

THE EFFECTS OF MYCOTOXINS ON PHEASANT HEALTH

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THE MYCOTOXIN CHALLENGE

- Mycotoxins are 'fungal metabolites which when ingested, inhaled, or absorbed through the skin cause decreased performance, sickness or death in man or animals, including birds' (Pitt, 1996)
- Mycotoxin = Greek word for fungus: « Mykes »
+ Latin word for poison: « toxicum »
- Any potential toxic substance produced by molds secondary metabolism

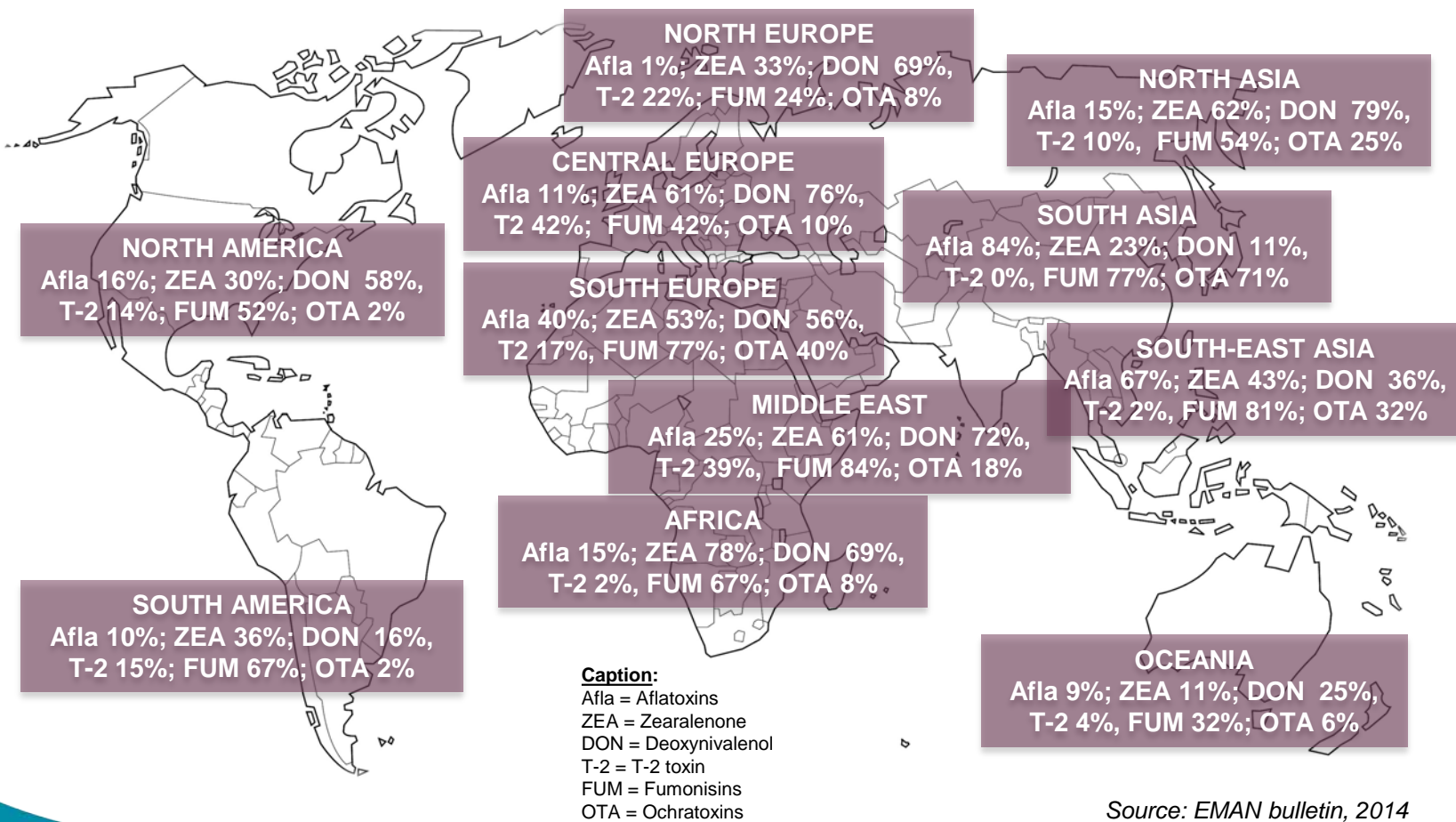


Mycotoxins are a high potential threat to human and animal health through the ingestion of food or feed prepared from infected commodities.

THE MYCOTOXIN CHALLENGE

MYCOTOXINS... ALL AROUND!!!

MYCOTOXIN RISK



Source: EMAN bulletin, 2014

THE MYCOTOXIN CHALLENGE

- Aflatoxins are very toxic as it reduce the protein synthesis in the liver. It also reduces the coloration of eggs (lower pigments absorption).
- Birds are very sensitive to ochratoxins, it is considered 3 times more toxic than aflatoxins.

MYCOTOXIN RISK

Aflatoxins

Immune depression
Limited productivity
Legs problems
Poor fertility / Lower hatchability



Ochratoxins

Immune depression
Renal lesions
Liver troubles
Higher feed conversion ratio
Low productivity

Caption:

XXX = field mycotoxins

XXX = storage mycotoxins

THE MYCOTOXIN CHALLENGE

Zearalenones

Hyperestrogenia
Poor fertility / Lower hatchability

Fumonisin

Immune depression
Gastrointestinal disturbances
High feed conversion ratio
Pulmonary edema
Liver toxicity

Trichothecenes (DON, T-2, HT-2)

Immune depression
Gastrointestinal disturbances
High feed conversion ratio
Decreased feed consumption
Dermal lesions
Alteration of eggs production and quality



- Birds are very sensitive to the hepatotoxicity of fumonisins.
- Type A-trichothecenes increase the lipid solubility leading to the modification of cells membranes
→ ex : oral lesions with 0.4mg/kg T2; Devegowda and Murthy, 2005
- Type B-trichothecenes provoke important alterations of the intestinal epithelium (Chi and Mirocha, 1978; Diaz et al, 1994; Allen et al, 1982)









































Caption:

XXX = field mycotoxins

XXX = storage mycotoxins

THE MYCOTOXIN CHALLENGE

TRICHTHOCENES FOCUS

Type	Type B-trichothecenes			Type A-trichothecenes		
MYCOTOXIN	3ADON	DON	15ADON/NIV	MAS	T-2/HT-2	DAS
TOXICITY (DON Equivalent)	0,5 DON	1 DON	2 DON	2,5 DON	5 DON	10 DON
	+ —————> ++					
SENSITIVITY						
++						
+						
+						
+						
FEED PRODUCTS AT RISK						
++						
+						
+						

DUCKS > TURKEYS > PHEASANTS > CHICKEN

THE MYCOTOXIN CHALLENGE

HOW DO MYCOTOXINS ALTER ANIMAL'S HEALTH AND PERFORMANCE?

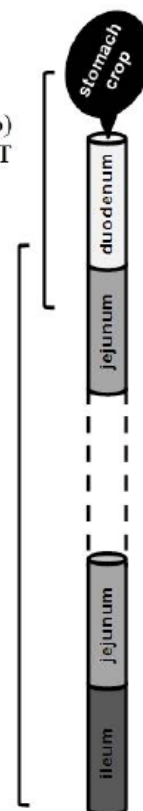
- ✓ Birds are considered to be less sensitive to mycotoxins as they absorbed 3 to 10 time less mycotoxins.
- ✓ Nevertheless, this implies that the lumen of the GIT may be exposed to high concentrations of toxins.

