

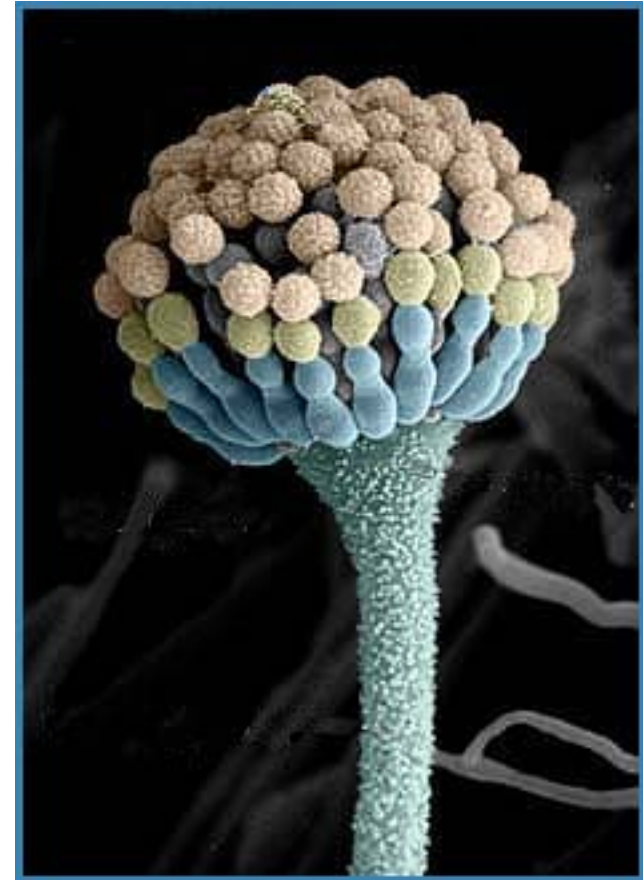
Health concerns of ergot and mycotoxins in the human food supply

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Mycotoxins

- Substances produced by fungi that contaminate various agricultural commodities
 - before harvest or under post-harvest conditions
- More than 300 known mycotoxins of widely different chemical structures and differing modes of action



Aspergillus

Why are mycotoxins important?

Mycotoxins are important because they can be costly when they affect:

- animal productivity
- human health
- international trade

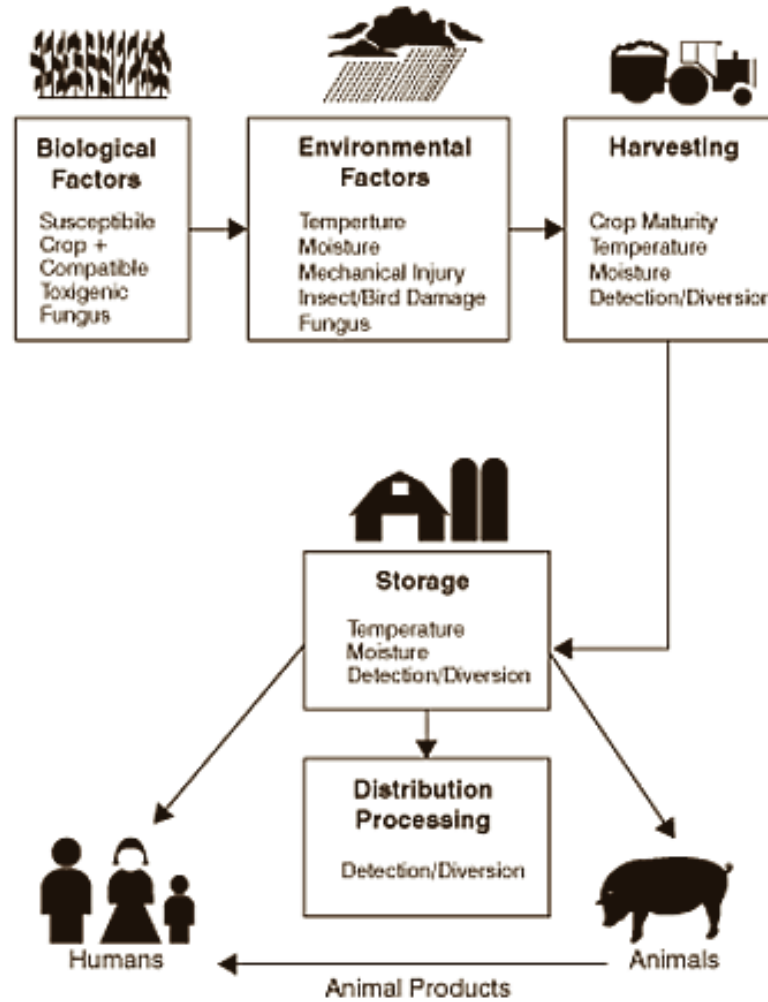
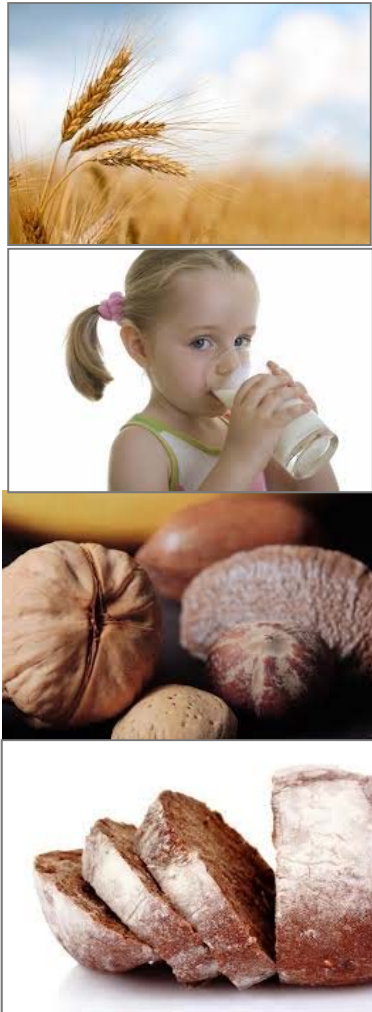
The Food and Agriculture Organization of the United Nations (FAO) states the cost of mycotoxins in Canada and United States is approx. **\$5 billion a year**



