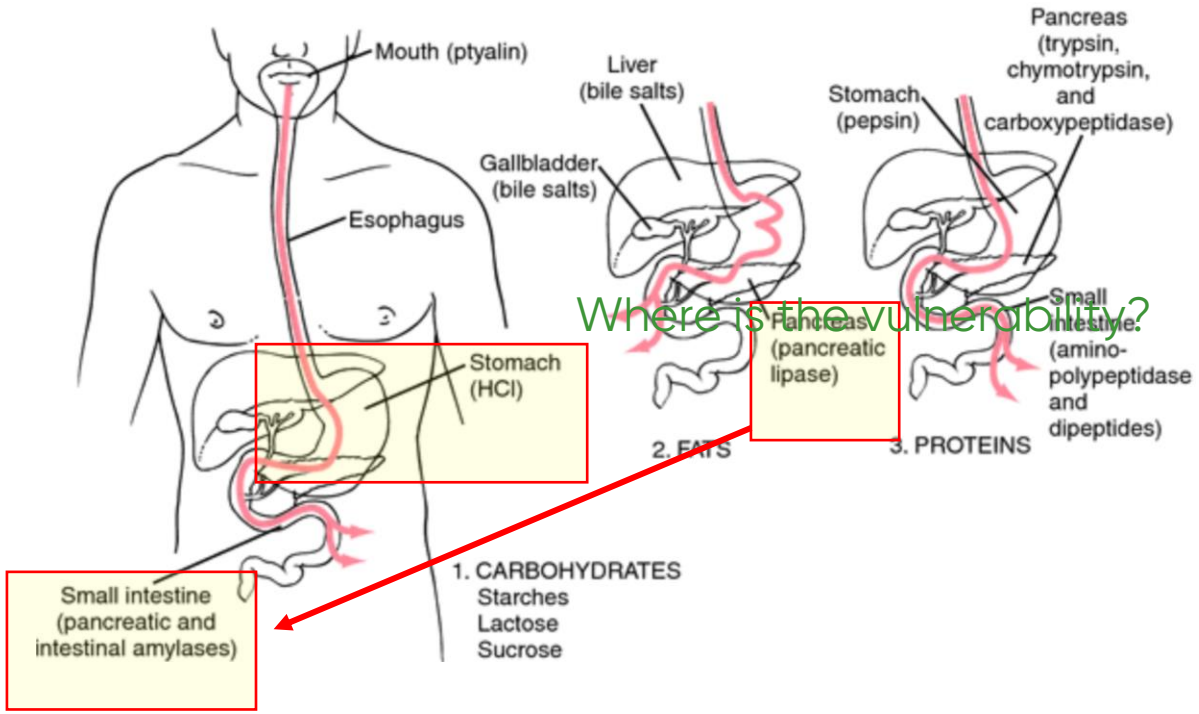
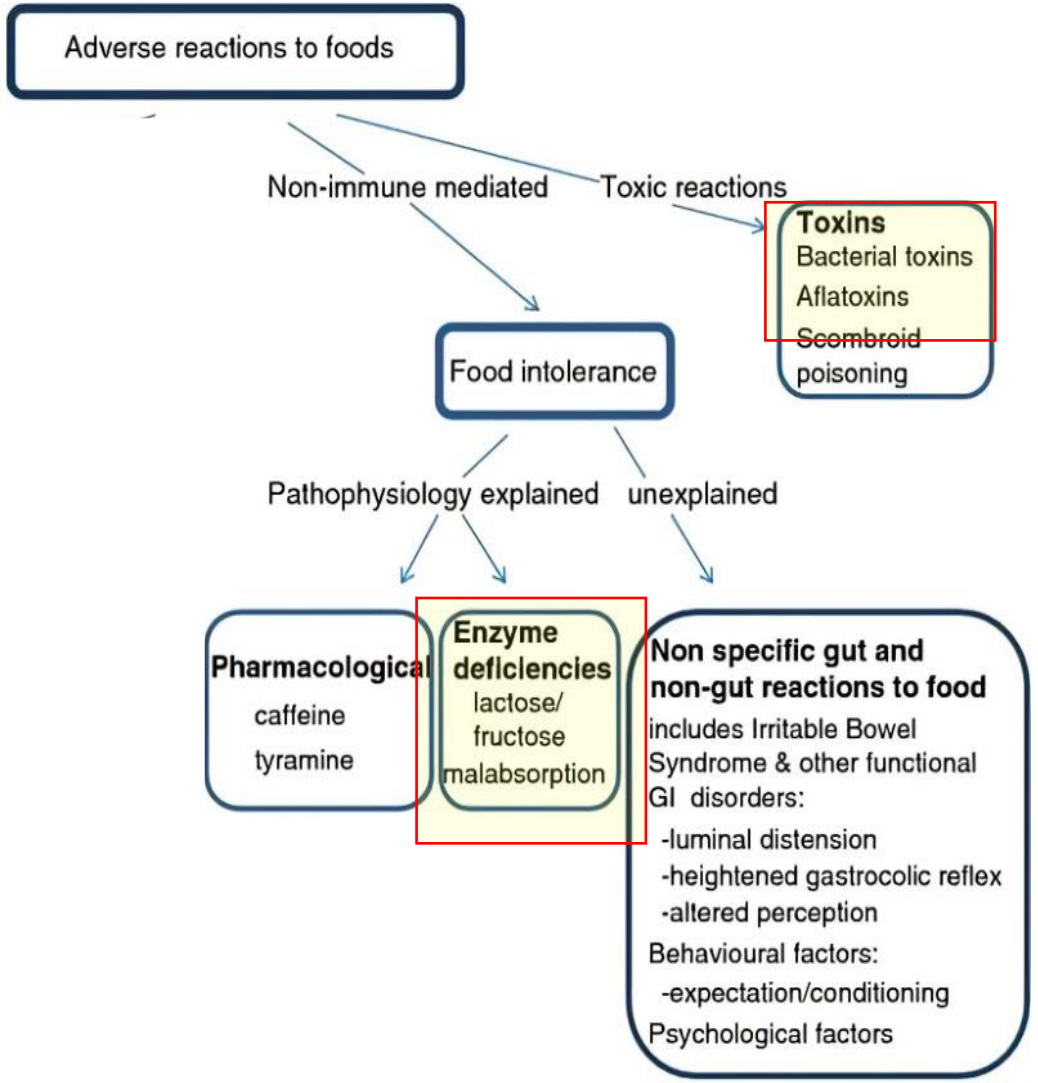


Where is the vulnerability?



Intestinal Growths

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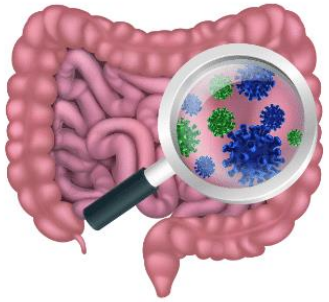
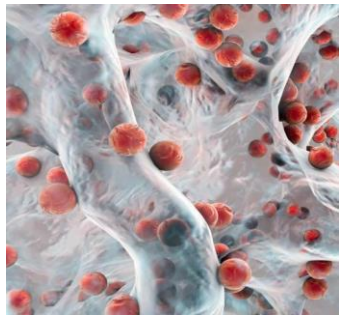


- Candida
- Yeast
- Pseudo
- Hyphal
- Sporulation

- Small Intestinal Bacterial Overgrowth
- Hydrogen / Methane
- Hydrogen sulphide



- Biofilms
- Antimicrobial and antifungal resistance

Candida

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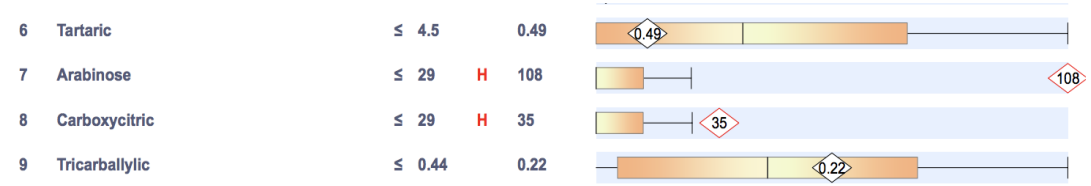
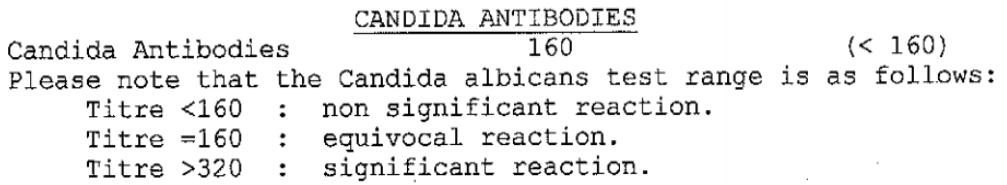
1. **Invasion of the intestinal lining** by hyphal Candida – causes "leaky gut"
2. **Arabinose** interferes with vitamin and amino acid metabolism – may affect behaviour, cause plaque build up and muscle weakness and mental health symptoms
3. **Tartaric acid** – interferes with energy production, leading to fatigue
4. **Gliotoxin** – from candida and other yeasts suppress immunity
5. **Acetyl aldehyde** –interferes with vitamin B6 metabolism, affecting hormones, brain chemistry and detoxification, leading to brain fog, poor skin health, and fatigue
6. **Biofilms** – make it hard to eradicate infections and perpetuate infections
7. **High Oxalate production –** causes achy joins and muscle soreness

Urine



Blood



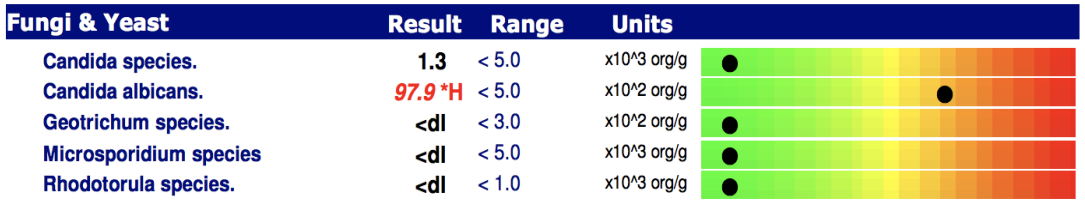
CANDIDA ANTIBODIES

Candida Antibodies 160 (< 160)

Please note that the Candida albicans test range is as follows:

Titre <160 : non significant reaction.
Titre =160 : equivocal reaction.
Titre >320 : significant reaction.