Most of the absorbed dose (80-90%) occur in the upper part of the GIT

- ✓ DON
- ✓ ZEA
- ✓ AF
- ✓ OTA

Enterohepatic circulation may increase the exposure all along the GIT

- ✓ DON
- ✓ T-2 toxin
- ✓ ZEA
- ✓ FB
- ✓ OTA



Percent absorbed

	Pig	Poultry
<i>AF</i>	>80%	>80%
<i>OTA</i>	65%	40%
<i>DON</i>	55%	5-20%
<i>FB</i>	3-6%	1%

Mechanism and route of uptake

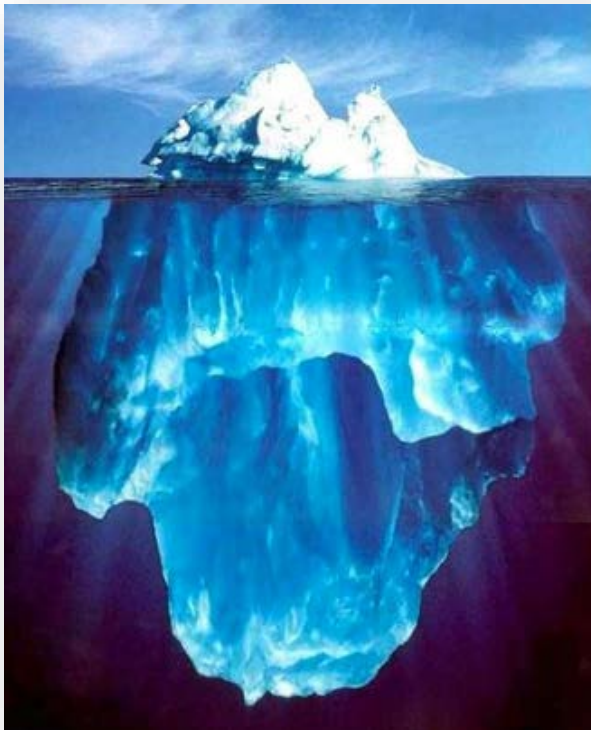
<i>AF</i>	Passive transport
<i>OTA</i>	Passive transport by simple diffusion
<i>DON</i>	Passive transport via the paracellular route
<i>FB</i>	Interaction with bile components

Extracted from Grenier and Applegate, 2013

THE MYCOTOXIN CHALLENGE

HOW DO MYCOTOXINS ALTER ANIMAL'S HEALTH AND PERFORMANCE?

MYCOTOXIN RISK



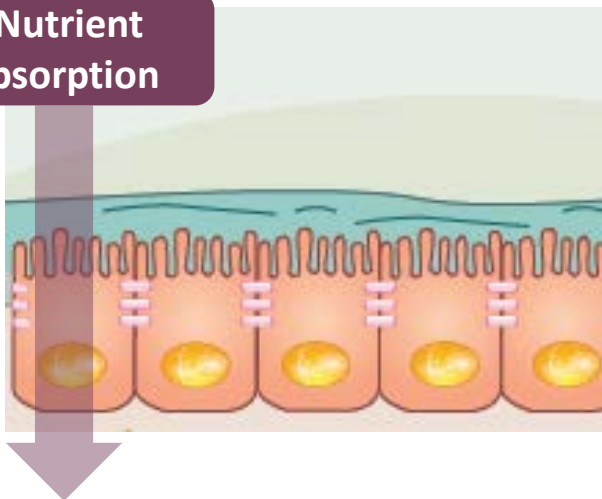
Visible part : acute intoxication

Hidden part:
subintoxication or chronic intoxications

This is now widely considered to be the most important impact of mycotoxins, particularly in developing countries. (FAO, 2001)

IMPACT OF MYCOTOXINS ON INTESTINAL FUNCTIONS

Nutrient
absorption



THE MYCOTOXIN CHALLENGE

HOW DO MYCOTOXINS ALTER ANIMAL'S HEALTH AND PERFORMANCE?

Nutrient
absorption

Deoxynivalenol (DON)

Inhibitor of protein synthesis



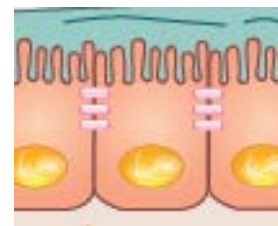
Decreases villus height



Lower absorptive surface area

**Reduces nutrient absorption
that alters FCR**

Adapted from Grenier and Applegate, 2013



THE MYCOTOXIN CHALLENGE

HOW DO MYCOTOXINS ALTER ANIMAL'S HEALTH AND PERFORMANCE?

Nutrient
absorption

Fumonisin (FUM)

Inhibitor of lipids synthesis



Decreases epithelial cells proliferation



Decreases villus height

**Reduces nutrient absorption
that alters FCR**

Adapted from Pinton et al, 2012

Villus height (μm)	CONTROL	FB1
Proximal jejunum	300 ±16 ^a	259 ±17 ^b
Median jejunum	321 ±13 ^a	259 ±21 ^b
Distal jejunum	265 ±13 ^a	182 ±13 ^b

THE MYCOTOXIN CHALLENGE

HOW DO MYCOTOXINS ALTER ANIMAL'S HEALTH AND PERFORMANCE?

Nutrient
absorption

DON damages epithelial cells



FUMONISINS reduces cell proliferation



SYNERGISTIC EFFECTS ON VILLUS HEIGHT
= less nutrients absorption surface

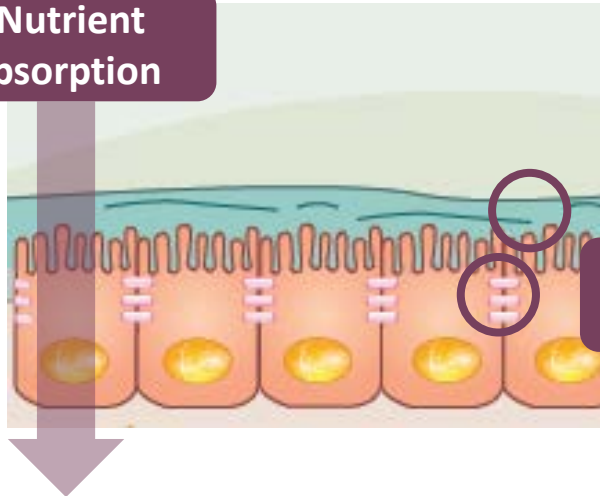
From Pinton et al, 2012 ; Grenier and Applegate, 2013

THE MYCOTOXIN CHALLENGE

HOW DO MYCOTOXINS ALTER ANIMAL'S HEALTH AND PERFORMANCE?

IMPACT OF MYCOTOXINS ON INTESTINAL FUNCTIONS

Nutrient
absorption



Barrier
integrity

THE MYCOTOXIN CHALLENGE

HOW DO MYCOTOXINS ALTER ANIMAL'S HEALTH AND PERFORMANCE?

Barrier integrity

Mycotoxins, especially DON have the ability to increase intestinal permeability.