Mycotoxins and world food supply

- It is estimated that 25% of world's food crops are affected annually by variable levels of mycotoxins
- >100 countries have regulations regarding levels of mycotoxins in food and feed

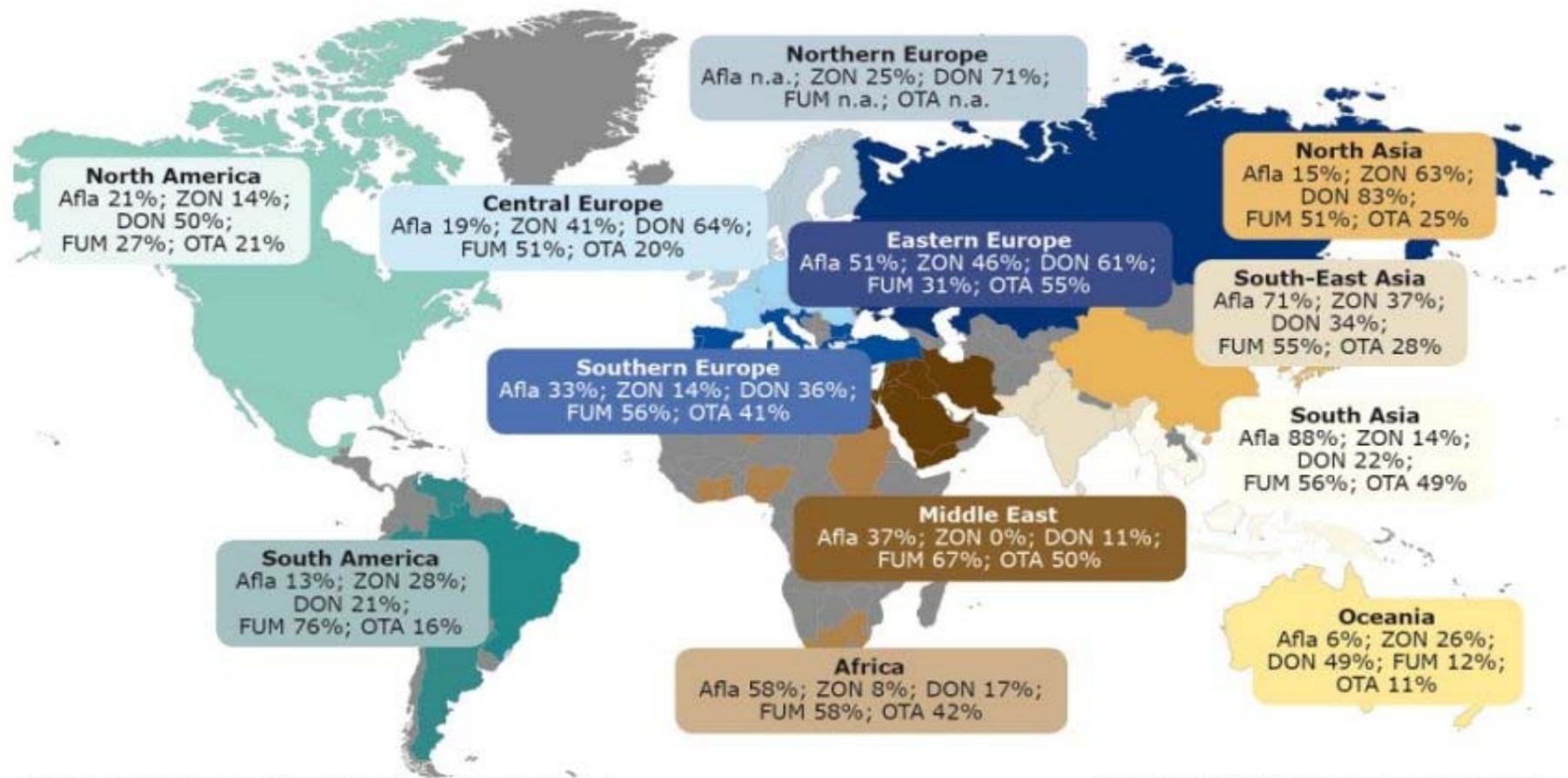




Why are we concerned about mycotoxins in the food supply?



- When consumed, mycotoxins cause mycotoxicosis and lead to acute or chronic diseases in humans



Mycotoxin contamination overview worldwide

Source: © BIOMIN Mycotoxin Report

**where poor methods of food handling and
storage are common**

where malnutrition is a problem

**where few regulations exist to protect
exposed populations**

Mycotoxins in Canada

In Canada, the mycotoxins of major concern are:

- Deoxynivalenol (DON)
- T-2 toxin
- Zearalenone (ZEA)
- Fumonisin B1 (FB1)
- Ochratoxin A (OTA)
- Ergot alkaloids

Aflatoxins are also of concern in food products imported from warmer tropical and subtropical regions



Mycotoxins in Food

Mycotoxins	Food Product
Aflatoxins	grain, berries, corn, peanuts, tree nuts, dried fruits, oilseeds, milk, animal tissues
Deoxynivalenol	wheat, corn
Ochratoxin	grains (especially wheat), coffee, grapes/wine, beer (when used contaminated grain), nuts, meat and eggs by contaminated feed
Fumonisin	corn
T-2 toxin	grains, corn
Ergot alkaloids	rye, wheat

Mycotoxins and Human Health

Mycotoxicoses can be categorized as acute or chronic

- acute toxicity → rapid onset and an obvious toxic response
- chronic toxicity → low-dose exposure over a long time period

Human exposure to mycotoxins

- environmental monitoring
 - measured in food, air, or other samples
- biological monitoring
 - directly in tissues, fluids, and excreta



Mycotoxins and Health Effects

Mycotoxin	Health Effects
Aflatoxins	Liver damage, intestinal bleeding, cancer
Ergot alkaloids	Hallucinations, gangrene, loss of limbs, hastening of birth
Fumonisin	Pulmonary edema, leukoencephalomalacia, esophageal cancer, neural tube defects, liver damage, reduced growth
Ochratoxins	Kidney and liver damage, cancer
