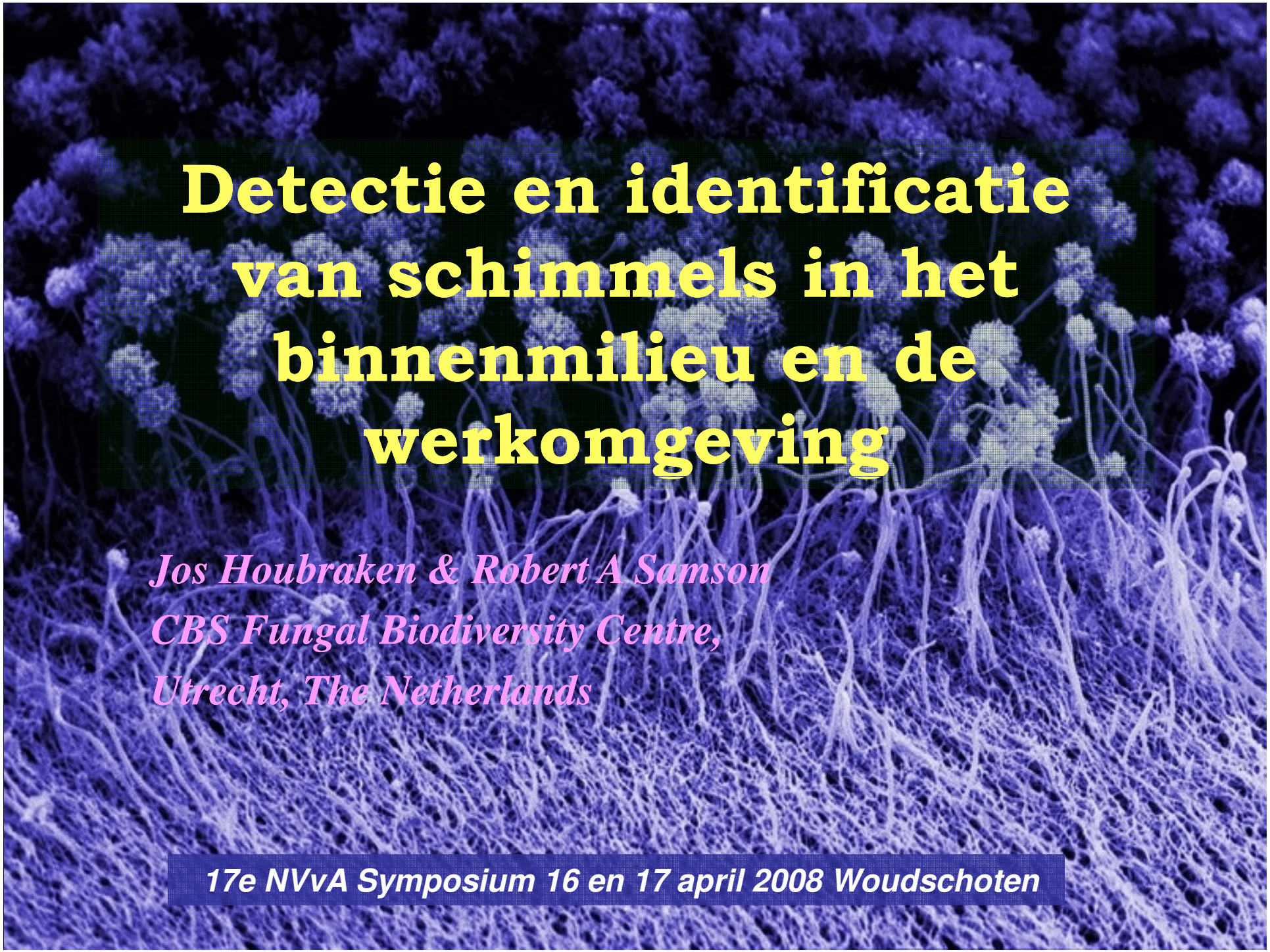

Detectie en identificatie van schimmels in het binnenmilieu en de werkomgeving

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17e NVvA Symposium 16 en 17 april 2008 Woudschoten

Overview

- Introduction
- Recommended approaches
- methods for isolation and detection

Centraalbureau voor Schimmelcultures

Ecology of indoor moulds

- The fungal flora of indoor environments is known and is different in its composition from outdoors (phylloplane fungi)
- The fungal flora is very similar to that occurring in food
- many species are xerotolerant or xerophilic
- species are specific for materials with different wateractivities