DON and FB1



Activation of MAPK

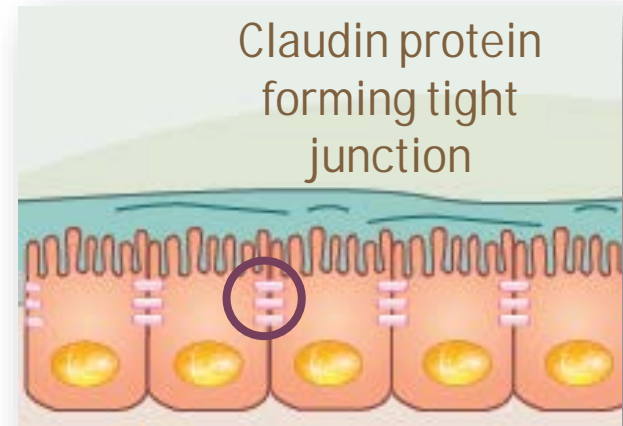


↓ of claudin expression



Open tight junction proteins

↘ **Intestinal barrier function**



Extracted from Grenier and Applegate, 2013

THE MYCOTOXIN CHALLENGE

HOW DO MYCOTOXINS ALTER ANIMAL'S HEALTH AND PERFORMANCE?

Barrier
integrity

DON + T-2



Reduction of the number
of goblets cells



↘ Mucus production

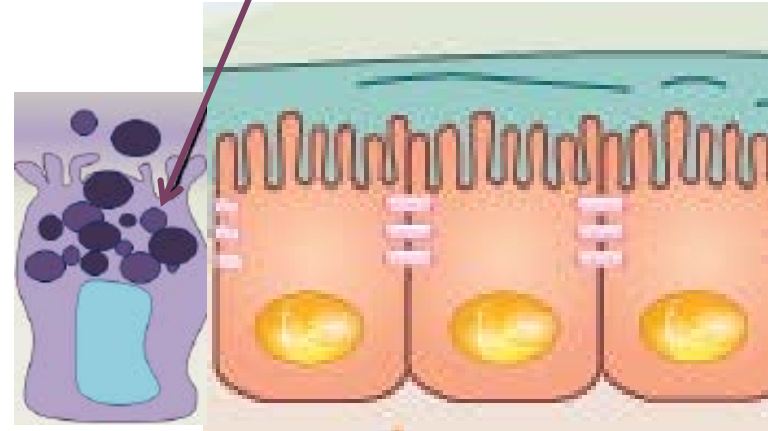


↘ TEER

(transepithelial electrical resistance)

↗ **intestinal disorders**

Goblets cells
producing mucus



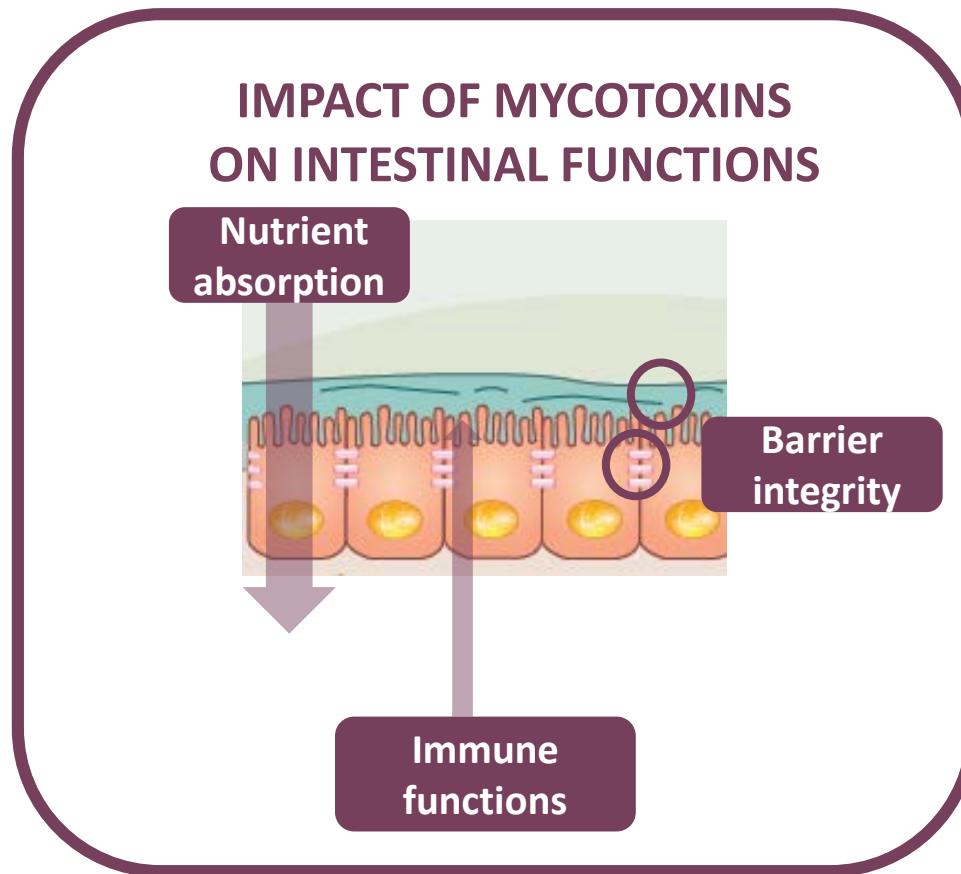
Extracted from Antonissen et al., 2014

Maresca et al., 2013

THE MYCOTOXIN CHALLENGE

HOW DO MYCOTOXINS ALTER ANIMAL'S HEALTH AND PERFORMANCE?

MYCOTOXIN RISK



THE MYCOTOXIN CHALLENGE

HOW DO MYCOTOXINS ALTER ANIMAL'S HEALTH AND PERFORMANCE?

Immune functions

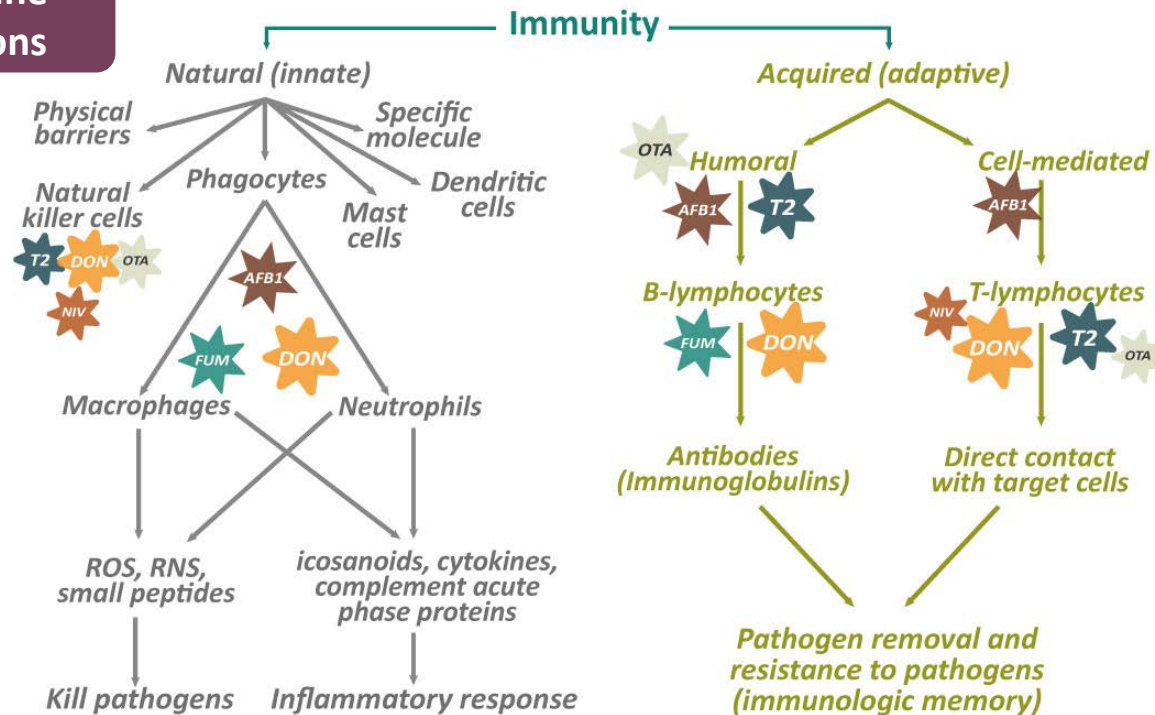
MYCOTOXIN RISK

- Mycotoxins are one of the most immunosuppressive factors coming from feed (Surai and Dvorska, 2005)
- **Mycotoxins leading to immune depression** (in descending order) (Devegowda and Murphy, 2005)
 1. Aflatoxins
 2. T-2, HT-2, DON
 3. OTA
 4. FUM
- It is estimated that **up to 70% of the immune defenses of the organism are located in the intestine.**

THE MYCOTOXIN CHALLENGE

HOW DO MYCOTOXINS ALTER ANIMAL'S HEALTH AND PERFORMANCE?

