# Discussion Forum

## Bioavailability, degradation, and detoxification of mycotoxins

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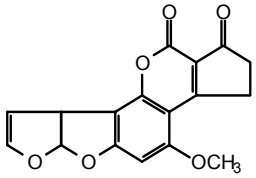
Co-chairs: Gerd Schatzmayr, Felicia Wu

# Discussion categories

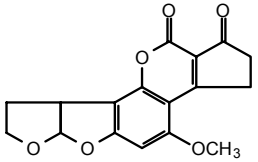

- Mycotoxins discussed
  - Aflatoxin
  - Fumonisin
  - DON
- How to control them in food or feed
  - Biotransformation/biodegradation
  - Enterosorption (binding)
  - Dietary chemoprevention
- *In vitro* vs. animal vs. human evidence

# So much depends on chemical structure of toxin

## Aflatoxins

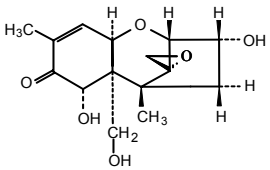


*Aflatoxin $B_1$*

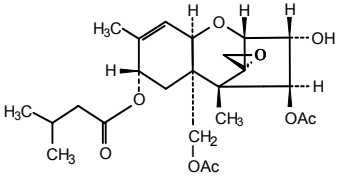


*Aflatoxin $B_2$*

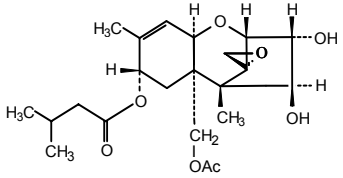
## Trichothecenes



*Deoxynivalenol*

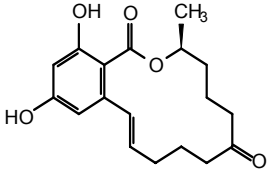


*T-2 Toxin*

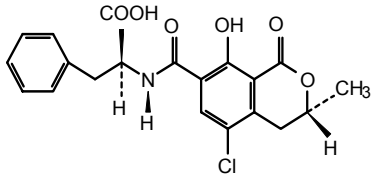


*HT-2 Toxin*

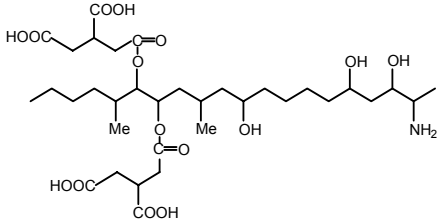
## Zearalenone



## Ochratoxins



## Fumonisins



# Biotransformation

- Aflatoxin: ammoniation, ozonation
- Fumonisin: nixtamalization, degradation enzymes, transgenic maize
- DON: bacterial transformation