Stool



Fungi & Yeast	Result	Range	Units
Candida species.	1.3	< 5.0	x10^3 org/g
Candida albicans.	97.9 *H	< 5.0	x10^2 org/g
Geotrichum species.	<dl	< 3.0	x10^2 org/g
Microsporidium species	<dl	< 5.0	x10^3 org/g
Rhodotorula species.	<dl	< 1.0	x10^3 org/g

Candida – typical intervention

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- Low sugar diet
- Medium chain fatty acids like Caprylic acid show an inhibitory effect low concentrations, remain in gut for 3 hours – reduces candida populations by up to 80%
- Berberis aquifolium, Berberis vulgaris, Berberis aristata, Hydrastis canadensis, Phellodendron amurense, Coptis chinensis, and Tinospora cordifolia (da Silva et al., 2016)
- Beneficial bacteria such as *Saccharomyces boulardii – inhibitory effects*
- Pau D'Arco, Olive Leaf Extract, Oregano Extract, Grapefruit Seed Extract, coconut-based aplitic acid, Garlic, Uva ursi
- **Antifungal resistance = *biofilm formation*** RELAPSE

Candida Adhesion

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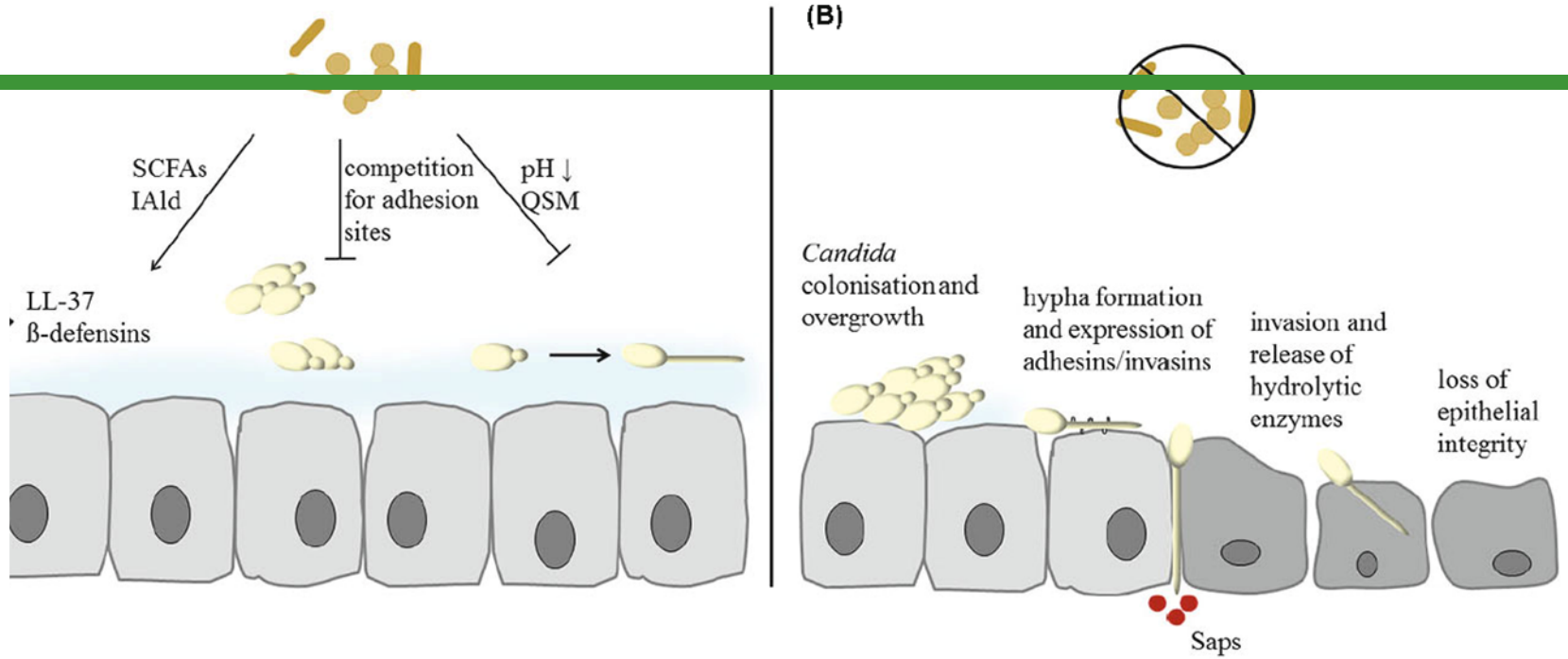

- B-defensins are antimicrobial peptides produced by phagocytic cells, lymphocytes and the epithelial lining.
- SFCA are produced by bacterial metabolism from 'malabsorbed' carbohydrates entering the colon
- Hydrolytic enzymes penetrate the intestinal barrier
- SAPS - secreted aspartic proteases

Candida Structures

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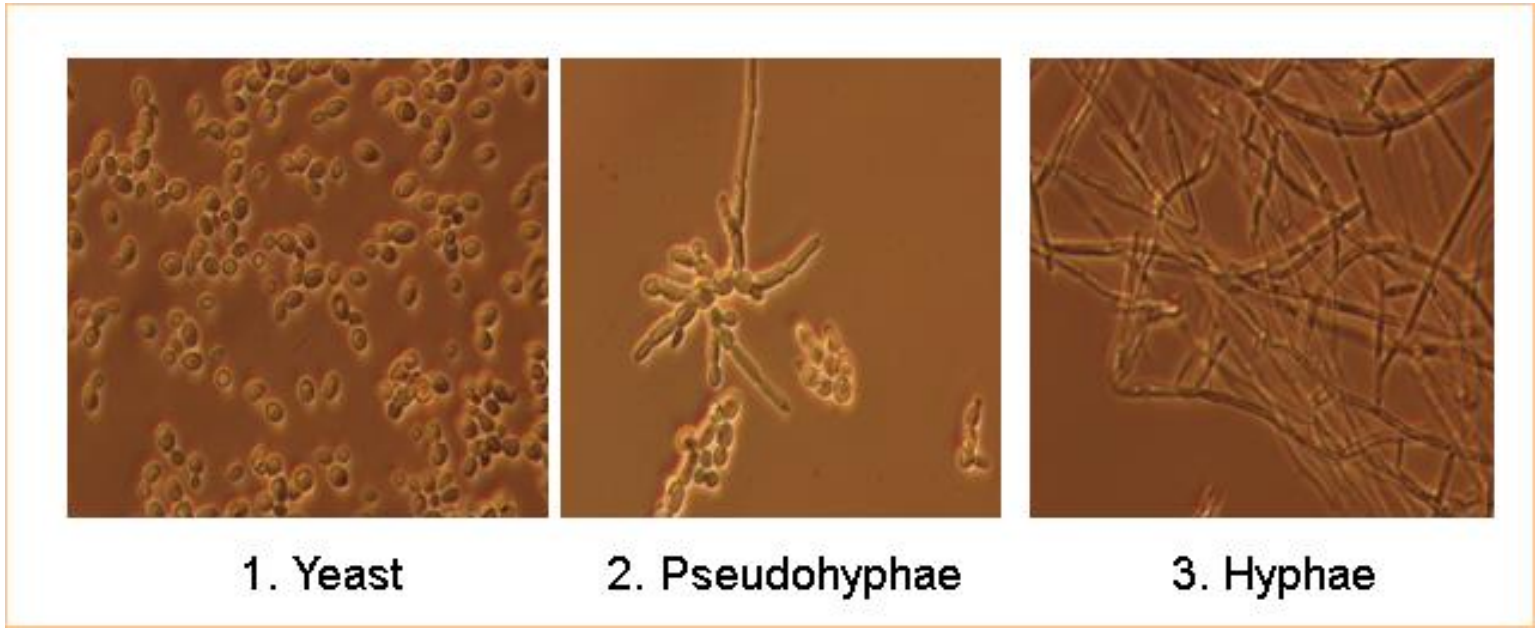

Cellulase

Hemicellulase, Beta Glucanase,
Lysozyme + antifungals

Candida Structure

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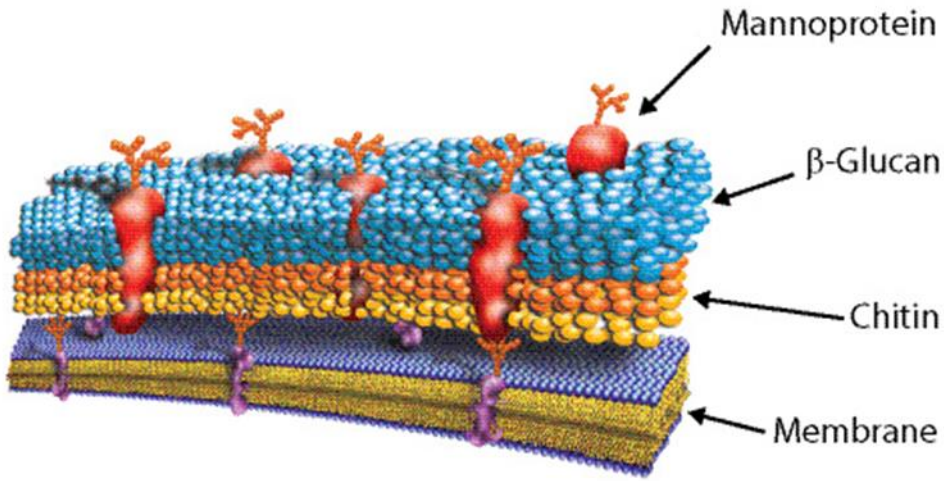
- The cell wall makes up ~30 % of the dry weight of the cell.
- It is made of
- ~25% helical β(1-3) β(1-6)-D-glucans (hemicellulose)
- ~ 25% oligo-mannans
- ~20 % protein
- ~10% lipids
- some chitin



Fungal Beta Glucan

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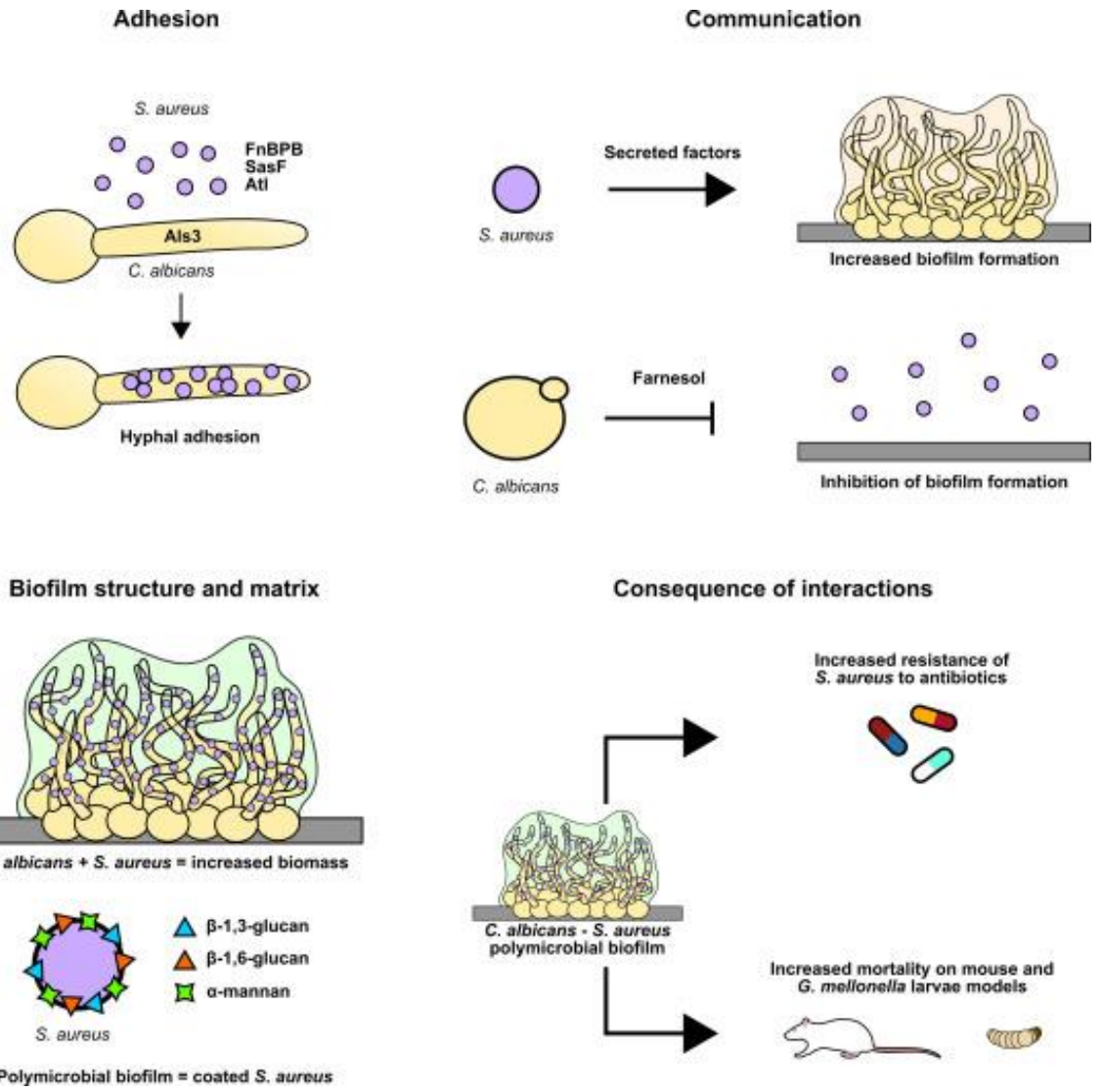
- **Fungal β-1,3-glucan** is one of the key components of the matrix of *C. albicans*-*S. aureus* biofilms