Immune functions



THE MYCOTOXIN CHALLENGE

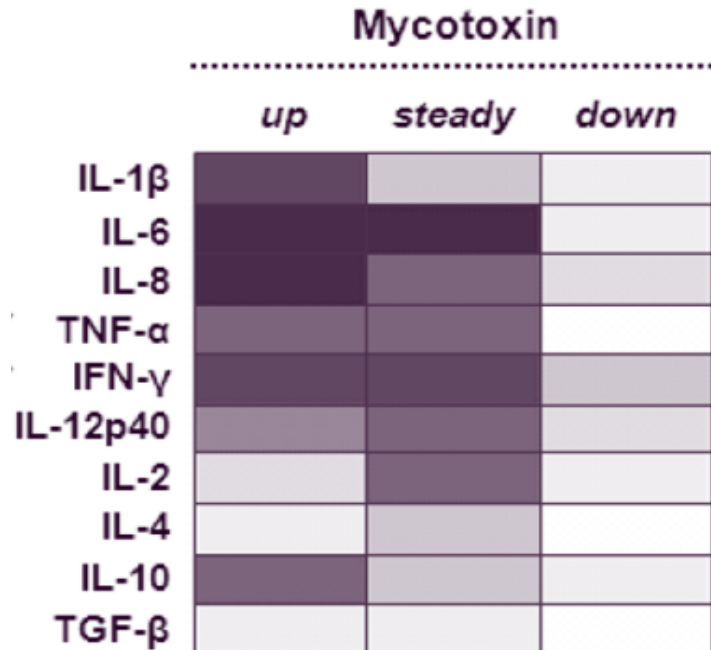
HOW DO MYCOTOXINS ALTER ANIMAL'S HEALTH AND PERFORMANCE?

Immune
functions

pro-inflammatory
cytokines

Th1 signature

Th2 & T-reg signature



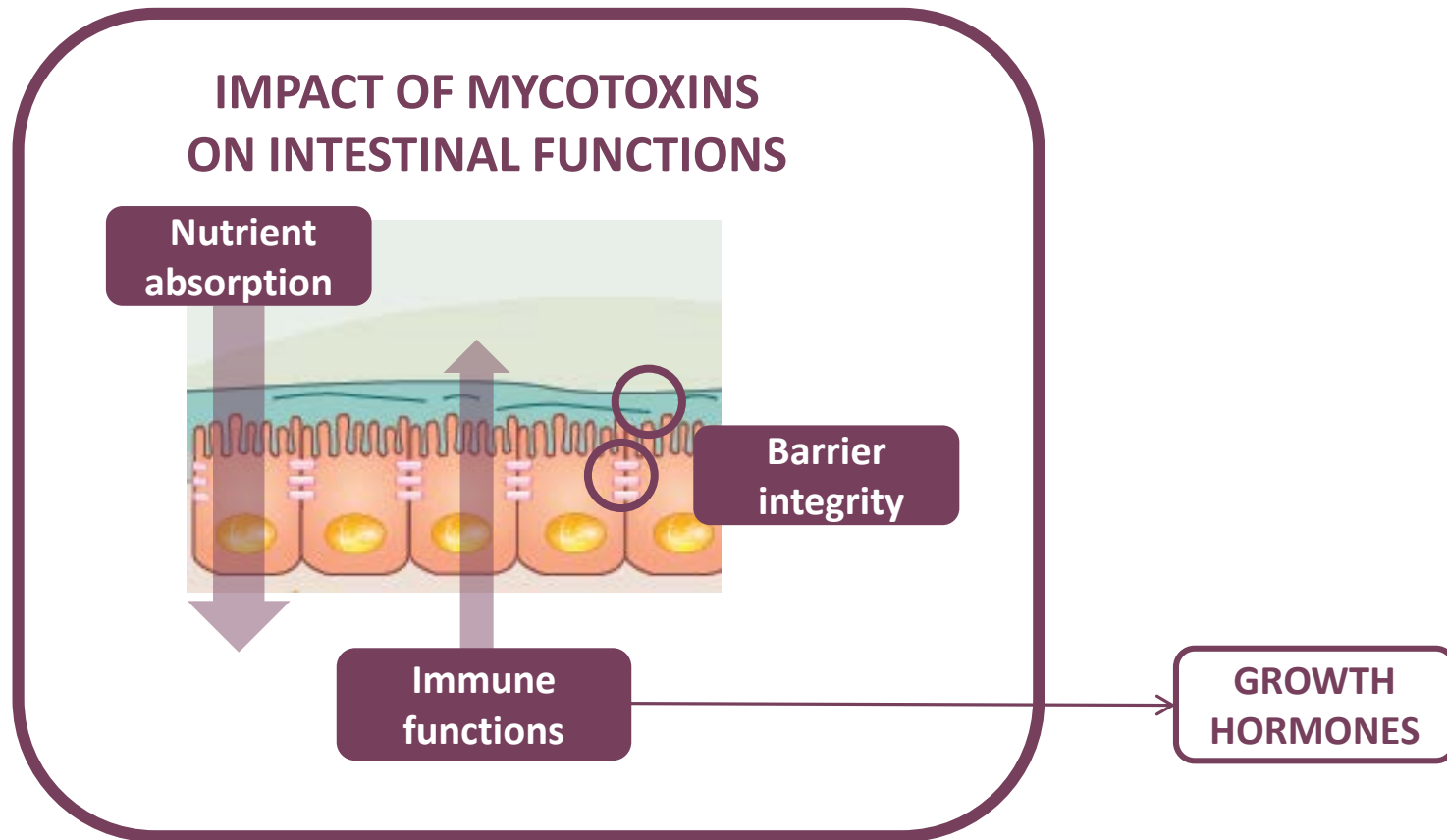
Heat map of mycotoxins interaction with gut epithelium
(Grenier and Applegate, 2013)

Effects of DON on pro-inflammatory cytokines are the most important ones

THE MYCOTOXIN CHALLENGE

HOW DO MYCOTOXINS ALTER ANIMAL'S HEALTH AND PERFORMANCE?