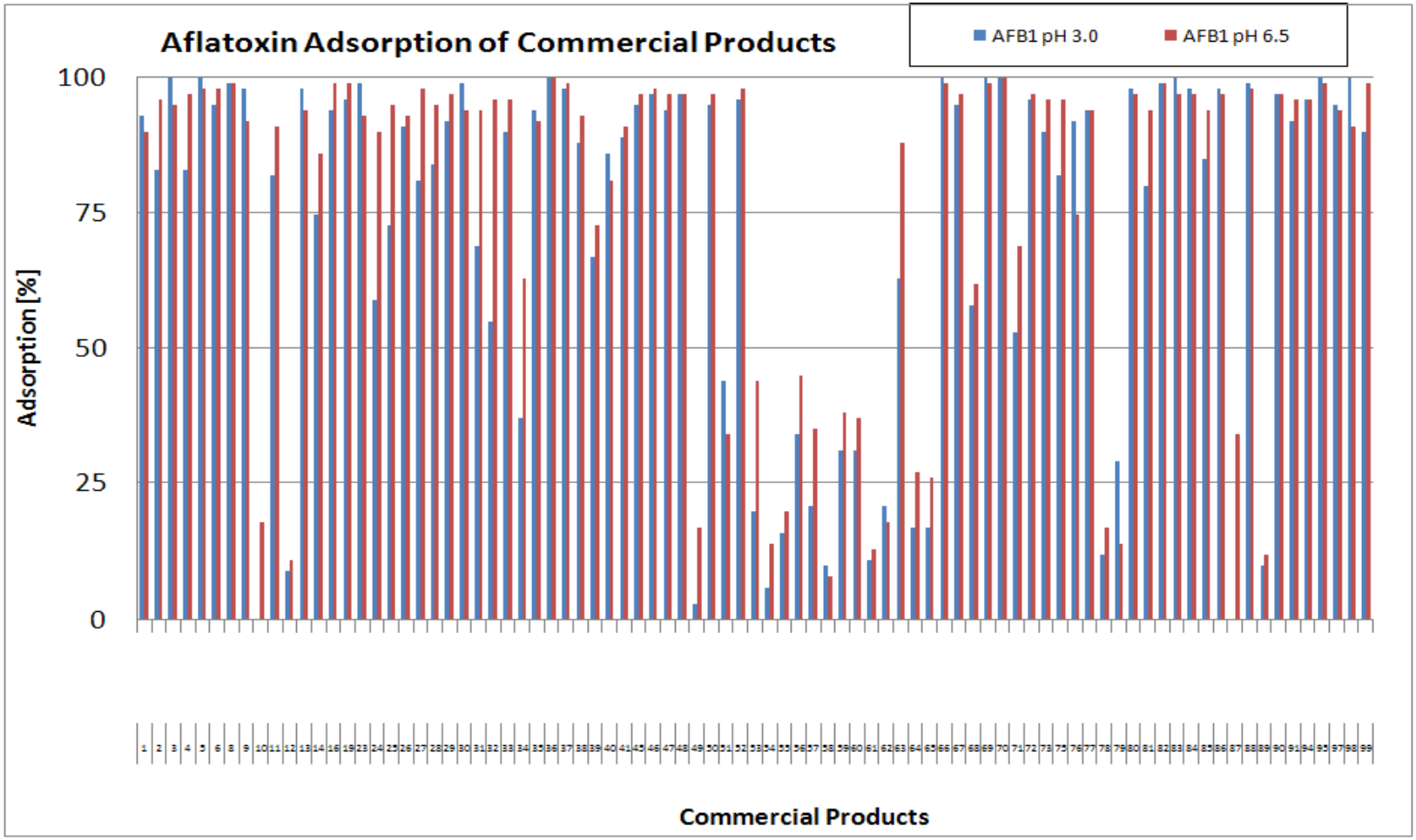
- Potential risks:
  - Destruction of nutrients
  - Production of metabolites with unknown toxicity

# Enterosorption (binding)

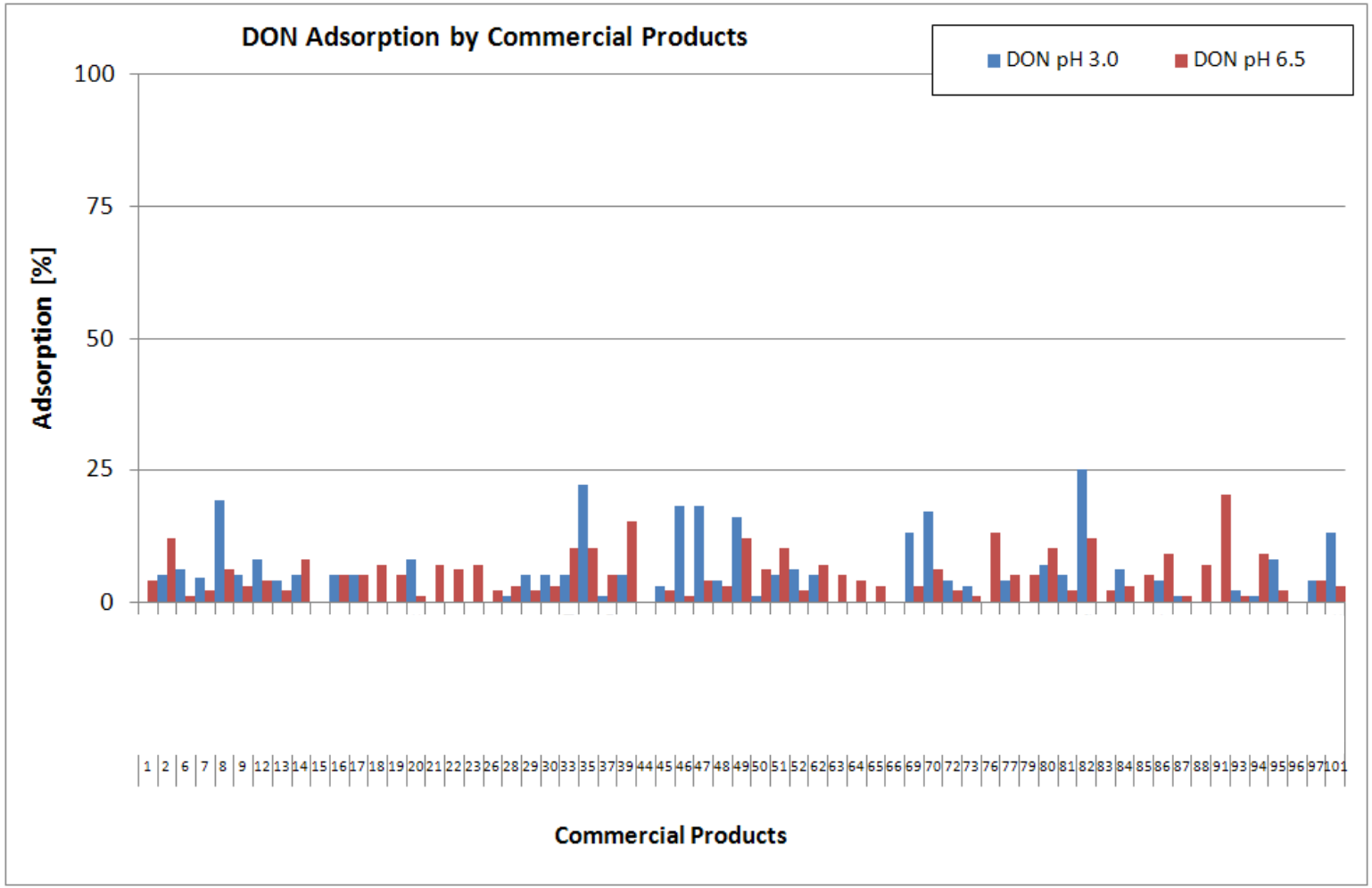
- Clay minerals
- Organic materials (e.g., yeast cell walls)