- **Inhibition of β-1,3-glucan** significantly alters fungal and bacterial resistance to antibiotics



Beta-Glucanases

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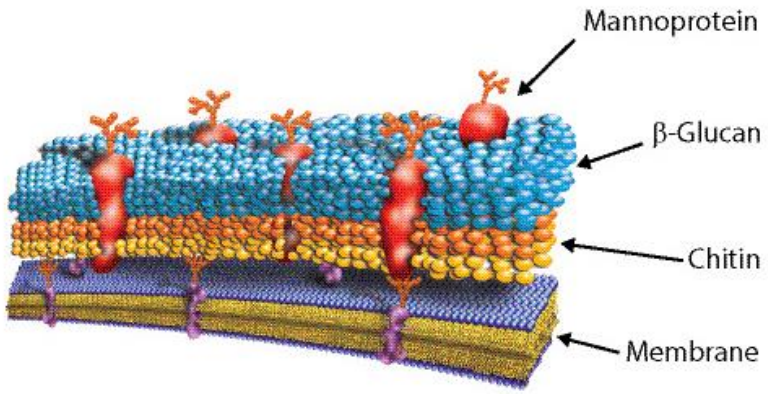

- **β-1,3-glucanases** produced by plants are natural anti-fungals
- *Aspergillus niger*
- **β-1,3-Glucan** hydrolysing enzymes
- Hydrolysis of polymers like cellulose, laminarin, and **β-1,6-glucans** produce glucose as the end product
- Cellulase, protease and chitinase also facilitate breakdown

Lysozyme

- **Lysozyme** damages the cell walls of bacteria and fungi by hydrolysing the β1–4 glycosidic bonds between the components of fungal chitin

Hemicellulase

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Hemicellulases are enzymes that break down material typically associated with or attached to cellulose

This category of enzyme includes xylanase, arabinoxylanase, beta-glucanase, beta-mannanase, pectinase, arabinase, pectin methylesterase, pectin lyase, and polygalacturonases

Antimicrobial Agents and Chemotherapy

Role of Matrix β-1,3 Glucan in Antifungal Resistance of Non-albicans Candida Biofilms

K. F. Mitchell, H. T. Taff, M. A. Cuevas, E. L. Reinicke, H. Sanchez and D. R. Andes
Antimicrob. Agents Chemother. 2013, 57(4):1918. DOI: 10.1128/AAC.02378-12.
Published Ahead of Print 14 January 2013.

We utilized a 6-well plate format for assessment of antifungal drug biofilm penetration using [H^3]fluconazole as described previously (13, 19). Briefly, mature biofilms (24 h of incubation) were washed twice with sterile water followed by exposure to a total of 8.48×10^5 cpm of [H^3]fluconazole in RPMI-MOPS medium. Biofilms were incubated for 30 min at 37°C and then chased with 20 μM unlabeled fluconazole in medium. The fluconazole content was measured in intact biofilms, isolated matrix, cell wall, and cell cytoplasm by scintillation counting. Assays were performed in triplicate for each *Candida* isolate. Consistent with previous findings in *C. albicans* (13, 19), the majority of [H^3]fluconazole is present in the extracellular matrix for each of these species, with very little or no drug found intracellularly or in the cell wall (Fig. 1B).

We next determined the effect of matrix β-1,3 glucan hydrolysis on biofilm susceptibility to fluconazole. Using a 96-well plate format, biofilm cell metabolic activity was assayed following exposure to fluconazole and β-1,3 glucanase alone and in combination using a tetrazolium salt XTT reduction assay (20–23). Briefly, after 24 h of biofilm growth, medium was replaced by fresh RPMI-MOPS with dilutions of fluconazole at 1 mg/ml, β-1,3 glucanase (Zymolyase 20T; MP Biomedicals) at 0.7 U/ml, or a combination of the two. The β-1,3 glucanase concentration was chosen based upon our previous studies with *C. albicans* demonstrating synergy with fluconazole and no effect on cell viability for the enzyme alone (12, 19). Experiments were performed in triplicate. Drug effect is expressed at the percent biofilm reduction relative to growth of untreated controls. The statistical significance of differences among therapies was determined using analysis of variance (ANOVA). Similar to previous reports, fluconazole alone exhibited minimal activity against biofilms for each strain and species (12, 19). The low concentration of β-1,3 glucanase also produced little change in cell metabolic activity. However, fluconazole caused marked biofilm reduction in the presence of the β-1,3 glucan-hydrolyzing enzyme. This effect was observed for all strains tested (Fig. 1C).

Mannan

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Review > Appl Microbiol Biotechnol. 2008 May;79(2):165-78. doi: 10.1007/s00253-008-1423-4.

An overview of mannan structure and mannan-degrading enzyme systems

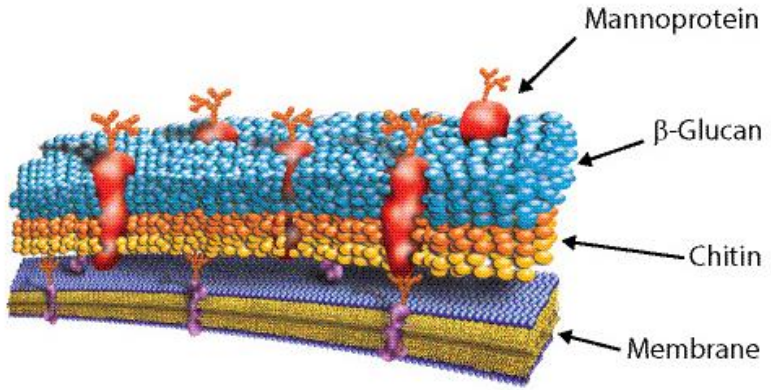
L R S Moreira [1], E X F Filho

Affiliations + expand

PMID: 18385995 DOI: 10.1007/s00253-008-1423-4

Abstract

Hemicellulose is a complex group of heterogeneous polymers and represents one of the major sources of renewable organic matter. Mannan is one of the major constituent groups of hemicellulose in the wall of higher plants. It comprises linear or branched polymers derived from sugars such as D-mannose, D-galactose, and D-glucose. The principal component of softwood hemicellulose is glucomannan. Structural studies revealed that the galactosyl side chain hydrogen interacts to the mannan backbone intramolecularly and provides structural stability. Differences in the distribution of D-galactosyl units along the mannan structure are found in galactomannans from different sources. Acetyl groups were identified and distributed irregularly in glucomannan. Some of the mannosyl units of galactoglucomannan are partially substituted by O-acetyl groups. Some unusual structures are found in the mannan family from seaweed, showing a complex system of sulfated structure. Endohydrolases and exohydrolases are involved in the breakdown of the mannan backbone to oligosaccharides or fermentable sugars. The main-chain mannan-degrading enzymes include beta-mannanase, beta-glucosidase, and beta-mannosidase. Additional enzymes such as acetyl mannan esterase and alpha-galactosidase are required to remove side-chain substituents that are attached at various points on mannan, creating more sites for subsequent enzymatic hydrolysis. Mannan-degrading enzymes have found applications in the pharmaceutical, food, feed, and pulp and paper industries. This review reports the structure of mannans and some biochemical properties and applications of mannan-degrading enzymes.



Lysozyme

ENZYME SCIENCE UK
EXCEPTIONAL ENZYME FORMULAS

Int J Biol Macromol. 2018 Mar;108:942-946. doi: 10.1016/j.ijbiomac.2017.11.003. Epub 2017 Nov 4.

β-1,3-glucanase disrupts biofilm formation and increases antifungal susceptibility of Candida albicans DAY185

Yulong Tan [1], Su Ma [2], Matthias Leonhard [3], Doris Moser [4], Berit Schneider-Stickler [3]

Affiliations + expand

PMID: 29104052 DOI: 10.1016/j.ijbiomac.2017.11.003

Abstract

β-1,3-glucan plays a role in Candida biofilm formation and survival of biofilm-forming Candida to stresses. In this study, we evaluated the antibiofilm activity of β-1,3-glucanase, which can degrade poly-β(1→3)-glucose of Candida albicans biofilms. Biofilm was dispersed by 55.96%. β-1,3-glucanase had no effect on Candida planktonic growth as well as adhesion. β-1,3-glucanase markedly enhanced the antifungal susceptibility of fluconazole and amphotericin B. The examination using confocal laser scanning microscopy and scanning electron microscope confirmed the antibiofilm activity of β-1,3-glucanase. Our findings demonstrate that β-1,3-glucanase may be useful as an antibiofilm agent.

Keywords: Antibiofilm; Antifungal; Enzyme.

Med Mycol J. 2017;58(3):J63-J69. doi: 10.3314/mmj.17-00005.

[Inhibition of Growth of Candida albicans by a Lysozyme-chitosan Conjugate, LYZOX and its Combination with Decanoic Acid]

[Article in Japanese]

Hiroki Kageshima [1], Kazumi Hayama [2], Miki Takahashi [2], Miho Abe [2], Tsuyoshi Yamada [2], Akira Saito [1], Shoichiro Hirano [1], Yoichi Murakami [1], Shigeru Abe [2]

Affiliations + expand

PMID: 28855481 DOI: 10.3314/mmj.17-00005

Free article

Abstract

A lysozyme-chitosan conjugate preparation (LYZOX), produced from egg white lysozyme and chitosan by Maillard reaction, is a commercial product developed as a cosmetic ingredient or food additive. Effects of LYZOX on in vitro growth of Candida albicans were examined. C. albicans cells were treated with LYZOX for 3 hrs, and then washed and cultured for an additional 16 hrs in modified RPMI1640 medium. Mycelial growth of C. albicans was clearly inhibited by more than 100 μg/ml of LYZOX in a concentration-dependent manner. On the other hand, corresponding concentration of chitosan or lysozyme or their mixture only scarcely showed clear inhibitory effect. Similarly, anti-Candida activity of the combination of LYZOX and decanoic acid, a middle-chain fatty acid, was also examined. Inhibitory activity of this combination against mycelial growth of C. albicans was very potent and appeared synergistic, since fractionated inhibitory concentration (FIC) index for 70% growth inhibition was calculated to be 0.20. Oral application of this combination improved the symptoms of Candida-infected-tongue in an experimental murine candidiasis model. On the basis of these results, the possible application of LYZOX as a new functional product with anti-candida activity was discussed.