MYCOTOXIN RISK



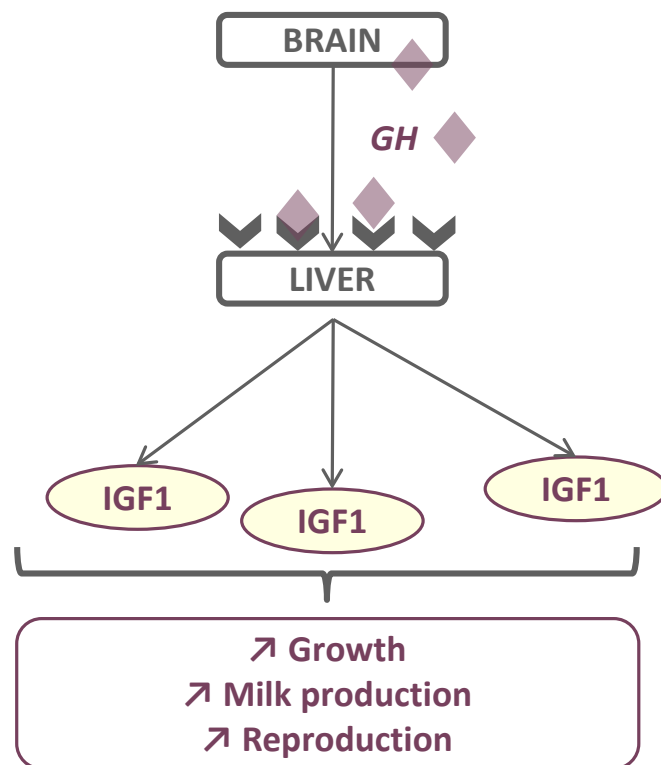
THE MYCOTOXIN CHALLENGE

HOW DO MYCOTOXINS ALTER ANIMAL'S HEALTH AND PERFORMANCE?

GROWTH HORMONES

What is IGF1?

- Insulin-like Growth Factor 1
- IGF1 mediates many actions of growth hormone and stimulates cell replication, cell differentiation and the synthesis of cellular products.
- As for their biological effects, in general, IGF1 is mainly responsible for cells multiplication.

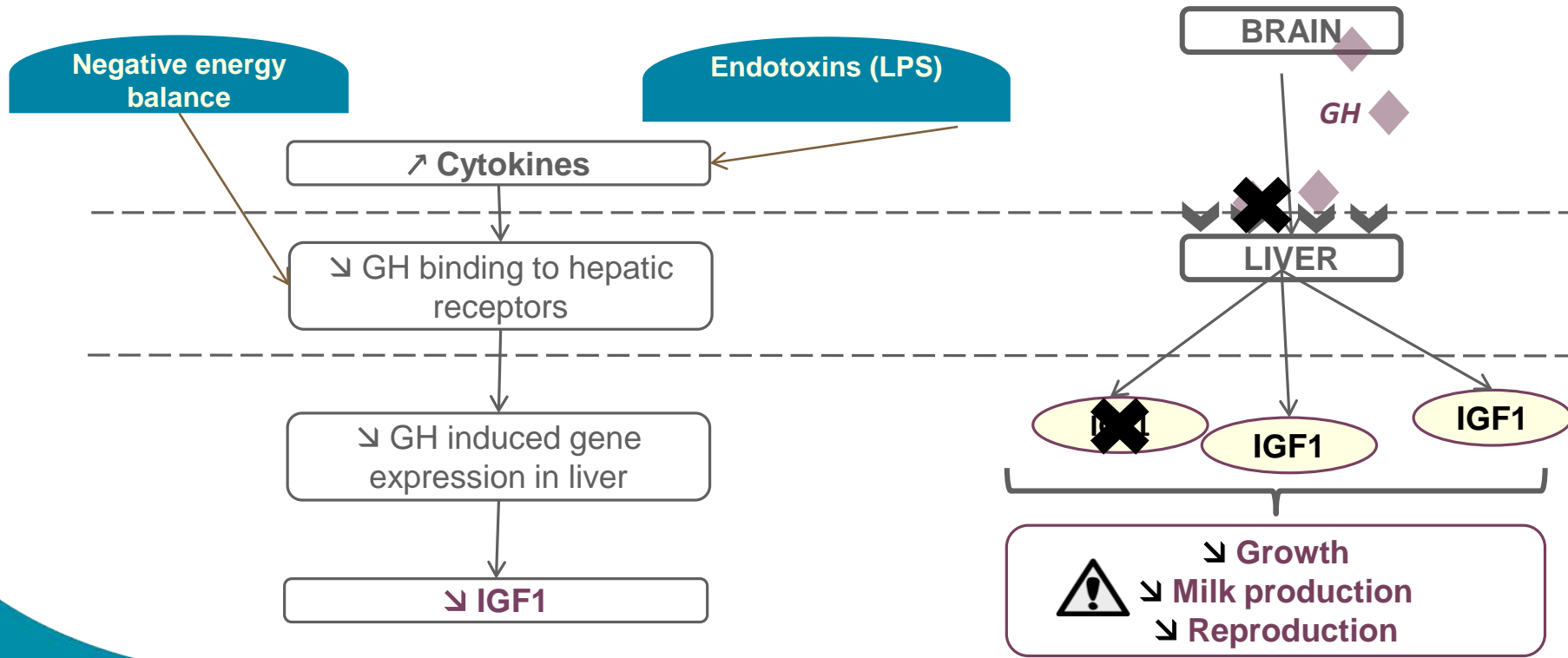


THE MYCOTOXIN CHALLENGE

HOW DO MYCOTOXINS ALTER ANIMAL'S HEALTH AND PERFORMANCE?

