

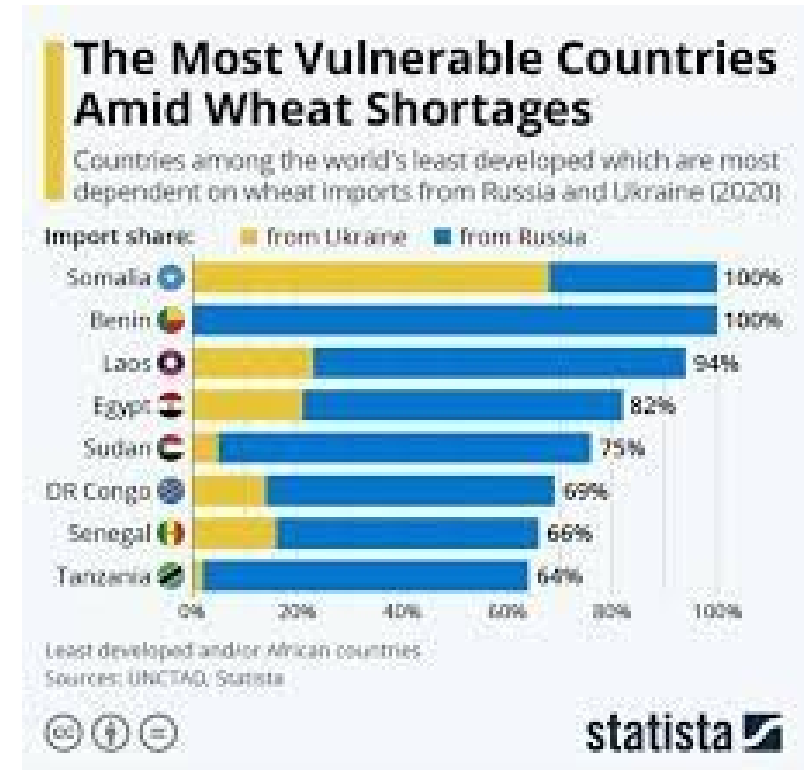
# Germination inhibitors and zonulin - keys to understanding the impact of wheat on human health

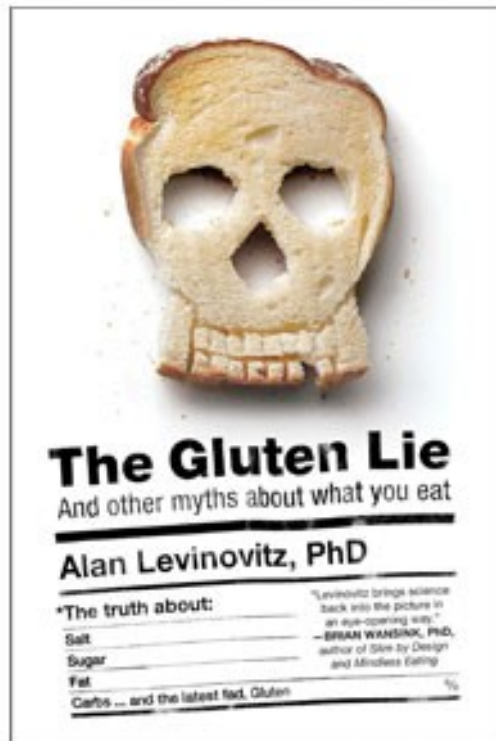


“Nordic Heritage Grain Conference  
Järna  
June 26-28<sup>th</sup> 2023

Anders Borgen

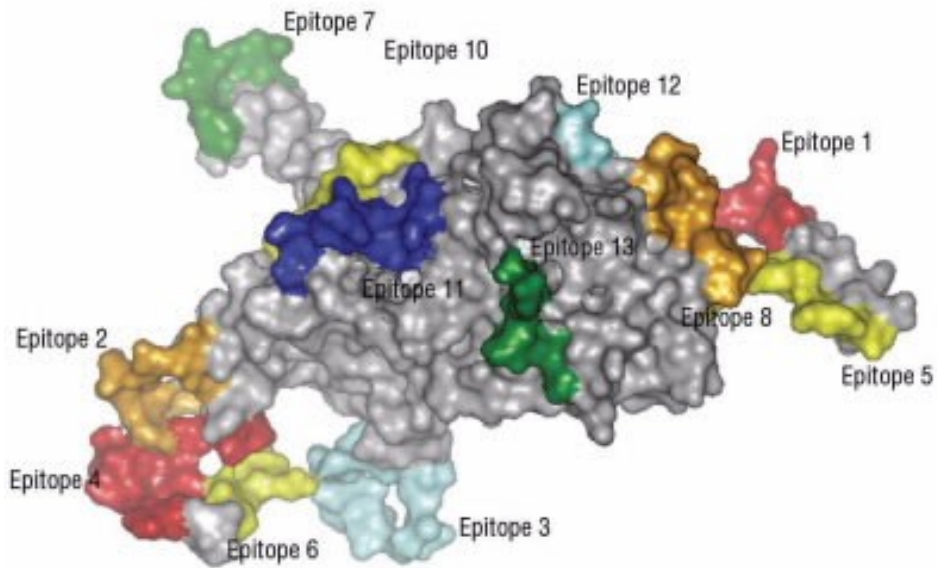
# 20% of our diet is wheat, and the rest are other grains and a few vegetables and meat