Experimental Dermatology ADF

ADF Perspectives | Free Access

Alternative approaches to antifungal therapies

Tarun Mehra, Martin Köberle, Christina Braunsdorf, Daniela Mailänder-Sanchez, Claudia Borelli
... See all authors

First published: 08 August 2012 | https://doi.org/10.1111/exd.12004 | Citations: 38

Lysozyme

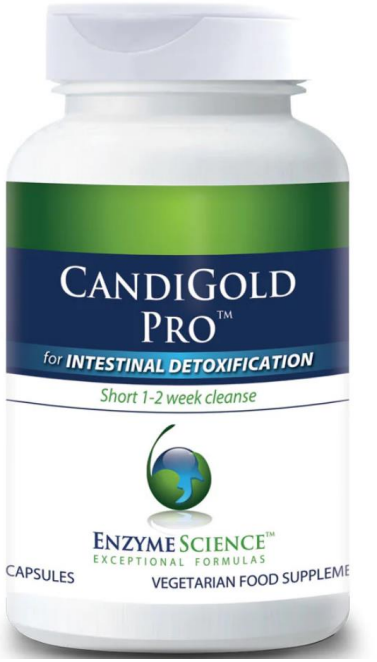
Lysozyme is an enzyme classically known for its muramidase activity lysing bacterial peptidoglycan and killing bacteria. However, as early as 1970, it was shown that lysozyme was also active against *C. albicans*, its mechanism of antifungal action staying subject to speculation 5. Subsequently, broad antifungal activity was also shown against numerous clinical isolates of all *Candida spp*., with a significant variation of interstrain and intrastrain sensitivity and against *Aspergillus fumigatus* and *Penicillium spp*. 6.

Lysozyme is found in virtually all human body fluids (e.g. saliva, respiratory secretions and liquor). Expression of lysozyme in the skin has been located in the cytoplasm of epidermal cells and throughout the pilosebaceous apparatus 6, in body secretions such as saliva and in neutrophils 7. Wu et al. investigated the effect of lysozyme on the viability and Sap activity of *C. albicans*. Saps are secreted aspartic proteases, and their main functions are probably to provide nutrition, aid penetration and invasion and evade immune responses 8. An incubation period of 24 h with sublethal concentrations of lysozyme resulted in a dose-dependent reduction in Sap activity and secretion, measured by spectrophotometry and ELISA, respectively. This finding was paralleled by decreasing *Candida* viability at higher, lethal concentrations (15 and 20 μg/ml), with significant differences in various strains, quantified by colony-forming units yielded per ml cultivated medium. Electron microscopy showed ballooned cells, some appearing collapsed and deflated, after 24-h exposure to lysozyme at concentrations below 10 μg/ml, which did not affect the viability of *C. albicans*. The fungicidal activity at high concentrations therefore was suggested to result in membrane or cell wall damage leading to osmotic imbalance 9. Also, the negatively charged domain of lysozyme has been assumed to target the *Candida* surface 9. Very recently, it could be demonstrated that the digestion of human milk lysozyme by pepsin yields five different antimicrobial peptides that are also active against *C. albicans* 10.

Ingredients

Serving Size: 1 Targeted Delivery Capsule
Servings Per Container: 42

Amount Per Serving	
Botanical, enzyme and bacteria blend	**290 mg**
Garlic Powder (*Allium sativum*) (Bulb)	
Grape seed extract (*Vitis vinifera*)	
Lysozyme (from **egg**)	
Oregano oil (*Origanum vulgare*)	
Thyme oil (*Thymus vulgaris*)	
Clove oil (*Syzygium aromaticum*)	
Peppermint extract (*aerial*)	
Bacillus subtilis	1 x 10^9 CFU
100% Vegetarian Capsule (gellan gum, cellulose, water)	
Hemicellulase	20,000 HCU
Protease *Thera-blend™*	10,000 HUT
Cellulase *Thera-blend™*	500 CU



Supplement Facts

Serving Size: 2 Capsules
Servings Per Container: 42

Amount Per Serving		%DV
Cellulase *Thera-blend™*	70,000 CU	**
Protease *Thera-blend™*	230,000 HUT	**
Broccoli Seed Extract	40 mg	**
Probiotic Blend:	1 Billion CFU	**
L.acidophilus DDS-1, L. rhamnosus, L.casei, L. gasseri, L. plantarum, L. bulgaricus, L. salivarius, L. paracasei		

** Daily Value not established

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> Appl Microbiol Biotechnol. 2019 Jun;103(11):4377-4392. doi: 10.1007/s00253-019-09805-z. Epub 2019 Apr 17.

Capability of iturin from Bacillus subtilis to inhibit Candida albicans in vitro and in vivo

Shuzhen Lei [1], Haobin Zhao [1], Bing Pang [1], Rui Qu [1], Ziyang Lian [1], Chunmei Jiang [1], Dongyan Shao [1], Qingsheng Huang [1], Mingliang Jin [1], Junling Shi [2]

Affiliations + expand

PMID: 30997554 DOI: 10.1007/s00253-019-09805-z

Full text links | Cite

microbial cell

Microb Cell. 2020 May 4; 7(5): 129–138. PMCID: PMC7199281
Published online 2020 Mar 20. doi: 10.15698/mic2020.05.716 PMID: 32391394

Sulforaphane alters the acidification of the yeast vacuole

Alexander Wilcox,[1,#] Michael Murphy,[1,#] Douglass Tucker,[1,#] David Laprade,[1] Breton Roussel,[1] Christopher Chin,[2] Victoria Hallisey,[1] Noah Kozub,[1] Abraham Brass,[2] and Nicanor Austriaco[1,*]

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This article has been cited by other articles in PMC.

Pharmacology

Original Paper
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Growth Inhibition of a Spectrum of Bacterial and Fungal Pathogens by Sulforaphane, an Isothiocyanate Product Found in Broccoli and Other Cruciferous Vegetables

Noelle L. Johansson[1], Charles S. Pavia[1,2], Jen Wei Chiao[2]

[1]Department of Biomedical Sciences, New York College of Osteopathic Medicine of New York Institute of Technology, Old Westbury, NY, USA
[2]Department of Medicine, New York Medical College, Valhalla, NY, USA

Further Information

SIBO –
Small Intestinal Bacterial Overgrowth

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The relative sterility of the small intestine relies on:

- Gastric acid
- Pancreatic enzyme production
- Gut motility
- Systemic and local immunity
- An intact ileal valve

Clinical Manifestations of SIBO

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Weight loss
Steatorrhea
Vitamin/mineral deficiency
- Fat-soluble vitamins (A, D, E, K)
- Vitamin B12
- Iron

Vitamin excess
- Folate

Hypoproteinaemia/hypoalbuminemia
Decreased xylose absorption (test)
Diarrhoea
Constipation
Abdominal pain or tenderness
Flatulence
Hydrogen / Methane Breath Test >20

Normal results:
Adults - 2-20 ng/mL, 2-20 µg/L, or 4.5-45.3 nmol/L
Children - 5-21 ng/mL, 5-21 µg/L, or 11.3-47.6 nmol/L
Infants - 14-51 ng/mL, 14-51 µg/L, or 31.7-115.5 nmol/L

Normal results:
Serum xylose concentration at 1 hr in excess of 1.3 mM
Urinary xylose excretion in excess of 7.0 mmol/5 hr

Gastric acid, pyloric valve

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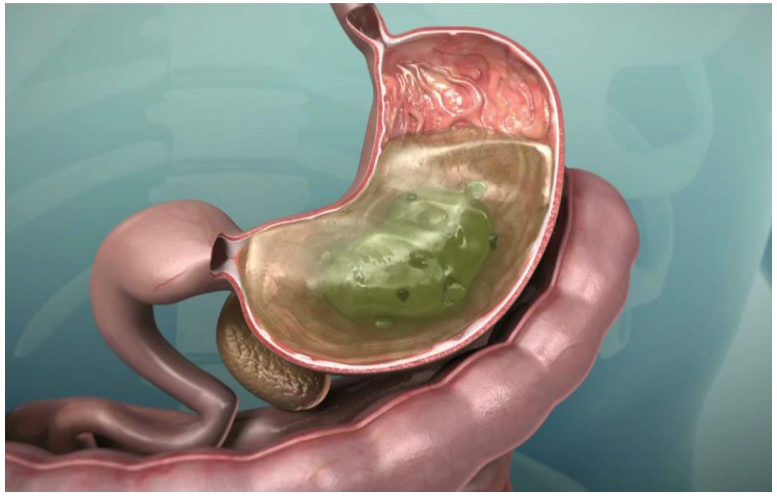
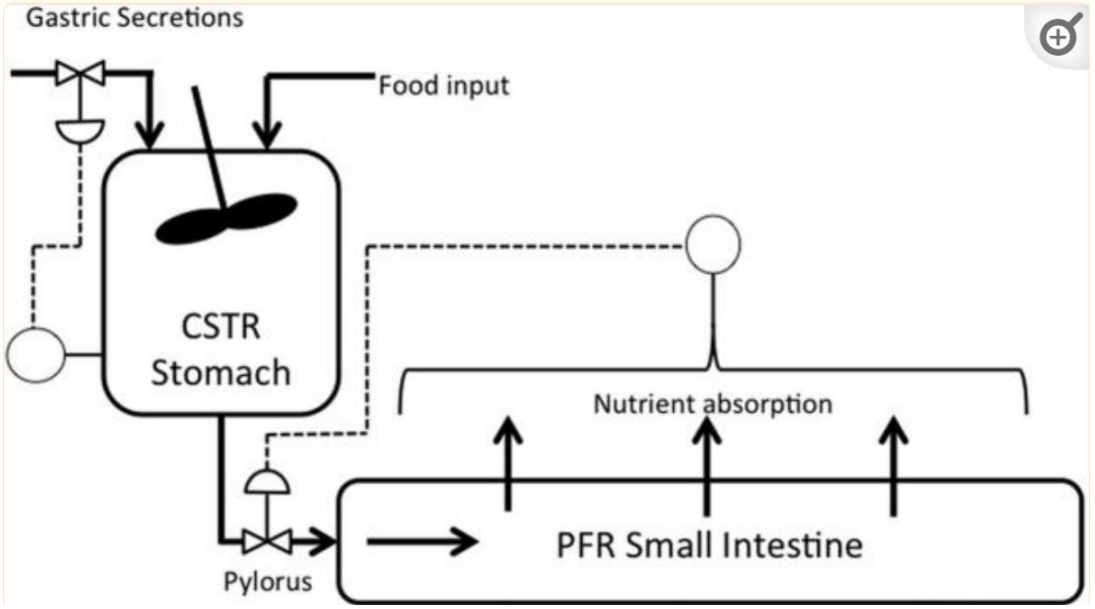
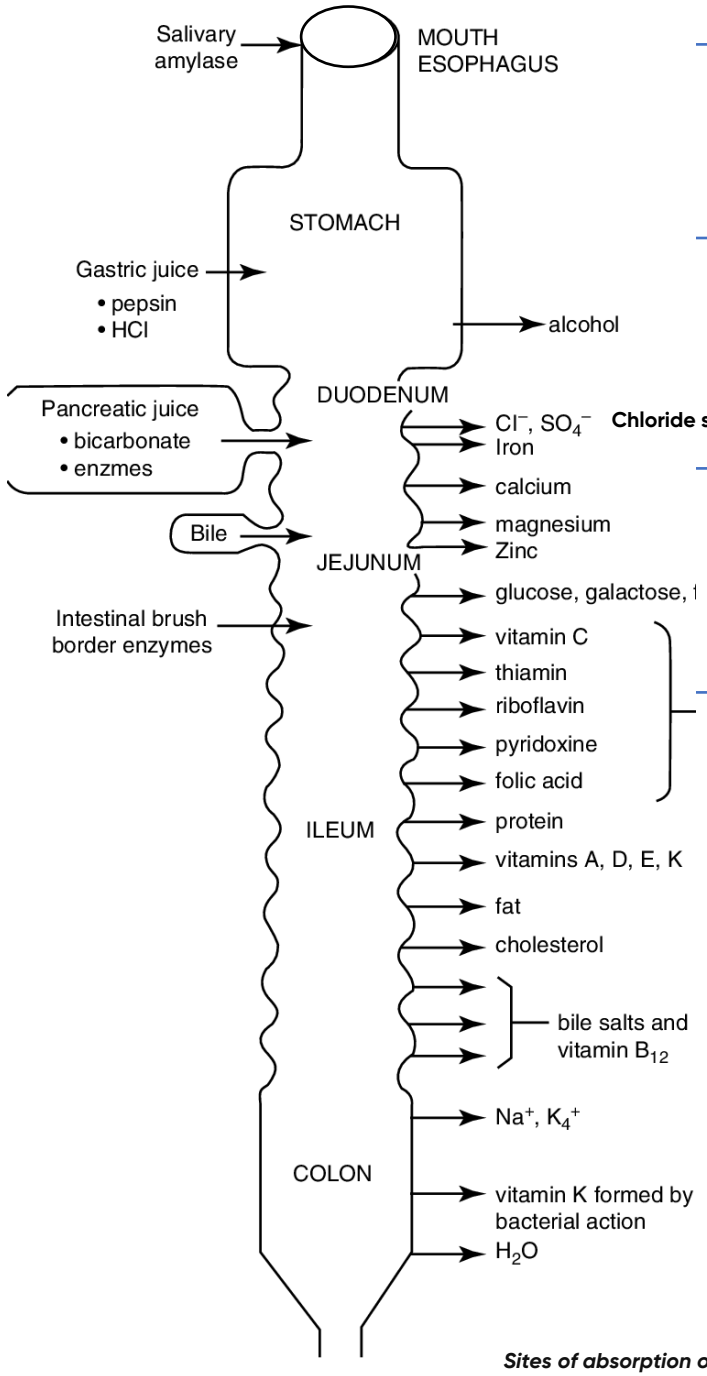