GROWTH HORMONES

MYCOTOXIN RISK

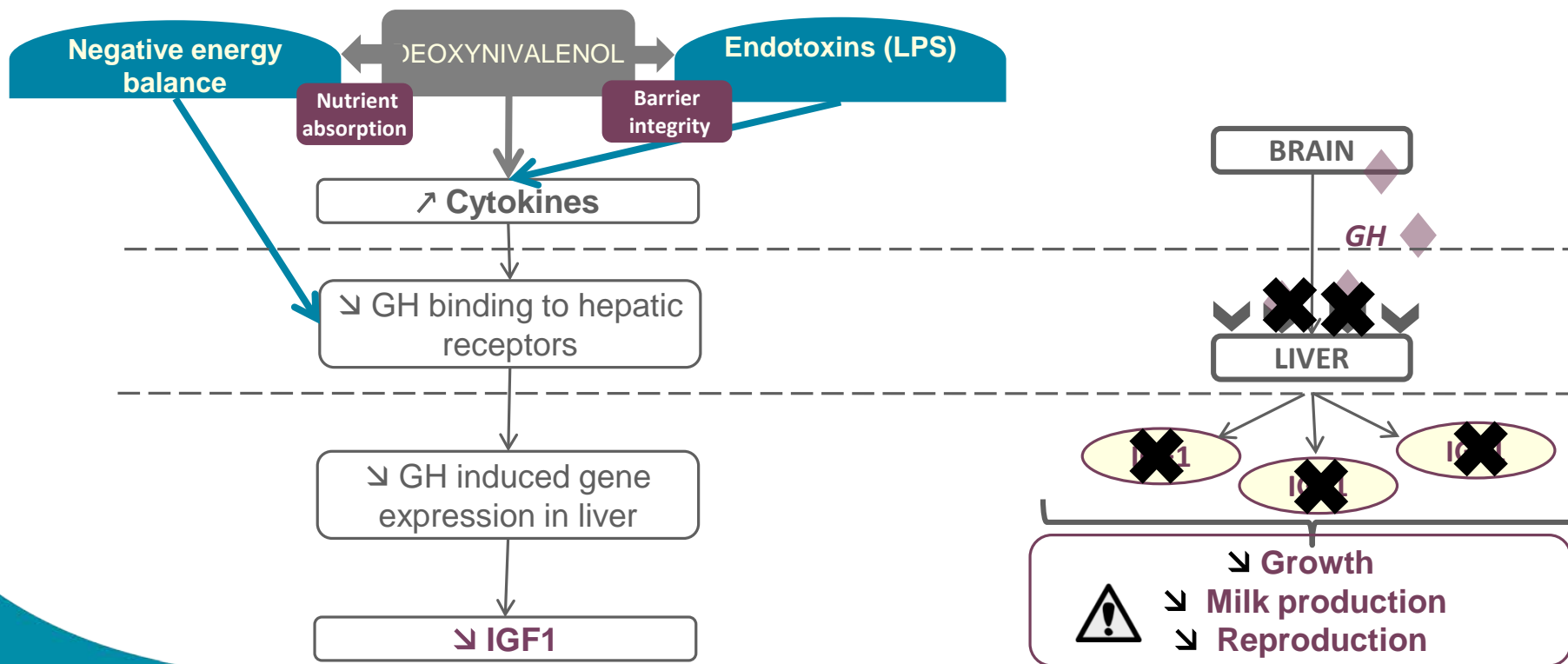


THE MYCOTOXIN CHALLENGE

HOW DO MYCOTOXINS ALTER ANIMAL'S HEALTH AND PERFORMANCE?

GROWTH
HORMONES

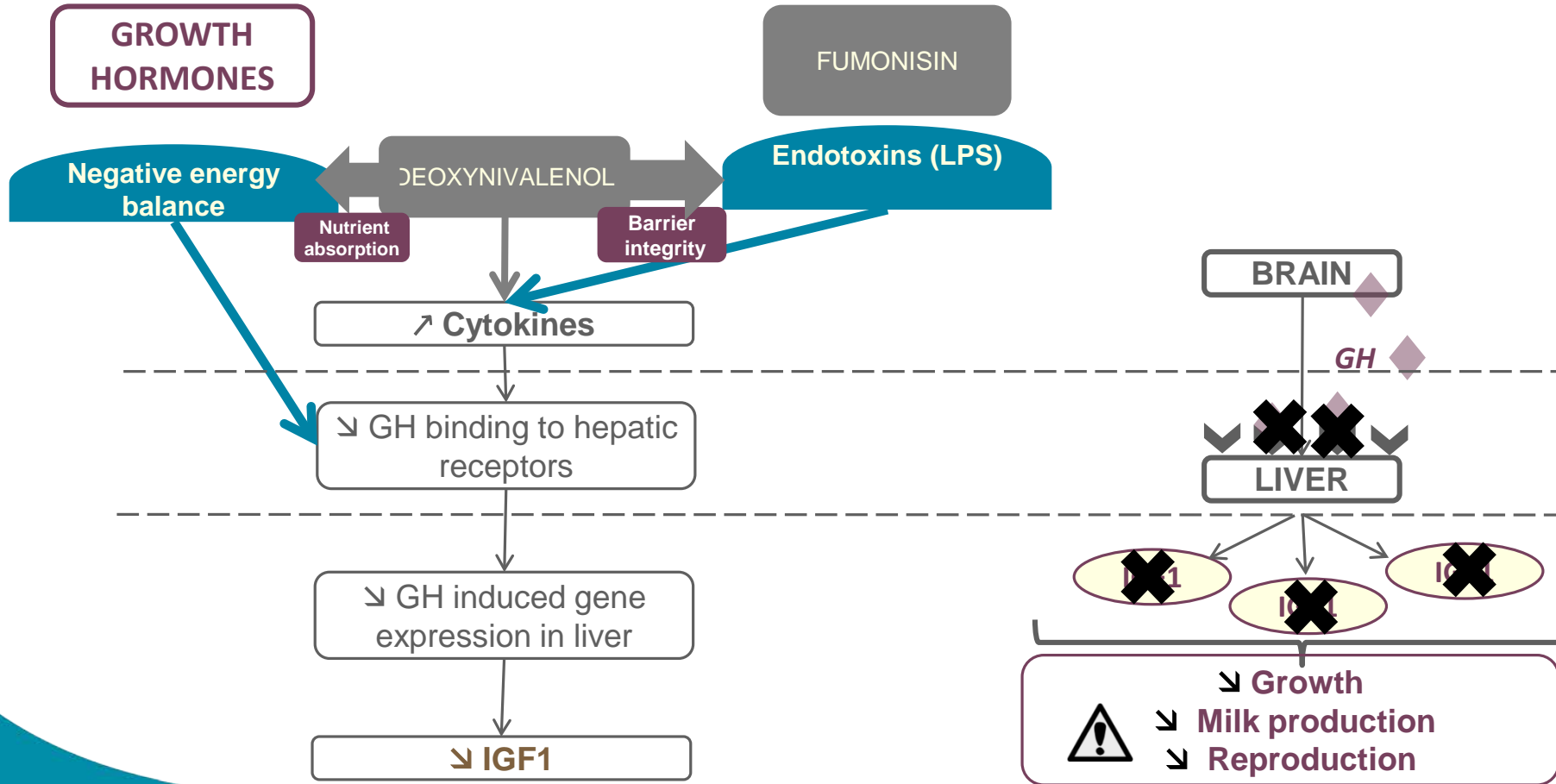
MYCOTOXIN RISK



THE MYCOTOXIN CHALLENGE

HOW DO MYCOTOXINS ALTER ANIMAL'S HEALTH AND PERFORMANCE?

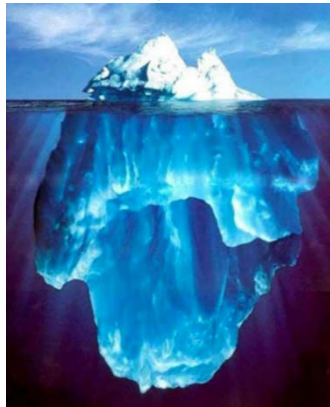
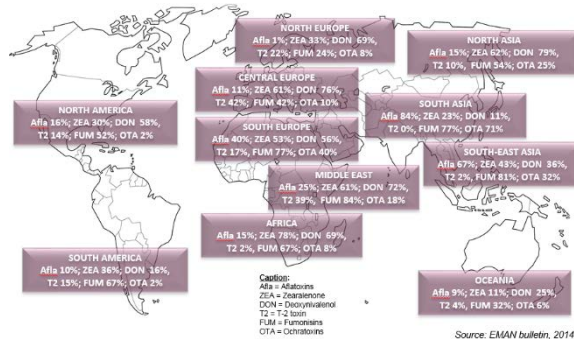
MYCOTOXIN RISK



THE MYCOTOXIN CHALLENGE

HOW DO MYCOTOXINS ALTER ANIMAL'S HEALTH AND PERFORMANCE?

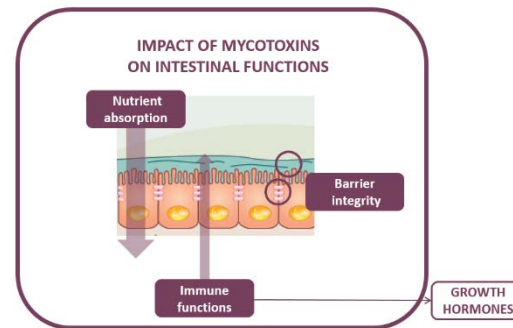
Mycotoxins are everywhere



Acute mycotoxicosis



Sub-acute mycotoxicosis



How to protect the animals from this variety of mycotoxins?