Trichothecenes	Feed refusal, diarrhea, vomiting, skin disorders, reduced growth
Zearalenone	Enlargement of uterus, abortion, malformation of testicles and ovaries

Recent Outbreak

- 2004
- 125 people died following a major outbreak of aflatoxicosis in Kenya
- Linked to aflatoxin poisoning from contaminated maize
- Rainfall surrounding harvest and poor storage conditions
- Outbreaks occurred in 2005 and again in 2006



Children

- 1st effect of mycotoxin ingestion is reduced food intake and growth
- Children consume more cereals than other groups → dietary staple in developing countries
- Strong association between mycotoxin exposure in children and stunting of growth/underweight (Africa)
 - Exposure in utero and early childhood
 - Co-exposed to infectious diseases



Pregnant and Nursing Women

- Some mycotoxins can pass placenta in humans and animals
- Link between some mycotoxins and neural tube defects
 - interfere with folic acid uptake
- Aflatoxin is the main mycotoxin with significant carry-over into milk and milk products (aflatoxin M)
 - established limit in milk is 0.5 ug/kg



Masked Mycotoxins

- Several mycotoxins can be attached to other molecules in the plant (sugars etc) and this changes their chemical structure
- Invisible to standard equipment for measuring mycotoxins
- Significant underestimation of the level of contamination

We may not even know the real level of harmful mycotoxins entering our food supply

Regulations

Various legislative measures have yet to be harmonized among countries

Mycotoxin	Grain for human food	
	USA	European Union
Aflatoxins	20 ppb	2-4 ppb
Deoxynivalenol	1000 ppb	750 ppb
Fumonisin	200-4000 ppb	1000 ppb
Zearalenone	No guidance levels	75-100 ppb

Conclusions

- Mycotoxins are a food safety risk globally
- Specific groups are more vulnerable to exposure and health effects of mycotoxins
- Major international effort aimed at:
 - identification and quantification of mycotoxins
 - evaluation of health effects in humans and animals
 - universal (global) set of regulatory guidelines for mycotoxins in food and feed