- Reduces bacterial content from **millions to thousands**
- Triggers release of digestive enzymes
- Protects the small intestine from overload



Moxon TE, Nimmegeers P, Telen D, Fryer PJ, Van Impe J, Bakalis S. Effect of chyme viscosity and nutrient feedback mechanism on gastric emptying. Chem Eng Sci. 2017 Nov 2;171:318-330. doi: 10.1016/j.ces.2017.05.048. PMID: 29104301; PMCID: PMC5569601.



Salivary amylase breaks down starch into disaccharides

Stomach pepsin breaks down large proteins into large peptides

Pancreas assists small intestine with:
Amylase to continue the breakdown of starch
Trypsin to continue the breakdown of protein
Lipase to break down fat

Small intestine releases:
Maltase, sucrase and lactase to break down remaining disaccharides into monosaccharides

Peptidase breaks down dipeptides into amino acids

Pancreatic enzymes

Sites of absorption of nutrients within the gastrointestinal tract. Adapted from: Mahan and Escott-Stump: Krause's Food, Nutrition and Diet Therapy, 9/e, p l3, ©1996, with permission from Elsevier

SIBO Method

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1. Hydrochloric acid – **retore bacteriostatic effect of stomach**
2. Digestive enzymes – **ensure uptake of nutrient, protection from food intolerance**
3. Antimicrobials in rotation
4. Bile – diet, bile salts, lipase, pancreatic enzymes – **remove additional burden of LPS**
5. Motility & Migrating Motor Complex – **supplementation, stress relief, fasted states**
6. The ileocecal valve – **chiropractic, 5HTP, enhance digestion (enzymes and HCL)**
7. Immune system – **restoration**

SIBO Structure

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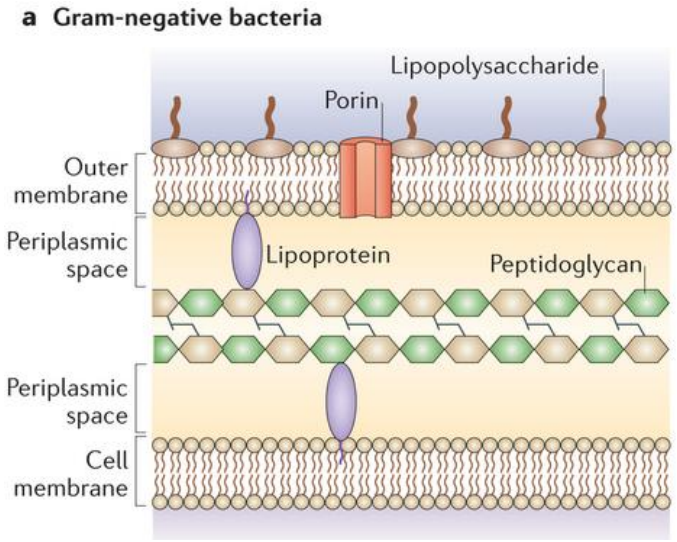

- **SIBO bacteria are primarily gram-negative**.
- LPS initiates reprogramming in both monocyte macrophages and neutrophils
- Suppresses host lipase in a variety of environments

Image credit: Detailed structure of gram positive bacterial, gram negative bacterial, mycobacterial, and fungal cell walls, Nature Reviews, Microbiology.

Ishaq, S. L. , Moses, P. L. , Wright, A. G. , 2016, 'The Pathology of Methanogenic Archaea in Human Gastrointestinal Tract Disease', in G. Mozsik (ed.), The Gut Microbiome - Implications for Human Disease, IntechOpen, London. 10.5772/64637.

Medvedev et al., 2006, Wysocka et al., 2001, Cross, 2002, Cavaillon et al., 2003, McCall and Yoza, 2007, Foster et al., 2007

Reference Module in Life Sciences
Brenner's Encyclopedia of Genetics (Second Edition)
2013, Pages 292-293

Lysozyme

E.M. Kutter

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https://doi.org/10.1016/B978-0-12-374984-0.00893-7

Abstract

Bacterial cells are generally protected from lysis induced by factors such as osmotic shock by having a cell wall made of peptidoglycan, also called murein. The entire peptidoglycan sack around each bacterial cell is in fact one giant, covalently bonded bag-shaped molecule. Growth of the cell requires that links of this sack be opened up long enough to insert new links in between them; penicillin leads to the death of growing bacterial cells by interfering with the filling and resealing of these small gaps in the cell's armor. Lysozymes are a particular class of enzymes that are able to attack this murein structure and thus generally effect the destruction of the cell. In 1922, the Scottish physician Alexander Fleming showed that saliva, tears, and sweat all contained a substance that could destroy bacteria. What he was observing was in fact lysozyme – the first human secretion shown to have chemotherapeutic properties. From a genetic/molecular biology perspective, one of the most important lysozymes is that produced by bacteriophage T4 to rupture the cell and release the phage. The early work of George Streisinger with mutants of this enzyme played a key role in exploring the nature of the genetic code, the generation, and study of a set of mutants with each of crystal structures.

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Ingredients

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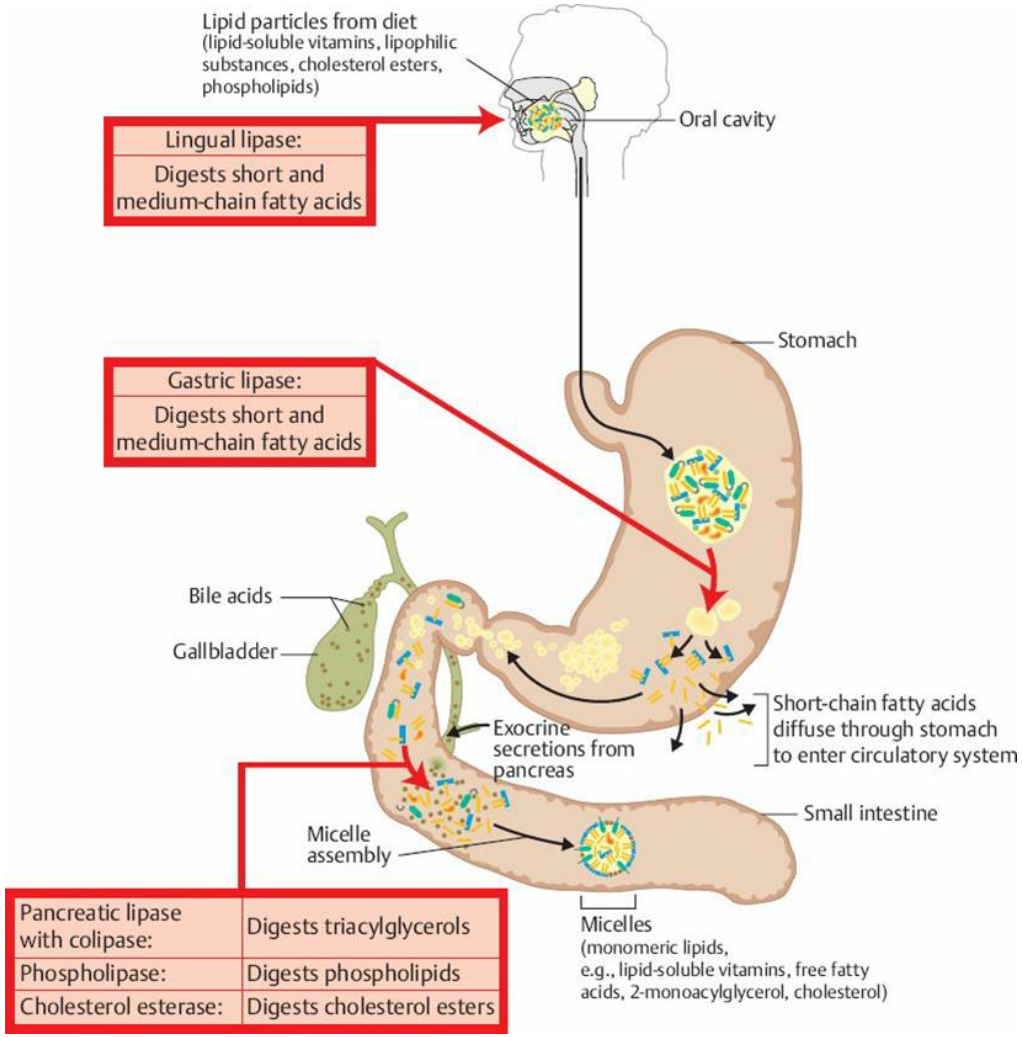
Clove oil (*Syzygium aromaticum*)	
Peppermint extract (*aerial*)	
Bacillus subtilis	1 x 10^9 CFU
100% Vegetarian Capsule (gellan gum, cellulose, water)	
Hemicellulase	20,000 HCU
Protease *Thera-blend™*	10,000 HUT
Cellulase *Thera-blend™*	500 CU



› Cardiovasc Toxicol. 2021 Jul;21(7):582-591. doi: 10.1007/s12012-021-09651-4. Epub 2021 Apr 15.

Bacterial Lipase Neutralized Toxicity of Lipopolysaccharide on Chicken Embryo Cardiac Tissue

Afsaneh Bagherzadeh [1], Hamidreza Vaziri [1], Fatemeh Sokouti Nasimi [2], Shahin Ahmadian [2], Adel Feyzi [3], Mehrdad Farhadi [4], Fariba Yahyavi [2], Behnam Hashemi [2], Reza Rahbarghazi [5 6], Mahdi Mahdipour [7 8]

Affiliations + expand

PMID: 33856644 DOI: 10.1007/s12012-021-09651-4

› iScience. 2021 Aug 19;24(9):103004. doi: 10.1016/j.isci.2021.103004. eCollection 2021 Sep 24.