USE A WIDE SPECTRUM TOXIN BINDER:

MT.X+

MT.X+: THE OLMIX SOLUTION

A SINGULAR COMBINATION OF ORGANIC AND INORGANIC NATURAL ADSORBENTS

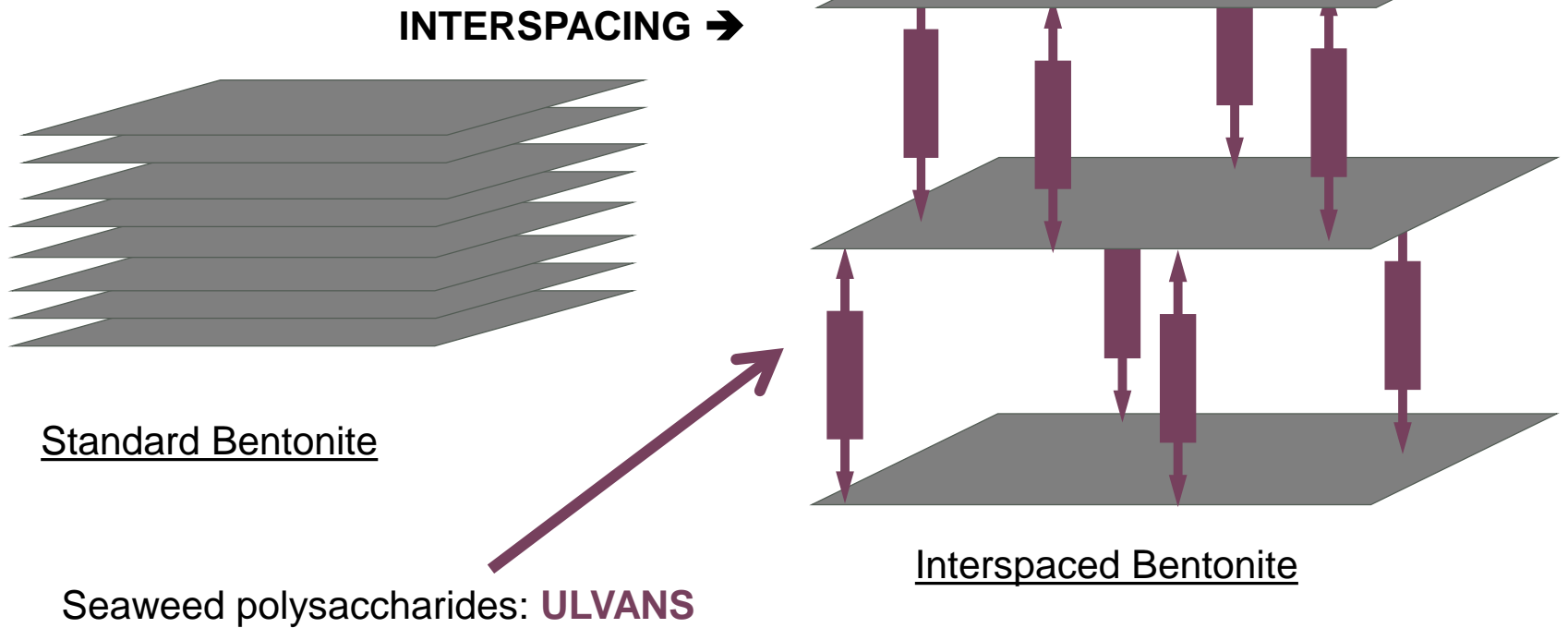
- Interspaced Bentonite
- Bentonite
- Diatomaceous earth
- Yeast cell walls
- Seaweeds extracts (Marine Polysaccharides)



MT.X+: THE OLMIX SOLUTION

INTERSPACED BENTONITE PROCESS

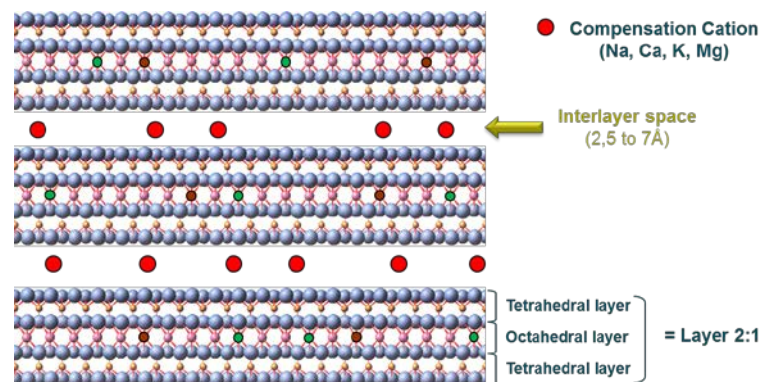
MYCOTOXIN RISK



MT.X+: THE OLMIX SOLUTION

INTERSPACED BENTONITE PROCESS

- Ulvans
 - Polyanionic polysaccharides present in green algae
 - Rich in sulphated xylorhamnoglucoronans
- Interaction between ulvans and Bentonite
 - Via silanol groups on the edges of Bentonite layers
 - With compensation cations in the interlayer space of Bentonite.