- 11.000 years ago, humans changed into grain based diet, resulting in
  - reduced age, reduced height (11cm), cardiovascular diseases, cancer, rheumatism, allergies, autoimmune diseases, dental caries
  - increased fertility and population
  - increased violence and work load
- In the past decades, lifestyle diseases incl. celiac and NCGS increase epidemically

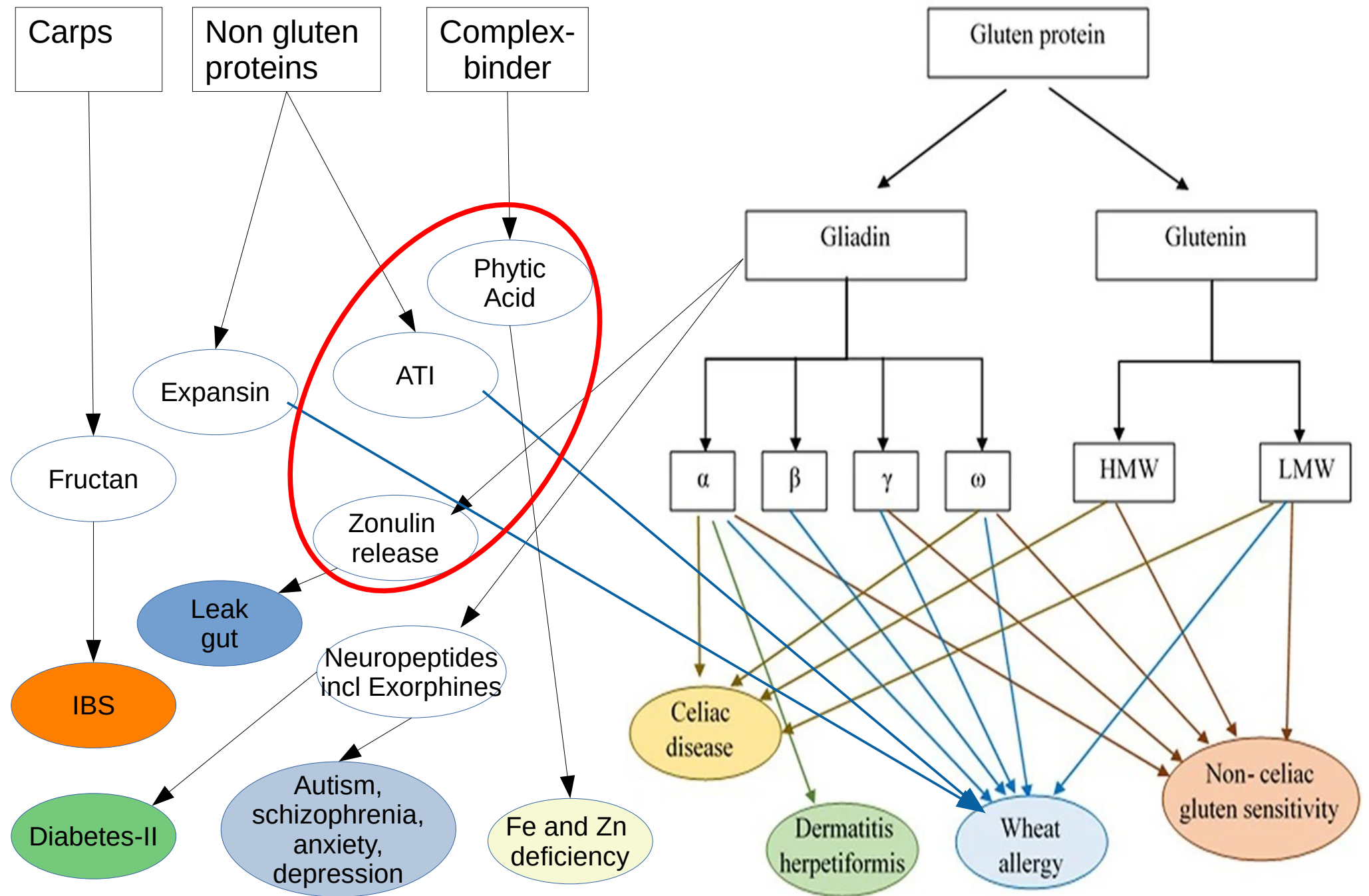
Biochemically, there is no end to the list of anti-nutrients in wheat...