A host lipase prevents lipopolysaccharide-induced foam cell formation

Jintao Feng [1], Wei Jiang [1 2], Xiaofang Cheng [1], Benkun Zou [1], Alan W Varley [3], Ting Liu [1], Guojun Qian [1], Wenjiao Zeng [4], Jianguo Tang [2], Qiang Zhao [5], Yiwei Chu [1], Yuanyuan Wei [1], Xiaobo Li [6], Robert S Munford [7], Mingfang Lu [1 2]

Affiliations + expand

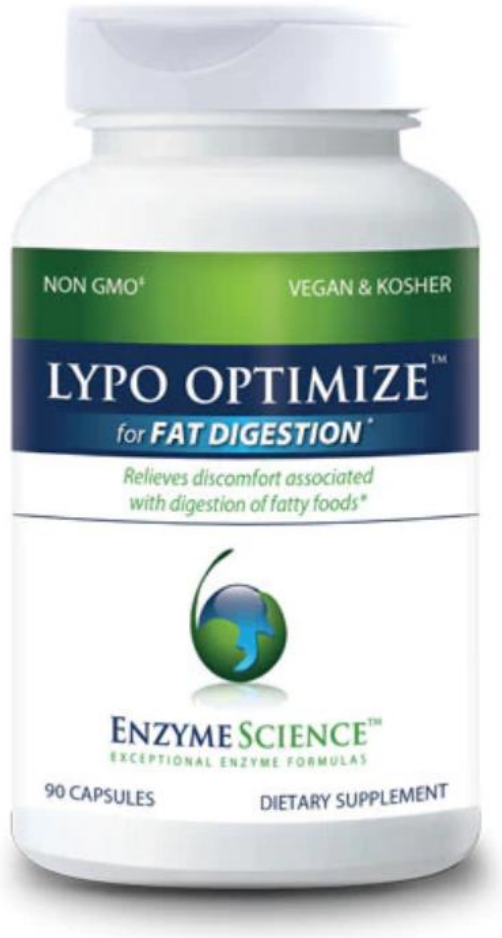
PMID: 34522852 PMCID: PMC8426562 DOI: 10.1016/j.isci.2021.103004
Free PMC article

Published: 11 September 2005

Lipopolysaccharide deacylation by an endogenous lipase controls innate antibody responses to Gram-negative bacteria

Mingfang Lu, Mei Zhang, Akira Takashima, Jerrold Weiss, Michael A Apicella, Xiang-Hong Li, Dorothy Yuan & Robert S Munford

Nature Immunology **6**, 989–994 (2005) | Cite this article



Antimicrobials

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1. Berberine (extract of berberis vulgaris and other berberine containing herbs)
2. Wormwood (Artemisia absinthium)
3. Goldenseal (high berberine content)
4. Oregano (dried or tincture)
5. Allicin (extract of garlic)
6. Neem
7. Oregon grape root – dried, tablet, tincture 6x per day
8. Neem leaf

Method

Choose 2 antimicrobials at a time. Dose as high as tolerable - 3-5g / 3000- 5000mg berberine 4- 6 weeks
2700 mg Allicin 4- 6x per day
If SIBO still present – repeat with two different antimicrobials
Consider an elemental diet if SIBO is unresponsive

› Glob Adv Health Med. 2014 May;3(3):16-24. doi: 10.7453/gahmj.2014.019.

Herbal therapy is equivalent to rifaximin for the treatment of small intestinal bacterial overgrowth

Victor Chedid [1], Sameer Dhalla [2], John O Clarke [3], Bani Chander Roland [4], Kerry B Dunbar [5], Joyce Koh [6], Edmundo Justino [7], Eric Tomakin [8], Gerard E Mullin [9]

Affiliations + expand

PMID: 24891990 PMCID: PMC4030608 DOI: 10.7453/gahmj.2014.019
Free PMC article

Biofilms

ENZYME SCIENCE UK
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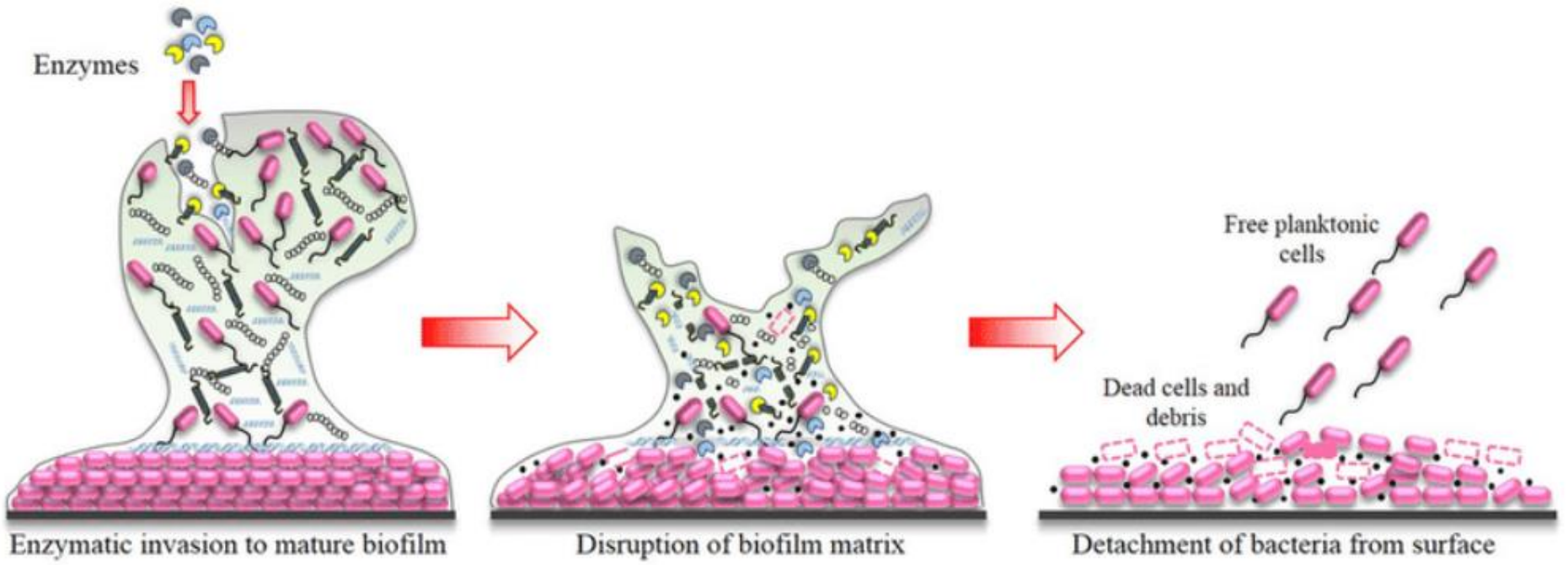

Biofilm formation can protect pathogens from many aspects of the innate immune system, including by inactivating neutrophils and monocytes. Altered immune recognition during this phase of growth is also evident by changes in the cytokine profiles of monocytes exposed to biofilm.

Serrapeptase

ENZYME SCIENCE UK
EXCEPTIONAL ENZYME FORMULAS

Biotechnol Rep (Amst). 2020 Dec; 28: e00544.
Published online 2020 Oct 17. doi: 10.1016/j.btre.2020.e00544
PMCID: PMC7585045
PMID: 33134103

Serratiopeptidase: Insights into the therapeutic applications

Swati B. Jadhav,[a,*] Neha Shah,[b] Ankit Rathi,[a,c] Vic Rathi,[a,c] and Abhijit Rathi[a]

Abstract

Go to: ▸

Therapeutic applications of enzymes have been widely accepted in clinical practices for decades. Proteolytic enzymes in particular, have been used for the treatment of diseases and disorders. Serratiopeptidase is a proteolytic enzyme having immense applications in therapeutic areas which have been validated by several *in vitro*, *in vivo,* and clinical studies as well as through anecdotal evidences. These applications are attributable to its versatile properties including anti-inflammatory, anti-biofilm, analgesic, anti-edemic, and fibrinolytic effects. The significant impact of serratiopeptidase reported needs to be backed by more scientific data. This review encompasses the details of therapeutic applications of serratiopeptidase based on available *in vitro*, *in vivo,* and clinical studies. We found some strong evidences regarding the efficacy of serratiopeptidase. However data on safety, tolerability, and its mechanism of action need detailing. This review aims to further explore the available literature on serratiopeptidase as well as provide scientific details for existing applications.

Biotechnol Rep (Amst)
Biotechnol Rep (Amst)

- It can modify the virulent phenotype of bacteria in biofilms
- It is effective against mature biofilms
- It enhances the bactericidal effect of antibiotics against bacterial biofilms
- Anti-inflammatory, anti-biofilm, analgesic, anti-edemic, and fibrinolytic effects
- Serratiopeptidase is widely used in Japan and Europe as the anti-inflammatory and pain treatment of choice

Serrapeptase

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Review

The role of serratiopeptidase in the resolution of inflammation

Manju Tiwari

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https://doi.org/10.1016/j.ajps.2017.01.003

Abstract

Inflammation remains a key event during most of the diseases and physiological imbalance. Acute inflammation is an essential physiological event by immune system for a protective measure to remove cause of inflammation and failure of resolution lead to chronic inflammation. Over a period of time, a number of drugs mostly chemical have been deployed to combat acute and chronic inflammation. Recently, enzyme based anti-inflammatory drugs became popular over conventional chemical based drugs. Serratiopeptidase, a proteolytic enzyme from trypsin family, possesses tremendous scope in combating inflammation. Serine protease possesses a higher affinity for cyclooxygenase (COX-I and COX-II), a key enzyme associated with production of different inflammatory mediators including interleukins (IL), prostaglandins (PGs) and thromboxane (TXs) etc. Currently, arthritis, sinusitis, bronchitis, fibrocystic breast disease, and carpal tunnel syndrome, etc. are the leading inflammatory disorders that affected the entire the globe. In order to conquer inflammation, both acute and chronic world, physician mostly relies on conventional drugs. The most common drugs to combat acute inflammation are

A 2017 review established that serrapeptase was able to block the enzymes responsible for triggering painful inflammatory responses. It was observed that serrapeptase did this just as effectively as other commonly used COX-I inhibitor drugs, including naproxen

Low Grade Inflammation

World J Gastroenterol. 2010 Mar 7; 16(9): 1057–1062.
Published online 2010 Mar 7. doi: 10.3748/wjg.v16.i9.1057
PMCID: PMC2835780
PMID: 20205274