Structure of Bentonite

MT.X+: THE OLMIX SOLUTION INTERSPACED BENTONITE PROCESS

Standard Bentonite

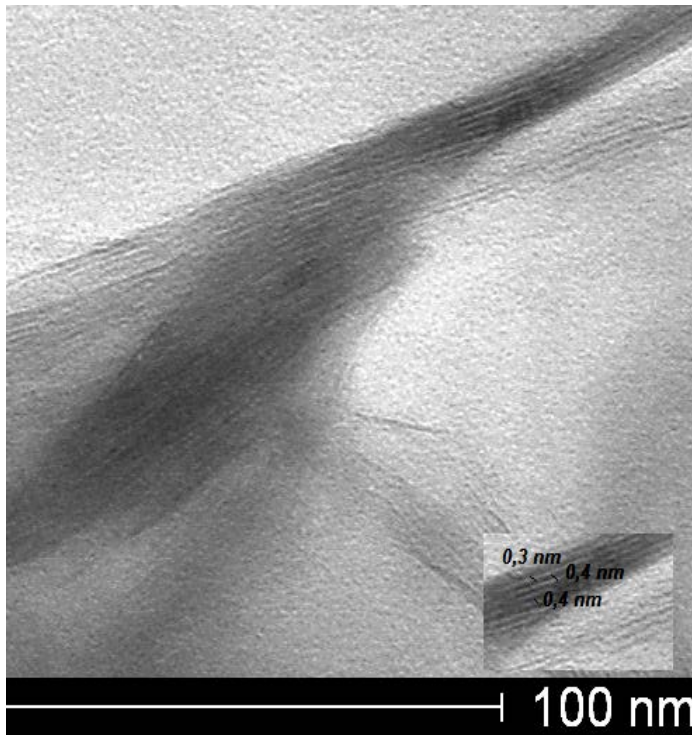


Figure 1: Standard Bentonite in TEM image

Interspaced Bentonite

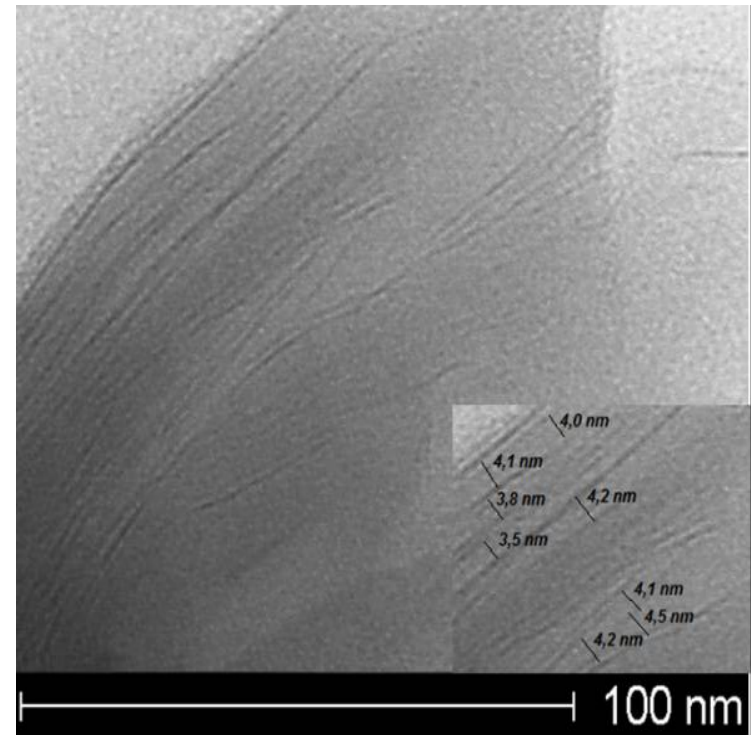
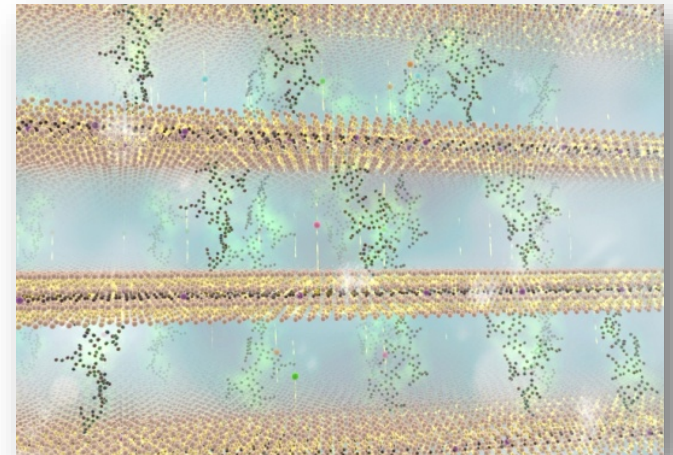


Figure 2: Interspaced Bentonite in TEM image

MT.X+: THE OLMIX SOLUTION

INTERSPACED BENTONITE

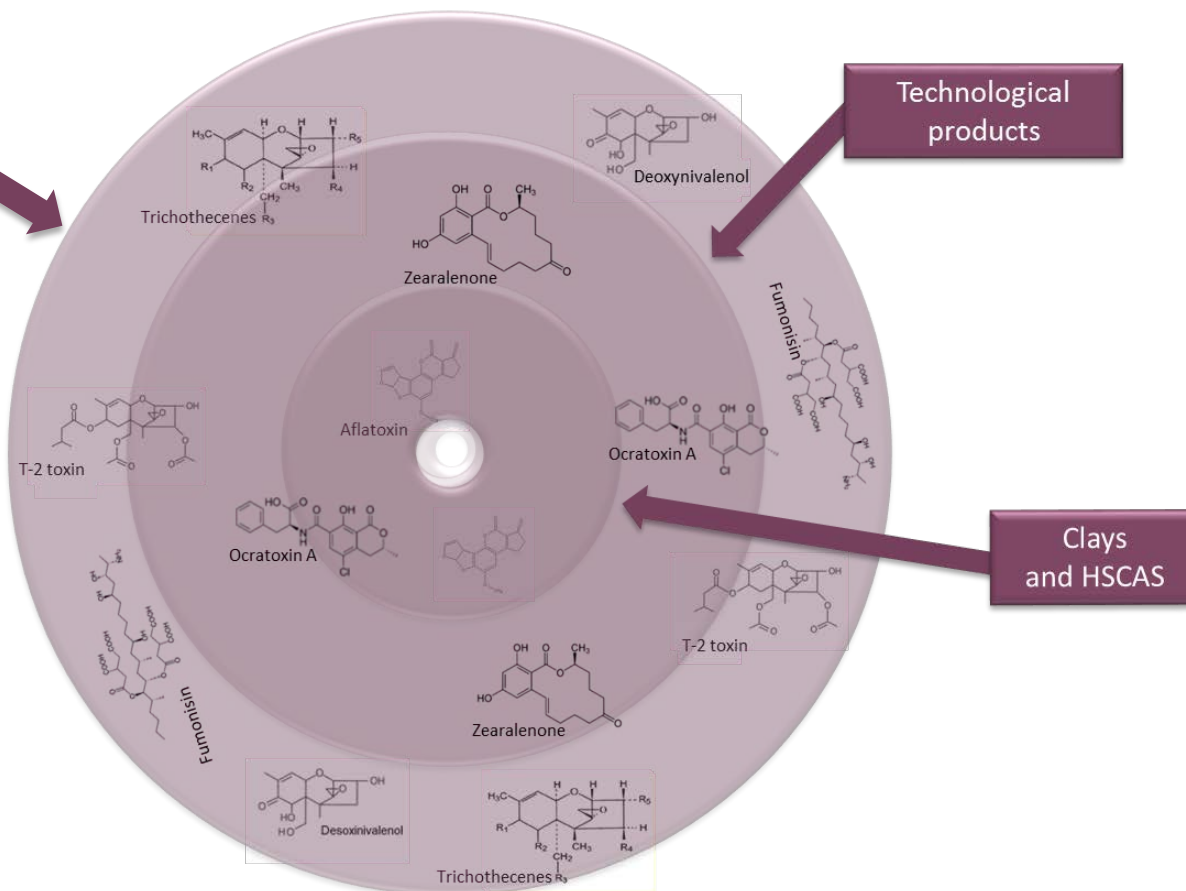
- The adsorption of mycotoxins in this innovative material is a complex mechanism involving:
 - CEC (cation exchange capacity) and surface area of Bentonite,
 - the polyanionic structure of ulvans
 - the microtubular structure formed in the interlayer space
- Ionic and hydrophobic interactions with mycotoxins
- Adsorption of small and large mycotoxins



MT.X+: THE OLMIX SOLUTION

MT.X+

MYCOTOXIN RISK



MT.X+: THE OLMIX SOLUTION

The level of MT.X+ must be adapted depending on the severity of symptoms and degree of polycontamination.

		Symptoms of depression of immune system	Symptoms of mycotoxicosis
SWINE	Sows and piglets	1 kg/ton	1,5-2 kg/ton
	Fattening pigs	0,5 kg/ton	1,5-2 kg/ton
POULTRY	Broilers < 20 days	1 kg/ton	1,5-2 kg/ton
	Broilers > 20 days	0,5 kg/ton	1,5-2 kg/ton
	Laying hens	0,5-1 kg/ton	1,5-2 kg/ton
	Breeders	1 kg/ton	1,5-2 kg/ton
	Ducks and turkeys	1 kg/ton	1,5-2 kg/ton
RUMINANTS		1g/kg DMI*/animal/day	1,5-2 g/kg DMI/animal/day
AQUACULTURE		1 kg/ton	1,5-2 kg/ton

* Dry Matter Intake

**Olmix technical service is at your disposal
for personal support**

MT.X+: THE OLMIX SOLUTION

mT.X+



mMi.S



MMi.S is dedicated to a direct use in farm, or use in poultry or mash feed

in order to improve its homogenization in feed.

Same formula, same efficacy!