- neuropeptides (wheat morphine)
- allergenic epitopes
- digestion inhibitors
- FODMAPs

....leading to or worsening all kind of noxious diseases, including many different allergic and autoimmune reactions, autism, schizophrenia, celiac, IBS, diabetes-I, mineral deficiency.....

# Anti-nutrients in wheat



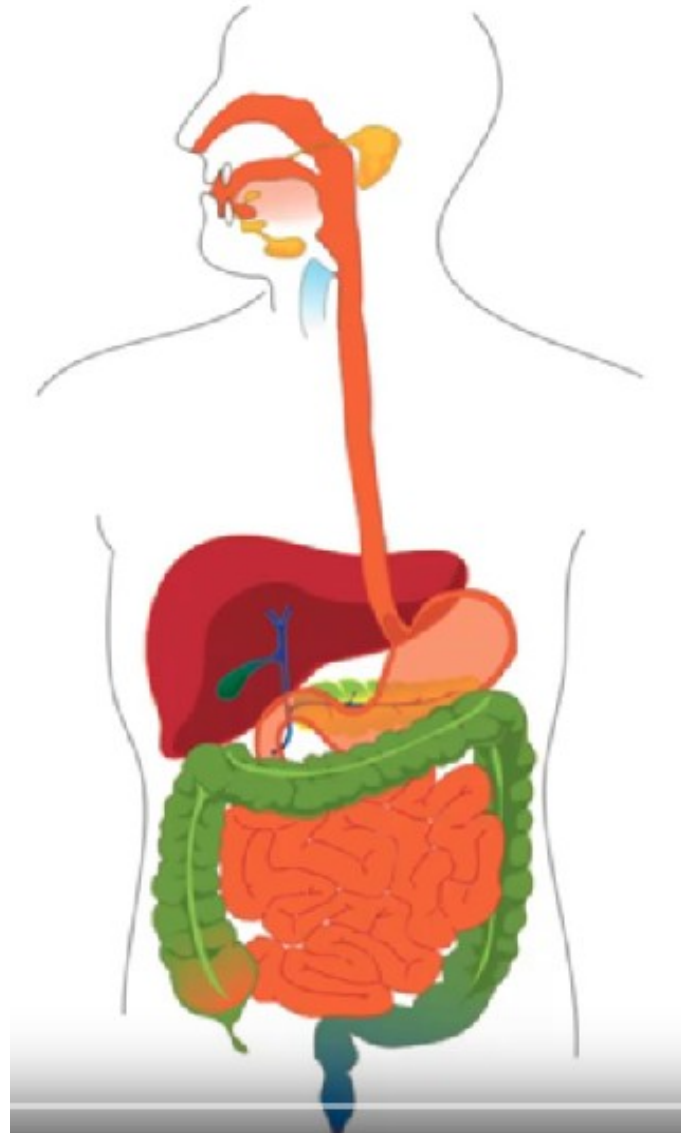
# Zonulin



- **Gluten increases production of Zonulins**
- **Zonulins directly affect tight junction (paracellular) intestinal permeability**
- **Increase in zonulins increases overall permeability**



# Our digestion system



- Food is reduced to sugar and amino acids in the stomach and duodenum
- Proteins and peptides cannot pass the intestinal wall

However,

- 1) not all proteins are fully digested, and
- 2) some peptides can pass into the bloodstream through the tight junctions