List of fungal species occurring in indoor environments

Absidia corymbifera
Acremonium murorum
Acremonium strictum
Alternaria alternaria
Aspergillus candidus
Aspergillus clavatus
Aspergillus flavus
Aspergillus flavipes
Aspergillus fumigatus
Aspergillus niger
Aspergillus ochraceus
Aspergillus penicillioides
Aspergillus restrictus
Aspergillus sydowii
Aspergillus terreus
Aspergillus versicolor
Aureobasidium pullulans
Botrytis cinerea
Candida peltata
Chaetomium aureum
Chaetomium globosum
Chaetomium indicum
Chrysonillia sitophila
Cladosporium cladosporioides
Cladosporium herbarum
Cladosporium sphaerospermum
Clonostachys rosea
Coprinus cordisporus
Cryptococcus laurentii
Curvularia lunata
Emericella nidulans
Epicoccum nigrum
Eurotium amstelodami
Eurotium chevalieri
Eurotium herbariorum
Exophiala dermatitidis
Fusarium culmorum
Fusarium solani
Fusarium verticillioides
Geomyces pannorum
Geotrichum candidum
Memnoniella echinata
Mucor hiemalis
Mucor plumbeus
Mucor racemosus
Oidiodendron griseum
Oidiodendron rhodogenum
Paecilomyces lilacinus
Paecilomyces variotii
Penicillium aurantiogriseum
Penicillium brevicompactum
Penicillium chrysogenum
Penicillium citrinum
Penicillium commune
Penicillium corylophilum
Penicillium expansum
Penicillium glabrum
Penicillium janthinellum
Penicillium olsonii
Penicillium rugulosum
Penicillium simplicissimum
Penicillium spinulosum
Penicillium variabile
Phialophora fastigiata
Phialophora verrucosa
Phoma glomerata
Phoma macrostoma
Pithomyces chartarum
Pyronema domesticum
Rhizopus stolonifer
Rhodotorula mucilaginosa
Schizophyllum commune
Scopulariopsis brevicaulis
Scopulariopsis candida
Scopulariopsis fusca
Serpula lacrymans
Sistotrema brinkmannii
Sporobolomyces roseus
Stachybotrys chartarum
Syncephalastrum racemosum
Trichoderma harzianum
Trichoderma koningii
Trichoderma viride
Tritirachium oryzae
Ulocladium chartarum
Verticillium lecanii
Wallemia sebi

Toxinogenic – pathogenic – xerophilic - basidiomycete

Approach for examination

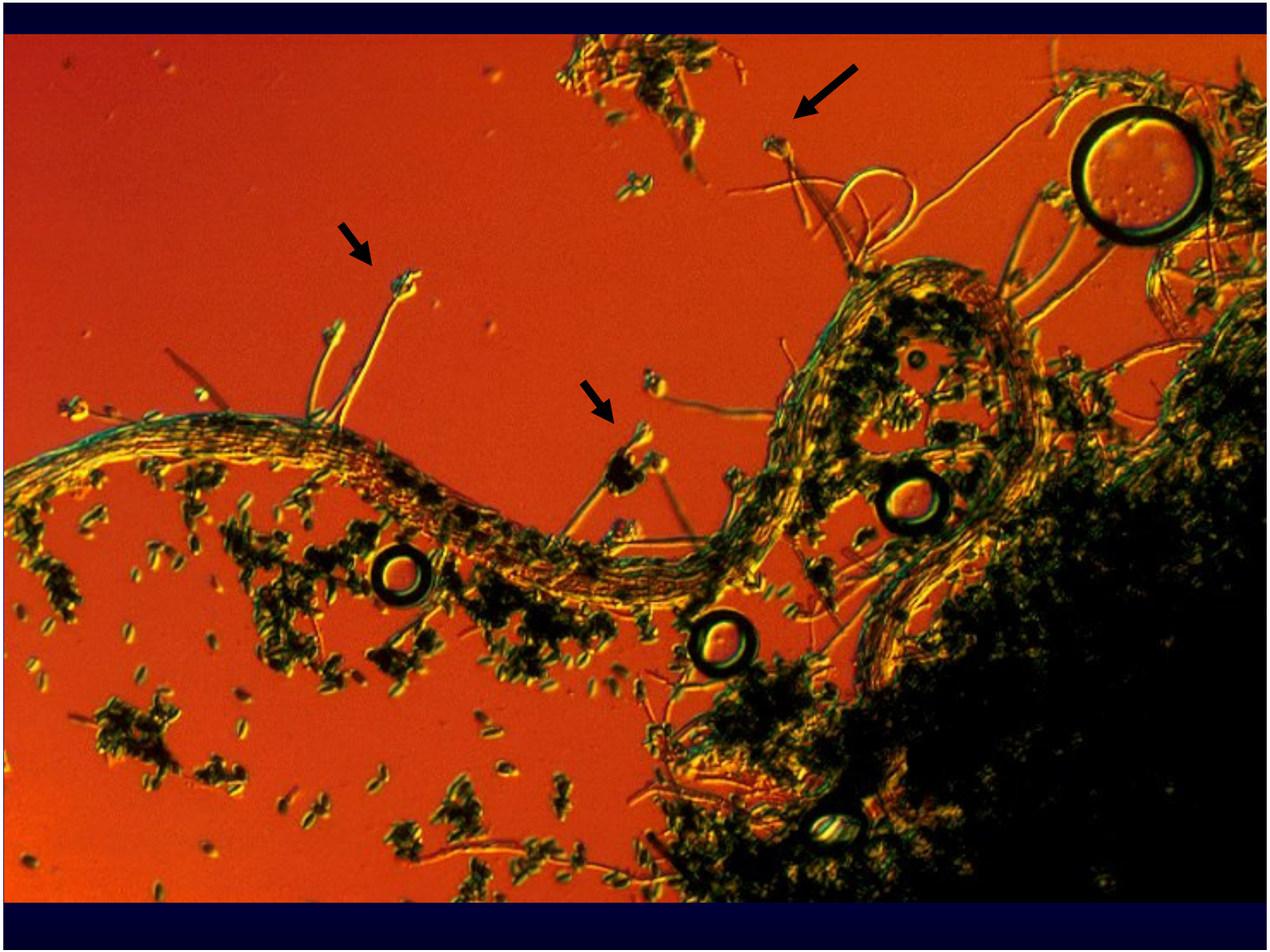
- Always start with a good inspection of the house or building
- Note water, moisture, leakage problems
- Inform about the history of the house or building
- Collect materials