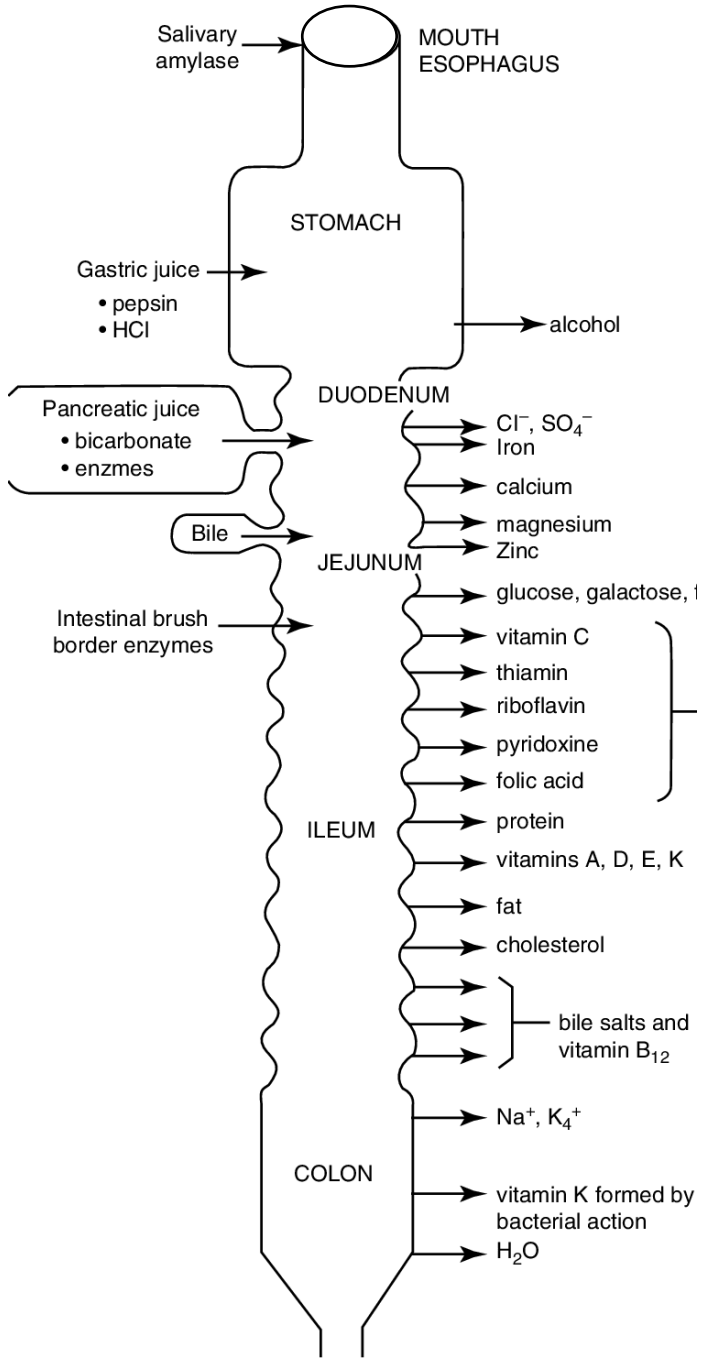
Even low-grade inflammation impacts on small intestinal function

Katri Peuhkuri, Heikki Vapaatalo, and Riitta Korpela

Abstract

Go to: ▸

Independent of the cause and location, inflammation - even when minimal - has clear effects on gastrointestinal morphology and function. These result in altered digestion, absorption and barrier function. There is evidence of reduced villus height and crypt depth, increased permeability, as well as altered sugar and peptide absorption in the small intestine after induction of inflammation in experimental models, which is supported by some clinical data. Identification of inflammatory factors which may promote the process of gastrointestinal dysfunction as well as clinical research to verify experimental observations of inflammatory modulation of gastrointestinal function are required. Moreover, nutritional strategies to support functional restitution are needed.



Leaky Gut

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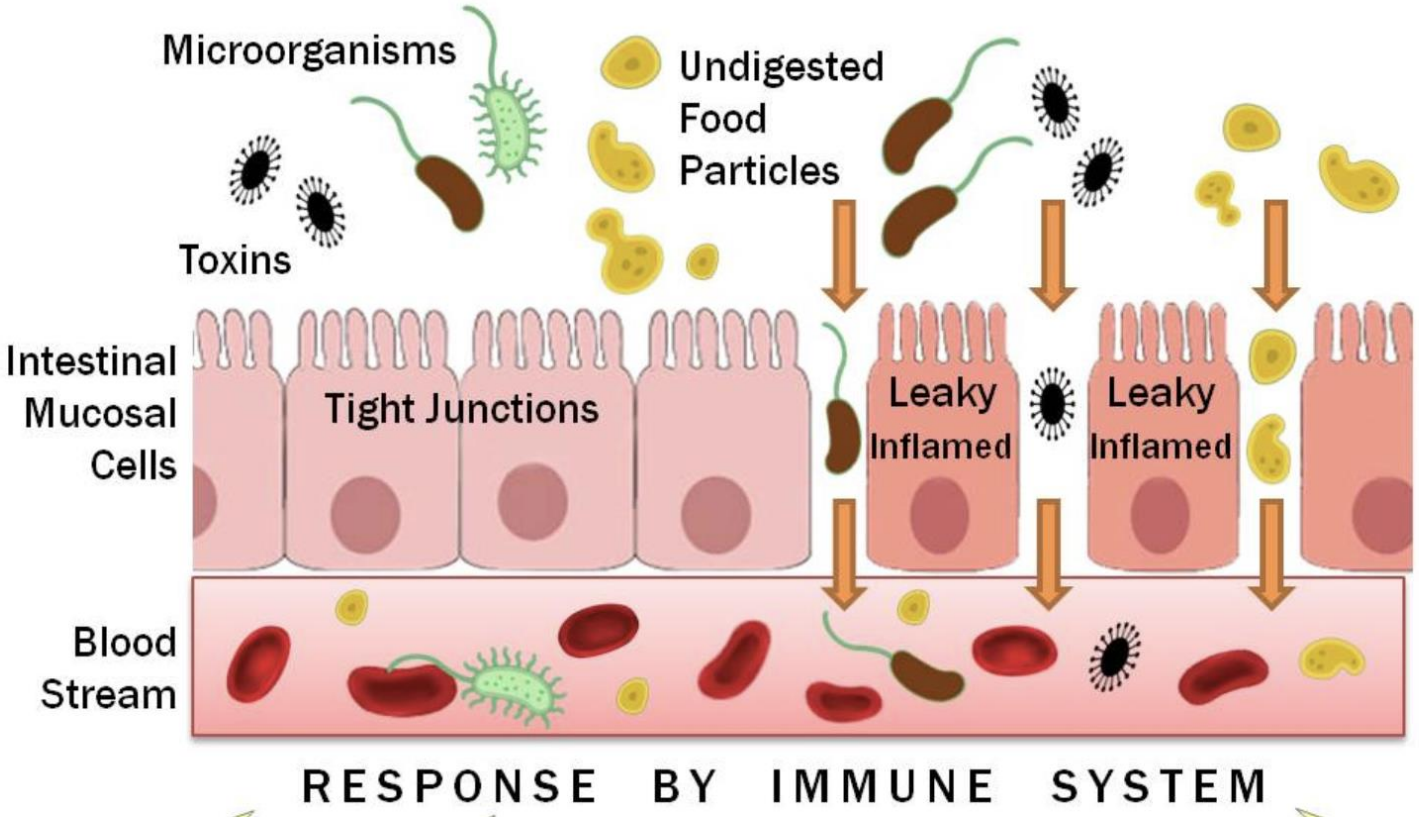
EXCEPTIONAL ENZYME FORMULAS



Bacteriostatic effect of the stomach

Enzyme insufficiency

Protein & Stomach Acid / Chewing

Candida / SIBO Biofilms

Relationship with enzymatic function

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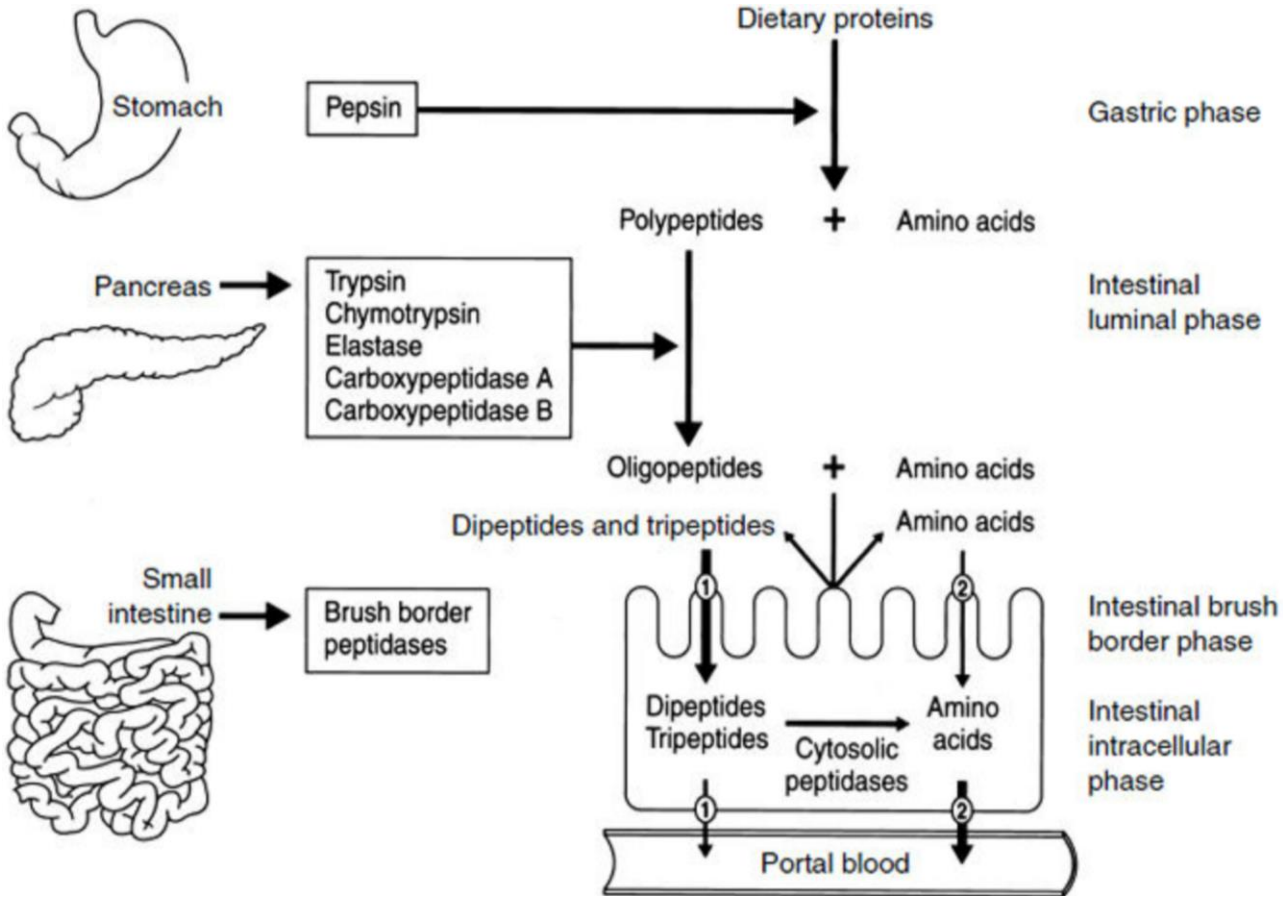
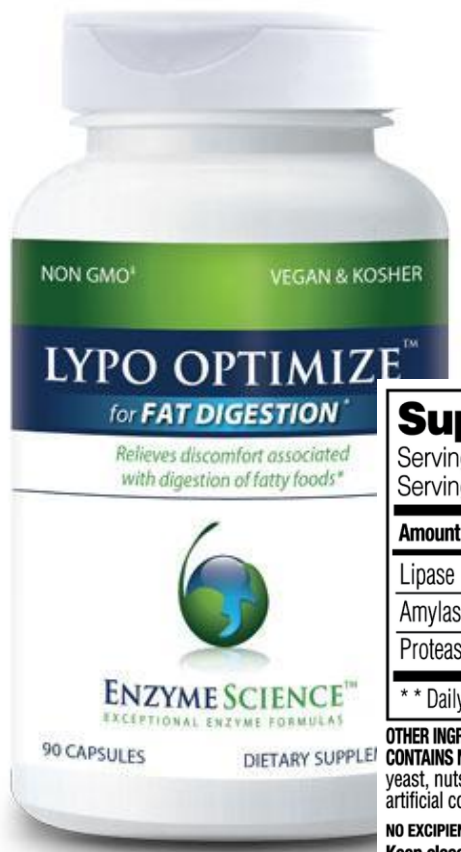


Popular digestive support



Supplement Facts

Serving Size: 1 Capsule
Servings Per Container: 90

Amount Per Serving		%DV
Lipase *Thera-blend™*	15,000 FIP	* *
Amylase *Thera-blend™*	9,000 DU	* *
Protease *Thera-blend™*	25,000 HUT	* *

* * Daily Value not established

OTHER INGREDIENTS: 100% Vegetarian Capsule (cellulose, water)
CONTAINS NO egg, dairy, preservatives, salt, sucrose, soy, wheat, yeast, nuts, corn, gluten, casein, potato, rice, artificial colors or flavors.