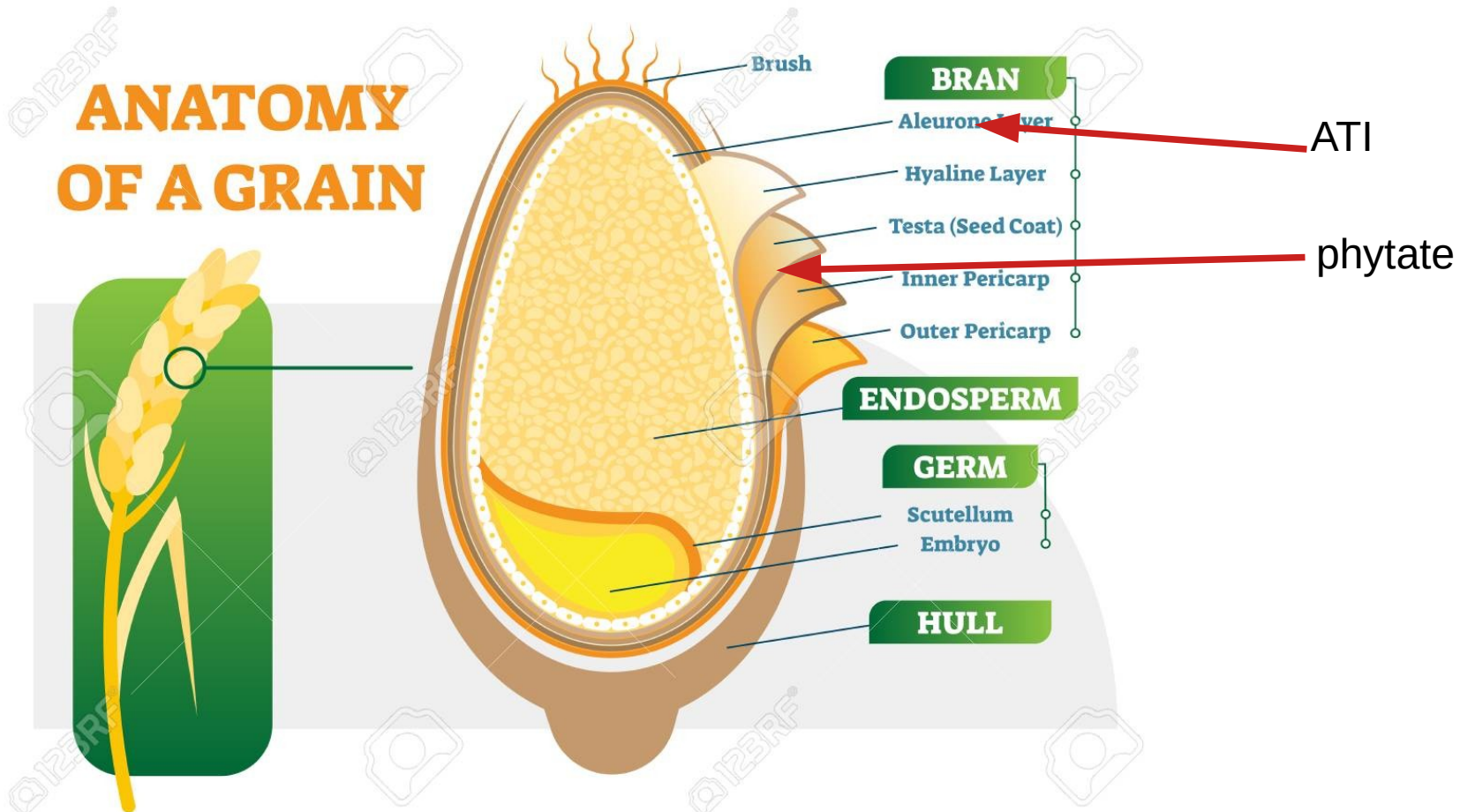
# Most wheat related diseases are increasing in pandemic scale in modern societies

- 1) decreased digestibility
- 2) increased gut permeability
- 3) (minor effects of genetic changes in wheat)