- Ability to adsorb mycotoxin depends on molecular structure of mycotoxin
  - Planar molecule (aflatoxins) easier to bind – enter the interlayer space of smectite clays

# Binding of Aflatoxin – commercial products in buffer



# Binding of Deoxynivalenol – commercial products in buffer



# Dietary chemoprevention

- Aflatoxin:
  - Agents that induce Phase 2 enzymes in liver
    - Oltipraz
    - Naturally occurring isothiocyanates (e.g., sulforaphane)
    - Triterpenoids
  - Agents that reduce inflammation
    - Non-steroidal anti-inflammatory drugs (NSAIDS)
    - Polyphenols in green tea

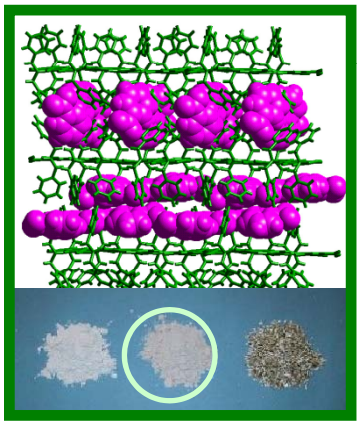
# *In vitro* vs. animal vs. human studies


- *In vitro* studies primarily for pre-screening
- Whole organism studies crucial in understanding effectiveness of these agents
- Examples: calcium aluminosilicate (CAS) clay as an enterosorbent for humans; broccoli sprouts tea
- 'Real world' concerns
  - How much does agent cost?
  - How to deliver it? (e.g., broccoli, clays)
  - Does it really work? E.g., will people actually comply? Culturally appropriate?
  - Any health risks? (contaminants, nutrient binding, side effects)

# Summary - Combination of different strategies

## ADSORPTION

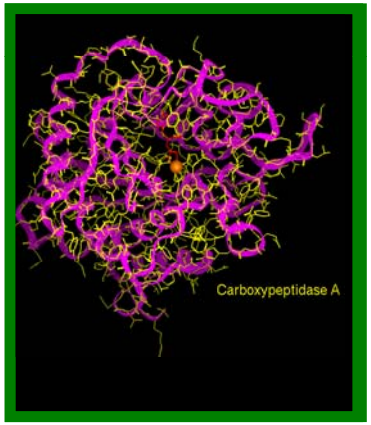
***Elimination of toxin***



…reduction of mycotoxin - bioavailability

## BIOTRANSFORMATION

***Elimination of toxicity***




…mycotoxin detoxification prior to resorption

## CHEMOPREVENTION

**(Hepatoprotection, etc)**

***Elimination of toxic effects***

…elimination of toxin related effects

# Summary


- Use different approaches for different toxins
- Do not stop at, or assume too much from, *in vitro* studies
- Consider practical issues when improving human and animal health through mycotoxin degradation / adsorbing / chemopreventive agents