Material for sampling

- Building materials
- Scraping of the wall
- House dust
- Cellotape preparations

Scotch tape preparation

- Transparent Scotch or cellotape
- Stick the adhesive part to the area you like to investigate
- Stick it to a microscope slide
- In the laboratory place a drop a lactic acid with some aniline blue between the slide and the tape
- Examine in the microscope

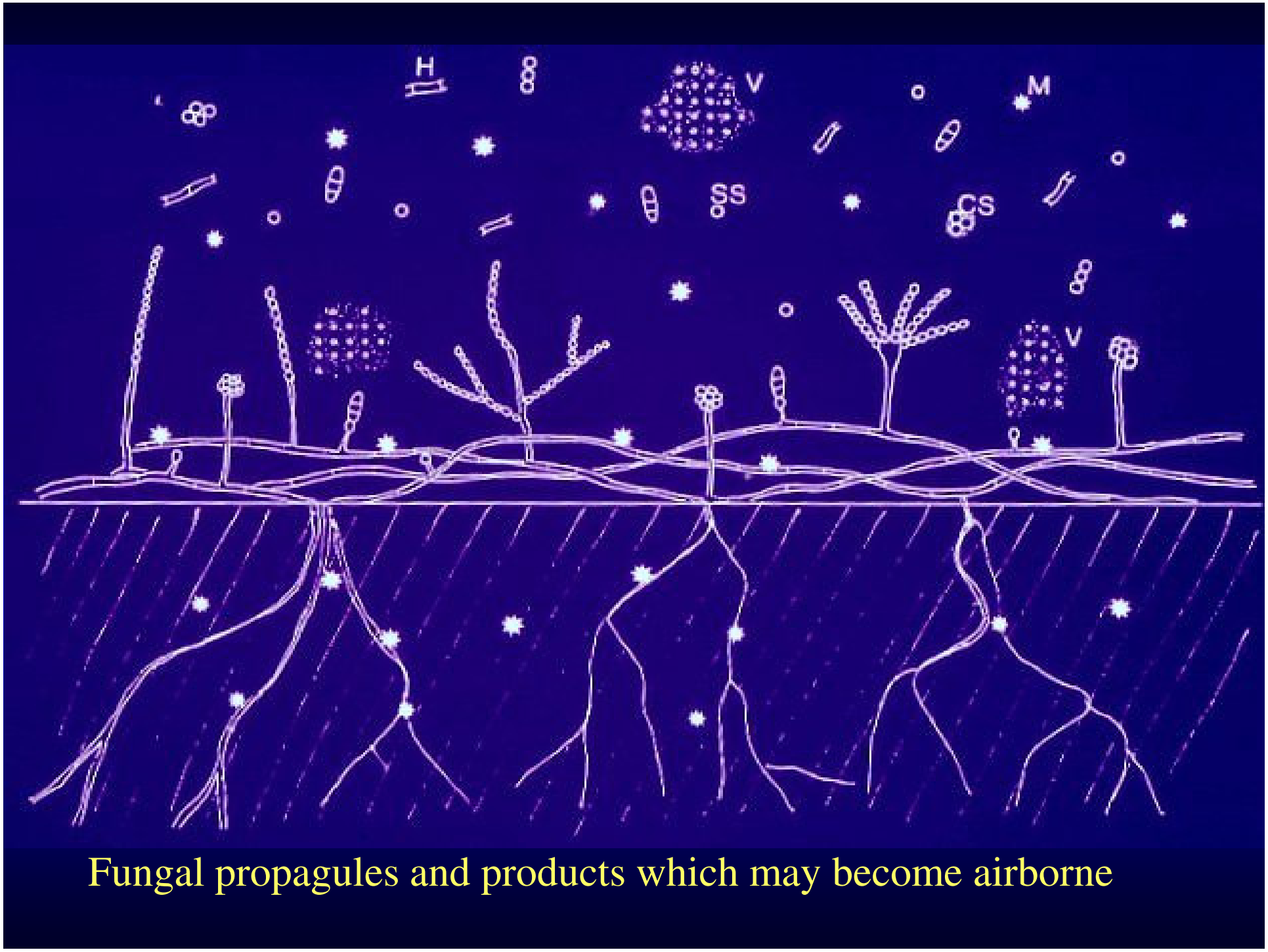


Detection of indoor moulds