# Why is digestibility decreasing?

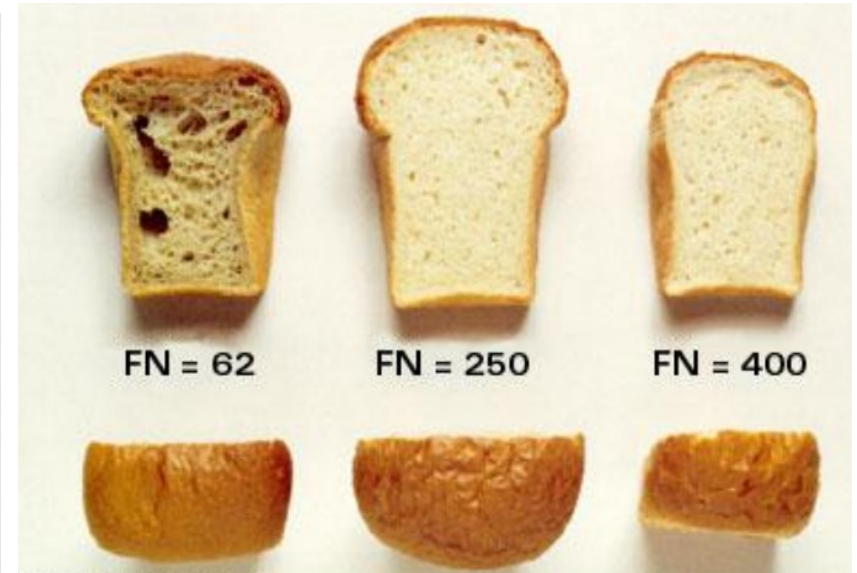
- Improved Falling number, preserving germination inhibitors (=digestion inhibitors)
  - Phytic acid (mineral binding)
  - ATI (enzyme inhibitor)
  - Polyphenols
- Reduced fermentation time in bakeries
  - yeast vs sour-dough
  - industrial bakery enzymes
- Reduced intake of dietary fibre
  - reducing residence time in the stomach and gut

# Whole grain and fibres



Crucial for human health, but with a potential side-effect

# Falling number



Crucial for baking quality, but with a potential side-effect

# Digestion of bread

By sifting we remove:  
Bran, incl. minerals and antioxidant  
Aleuleuron (protease)  
Germ, incl vitamins and omega-3

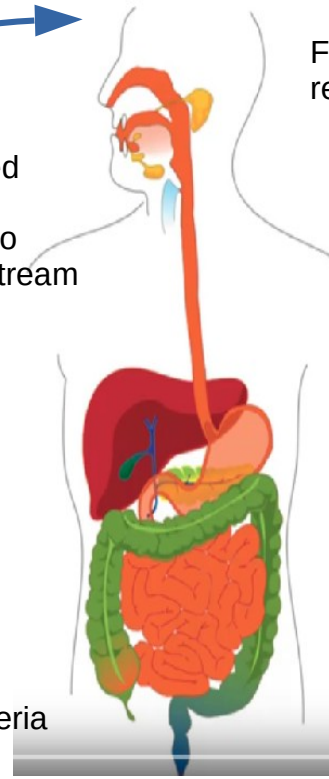
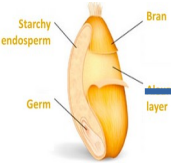
Breakdown of protein into peptides only if given enough time

Fibres prolongs resting time

Not digested peptides may slip into the blood stream if opened by zonulin

Gliadin triggers zonulin, opening gut-blood barrier and brain barrier

as does our life style such as sleep depression NSAID and fructose



Phytate  
ATI  
Expansin  
Exorphins  
Gliadin  
Glutenin

Breakdown starts when water is added, but is blocked by ATI

even worse if Vital-gluten is added without protease

Enzymes denatures when baking starts and break down stops until consumption

Fructan feeds bacteria but may release gas

# Lifestyle affecting gut permeability

- Fructose HFCS (activates zonulin and cause inflammation)
- NSAID (ibuprofen) (activates zonulin)
- Sleep depression (activates zonulin)
- Stress (activates zonulin)
- Omega-6 fatty acid (activates general immune response)  
(a few decades ago, our animals changed from grass based diet to grain based diet, resulting in further decrease in omega-3 and increase in life style diseases)

# Wheat varieties with altered health profile

- **Minerett:** Low content of Gliadin- $\alpha$ 9
- **Cadenza:** Low content of Gliadin- $\alpha$ 9 and Gliadin- $\alpha$ 20
- **Goldritter:** Low content of ATI
- **E3-spelt:** Low content of expansin and fructan
- **Purpurhvede:** High content of anthocyanin in the bran
- **Blå hvede:** High content of anthocyanin in aleuron
- **Gul hvede:** High content of lutein in endosperm
- **Yumai and Courtot:** High content of arabinoxylan

# Conclusion

Factors explaining increased intolerance of wheat

- 1) Maybe increased content of problematic substances in wheat due to breeding
- 2) Decreased breakdown of problematic substances in both processing and digestion
- 3) Increased susceptibility of problematic substances due to live style
- 4) Wheat is a nutritious foodstuff, but it should be processed with more caution in the context of our lifestyle.





Tank you for your attention

- <https://www.agrologica.dk/filer/publikationer/Health2020.pdf>
- <https://landsorten.dk/>
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