

# Schriftliche Prüfungen

## Semesterkurs Analytik V

### Analytical Strategy

### Sommer 2011

### MSc CHAB

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Vorname: \_\_\_\_\_ Name: \_\_\_\_\_

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- Es sind alle Aufgaben zu lösen. Jede Aufgabe wird separat benotet.  
*Every questions needs to be answered, each one will be corrected separately*
- **Zeit: 60 Min.** Teilen Sie sich Ihre Zeit gut ein.  
**Time: 60 min,** organize your time carefully
- Sie können auf **Englisch** oder **Deutsch** antworten  
*Answers are accepted in **German** or **English**.*
- Es sind alle Hilfsmittel mit Ausnahme von Computern und Telekommunikation erlaubt.  
*It is allowed to use all resources except of computers or communication devices.*
- Unleserliche Texte, unklare Formulierungen oder unsaubere Skizzen können nicht bewertet werden. Bitte bemühen Sie sich um eine saubere Darstellung.  
*Unreadable text, unclear formulations or graphs are not rated. Please try to use clear illustrations and descriptions*
- Beginnen Sie jede Aufgabe auf einem neuen Blatt und schreiben Sie jedes abzugebende Blatt einzeln mit Ihrem Namen und Vornamen an.  
*Every Question should start on a new page. Label every page with name and surname.*
- Dieses Deckblatt ist ausgefüllt abzugeben. Die Aufgabenstellung ist ebenfalls einzureichen.  
*Please fill out the first page. Hand in all pages including cover page and questions.*
- Wir bitten Sie um Fairness und wünschen Ihnen viel Erfolg!  
*We ask you for fairness and wish you good Luck!*

Alarming news after an inspection in food-transporting companies: A team of journalists and analytical chemists revealed enormous deficits in the cleaning of flour-carrier vans. They found vans that were strongly contaminated with mycotoxin-producing moulds (fungi).

Moulds are frequently found on cereals, maize, rice, nuts and fruits, particularly after long transport distances and long term storages. The consumption of mould-infested food can cause acute diseases such as diarrhea. Continuous ingestion even of low mycotoxin concentrations can cause severe malfunction of organs (e.g. liver and kidney), and some mycotoxins are suspected to cause cancer. Examples of food-borne mycotoxins and the producing fungal species are given in the table below, including some molecular structures of these toxins. Naturally, they occur in concentrations in the range of  $\mu\text{g}/\text{kg}$  up to  $\text{mg} / \text{kg}$ .

**Questions:**

1) You are inspector at the health authorities and in charge of controlling the transport of food, particularly agricultural products. You are supposed to perform spot test to ensure contamination-free transport. To standardize the control of food transport, you are preparing a protocol to determine mycotoxins in agricultural goods. For simplicity, consider only cereal products and wheat.

- a) Describe the sampling. What important aspects do you have to consider during sampling? What difficulties do you expect?
- b) Describe the further process after sampling until the final identification. Which analytical methods would you suggest for determination and identification of the mycotoxins? Chose exemplary a mycotoxin from the examples below and describe at least two analytical methods in more detail (except immunoassays, see below). Discuss advantages and limits (including the estimated detection limit).

2) Analytical methods based on immunological principles to determine mycotoxins have been developed in recent times and are commercially available. Make a schematic drawing of an immunoassay that could be used for mycotoxin analysis, and discuss the pro and contra arguments to employ these methods in a standardized method for spot test.

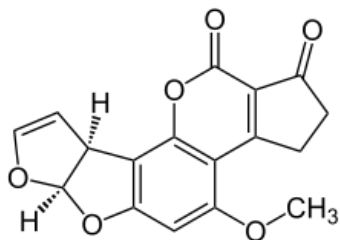
**Table 1** The major food-borne mycotoxins, their main producing fungal species and the commodities most frequently contaminated

Mycotoxin	Fungal species	Food commodity
Aflatoxins B <sub>1</sub> , B <sub>2</sub> , G <sub>1</sub> and G <sub>2</sub>	<i>Aspergillus flavus</i> <i>Aspergillus parasiticus</i>	Maize, wheat, rice, sorghum, ground nuts, tree nuts, figs
Aflatoxin M <sub>1</sub>	Metabolite of aflatoxin B <sub>1</sub> in mammals	Milk, milk products
Fumonisin B <sub>1</sub> , B <sub>2</sub> and B <sub>3</sub>	<i>Fusarium verticillioides</i> <i>Fusarium proliferatum</i>	Maize, maize products, sorghum, asparagus
Deoxynivalenol <sup>a</sup>	<i>Fusarium graminearum</i> <i>Fusarium culmorum</i>	Cereals, cereal products
T-2 toxin <sup>b</sup>	<i>Fusarium sporotrichioides</i> <i>Fusarium poae</i>	Cereals, cereal products
Zearalenone	<i>Fusarium graminearum</i> <i>Fusarium culmorum</i>	Cereals, cereal products
Ochratoxin A	<i>Aspergillus ochraceus</i> <i>Penicillium verrucosum</i> <i>Aspergillus carbonarius</i>	Cereals, dried vine fruit, wine, coffee
Patulin	<i>Penicillium expansum</i>	Apples, apple juice

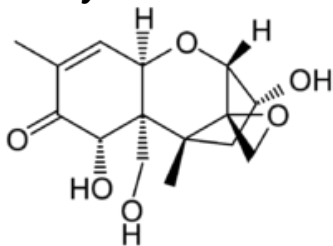
taken from: G. S. Shephard, *Chem. Soc. Rev.* 37 (2008), 2468 - 2477.

<sup>a</sup> Deoxynivalenol is a widely occurring group B trichothecene. It is commonly known in the USA as vomitoxin. <sup>b</sup> T-2 toxin is a group A trichothecene, mainly found in cereals grown in colder climates.

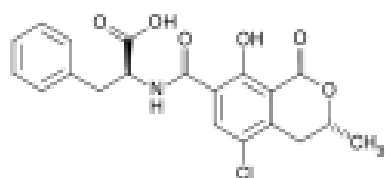
**Aflatoxin B<sub>1</sub>**



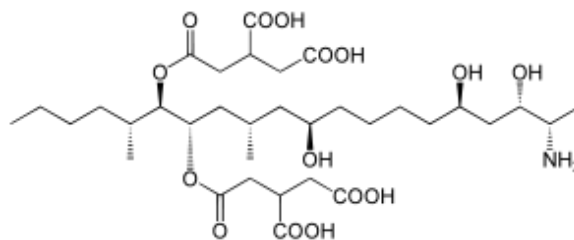
**Deoxynivalenol**



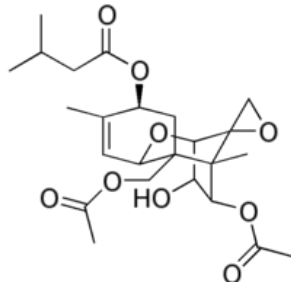
**Ochratoxin A**



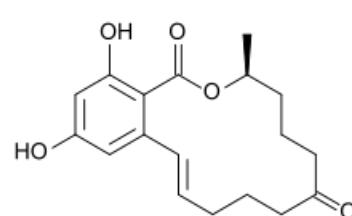
**Fumonisin B<sub>1</sub>**



**T2-Toxin**



**Zearalenone**



**Patulin**