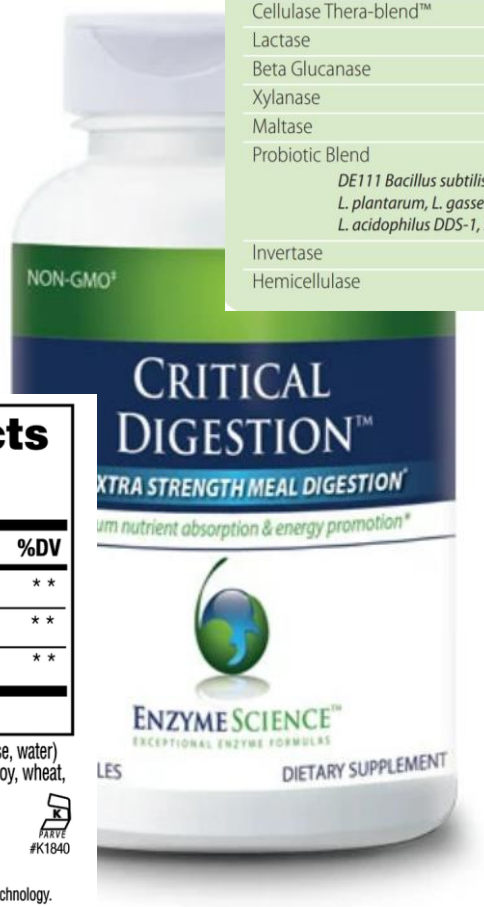
PARVE #K1840

NO EXCIPIENTS, BINDERS, OR FILLERS
Keep closed in dry place; avoid excessive heat.
‡Enzyme Science™ does not use ingredients produced using biotechnology.

PLEASE KEEP OUT OF REACH OF CHILDREN

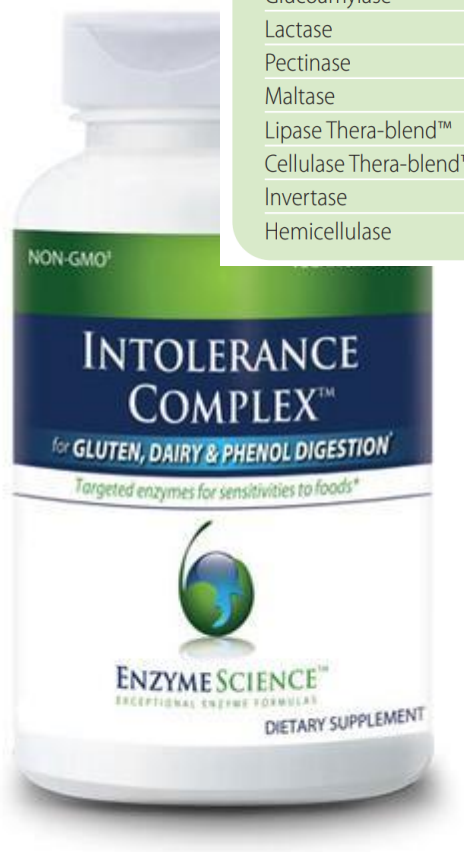
Supports People and Planet
www.enzyscience.com

Manufactured by Enzyme Science™
771 Commerce Drive, Venice, FL 34292-1731
Toll-free: 1.855.281.7246 www.enzyscience.com



Supplement Facts

Amylase Thera-blend™	23,500 DU
Protease Thera-blend™	75,000 HUT
ATPro™ Blend	78 mg
Magnesium Citrate, CoQ10, Phytase, ATP	
Glucoamylase	50 AGU
DPP-IV	250 DPPU
Lipase Thera-blend™	4,000 FIP
Alpha Galactosidase	500 GalU
Pectinase	150 Endo-PGU
Cellulase Thera-blend™	1,500 CU
Lactase	900 ALU
Beta Glucanase	25 BGU
Xylanase	1,000 XU
Maltase	200 DP°
Probiotic Blend	1 Billion CFU
DE111 Bacillus subtilis, Lactobacillus paracasei, L. plantarum, L. gasseri, L. rhamnosus, L. casei, L. acidophilus DDS-1, L. bulgaricus	
Invertase	535 SU
Hemicellulase	50 HCU



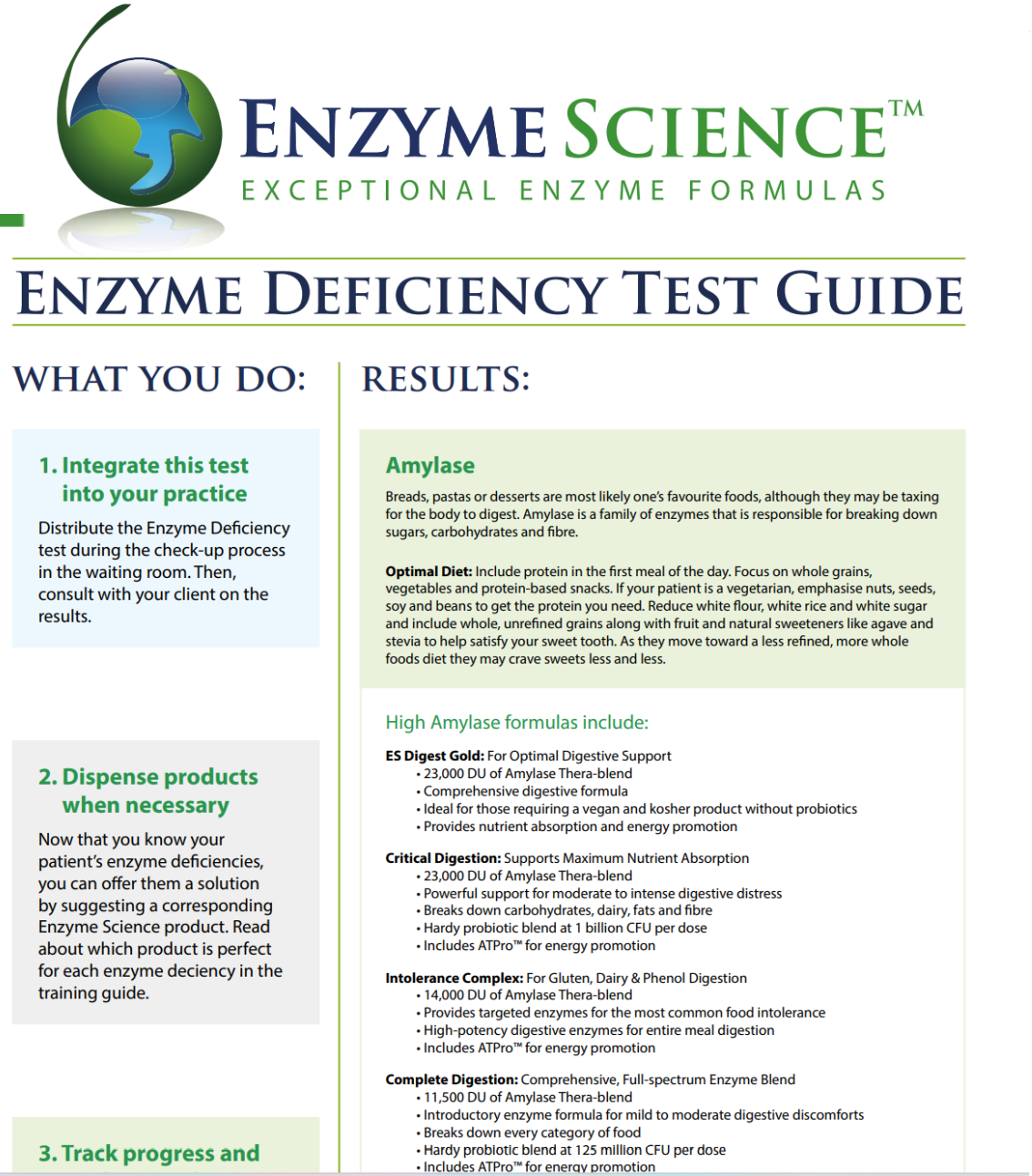
Supplement Facts

DPP-IV	2,000 DPPU
Xylanase	30,000 XU
Protease Thera-blend™	140,000 HUT
ATPro™ Blend	156 mg
Magnesium Citrate, CoQ10, Phytase, ATP	
Amylase Thera-blend™	14,000 DU
Alpha Galactosidase	1,200 GalU
Glucoamylase	40 AGU
Lactase	3,000 ALU
Pectinase	50 Endo-PGU
Maltase	200 DP°
Lipase Thera-blend™	800 FIP
Cellulase Thera-blend™	400 CU
Invertase	150 SU
Hemicellulase	50 HCU

Any questions?

www.EnzymeScience.co.uk

Register for a practitioner account for our practitioner resource pack, training, information and discounts on products and to access recordings and clinical support



ENZYME SCIENCE™
EXCEPTIONAL ENZYME FORMULAS

ENZYME DEFICIENCY TEST GUIDE

WHAT YOU DO:

1. Integrate this test into your practice

Distribute the Enzyme Deficiency test during the check-up process in the waiting room. Then, consult with your client on the results.

2. Dispense products when necessary

Now that you know your patient's enzyme deficiencies, you can offer them a solution by suggesting a corresponding Enzyme Science product. Read about which product is perfect for each enzyme deciency in the training guide.

3. Track progress and

RESULTS:

Amylase

Breads, pastas or desserts are most likely one's favourite foods, although they may be taxing for the body to digest. Amylase is a family of enzymes that is responsible for breaking down sugars, carbohydrates and fibre.

Optimal Diet: Include protein in the first meal of the day. Focus on whole grains, vegetables and protein-based snacks. If your patient is a vegetarian, emphasise nuts, seeds, soy and beans to get the protein you need. Reduce white flour, white rice and white sugar and include whole, unrefined grains along with fruit and natural sweeteners like agave and stevia to help satisfy your sweet tooth. As they move toward a less refined, more whole foods diet they may crave sweets less and less.

High Amylase formulas include:

ES Digest Gold: For Optimal Digestive Support
- 23,000 DU of Amylase Thera-blend
- Comprehensive digestive formula
- Ideal for those requiring a vegan and kosher product without probiotics
- Provides nutrient absorption and energy promotion

Critical Digestion: Supports Maximum Nutrient Absorption
- 23,000 DU of Amylase Thera-blend
- Powerful support for moderate to intense digestive distress
- Breaks down carbohydrates, dairy, fats and fibre
- Hardy probiotic blend at 1 billion CFU per dose
- Includes ATPro™ for energy promotion

Intolerance Complex: For Gluten, Dairy & Phenol Digestion
- 14,000 DU of Amylase Thera-blend
- Provides targeted enzymes for the most common food intolerance
- High-potency digestive enzymes for entire meal digestion
- Includes ATPro™ for energy promotion

Complete Digestion: Comprehensive, Full-spectrum Enzyme Blend
- 11,500 DU of Amylase Thera-blend
- Introductory enzyme formula for mild to moderate digestive discomforts
- Breaks down every category of food
- Hardy probiotic blend at 125 million CFU per dose
- Includes ATPro™ for energy promotion