- Microscopic examination of materials (cellotape preparations)
- swabs of surfaces
- direct plating
- airsampling

What is in the air?

- Fungal spores/conidia (2-10 µm)
- Various fungal fragments (pieces of mycelium, fruit-bodies etc.) (<0.1-2.5 µm)
- Fungal metabolites
  - Primary metabolites
  - Secondary metabolites: mycotoxins, volatiles
  - Metabolites can also be in the spores and mycelium

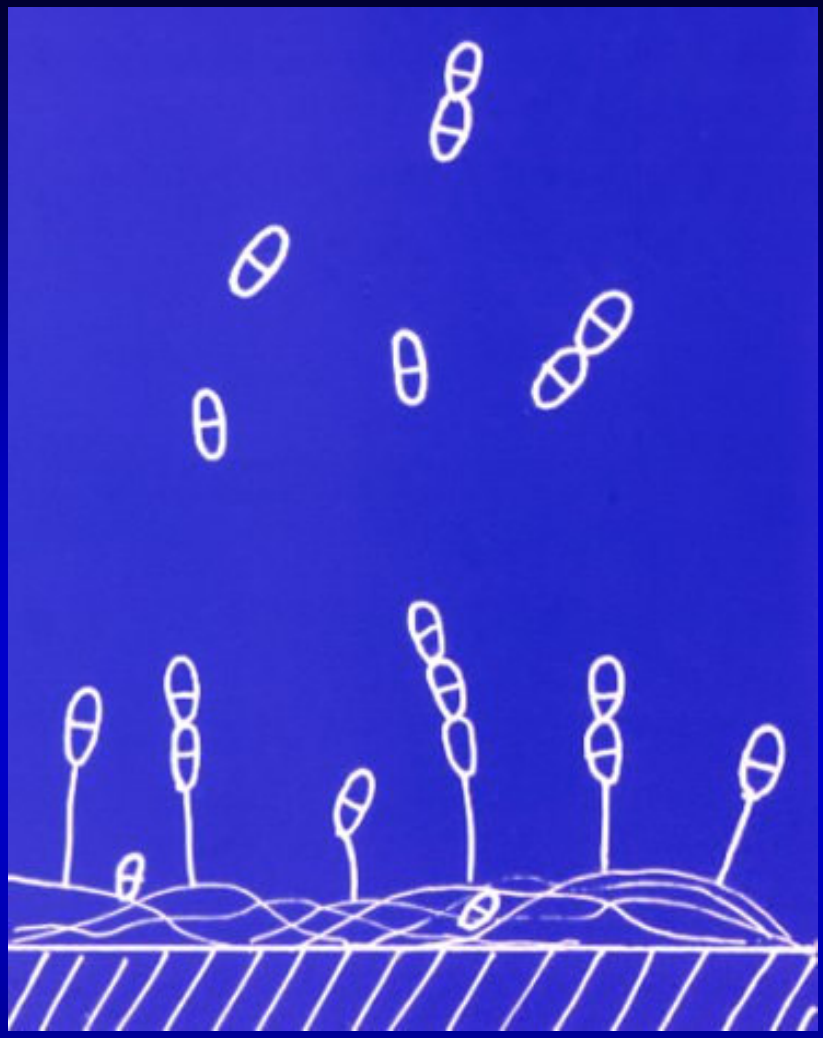


Fungal propagules and products which may become airborne

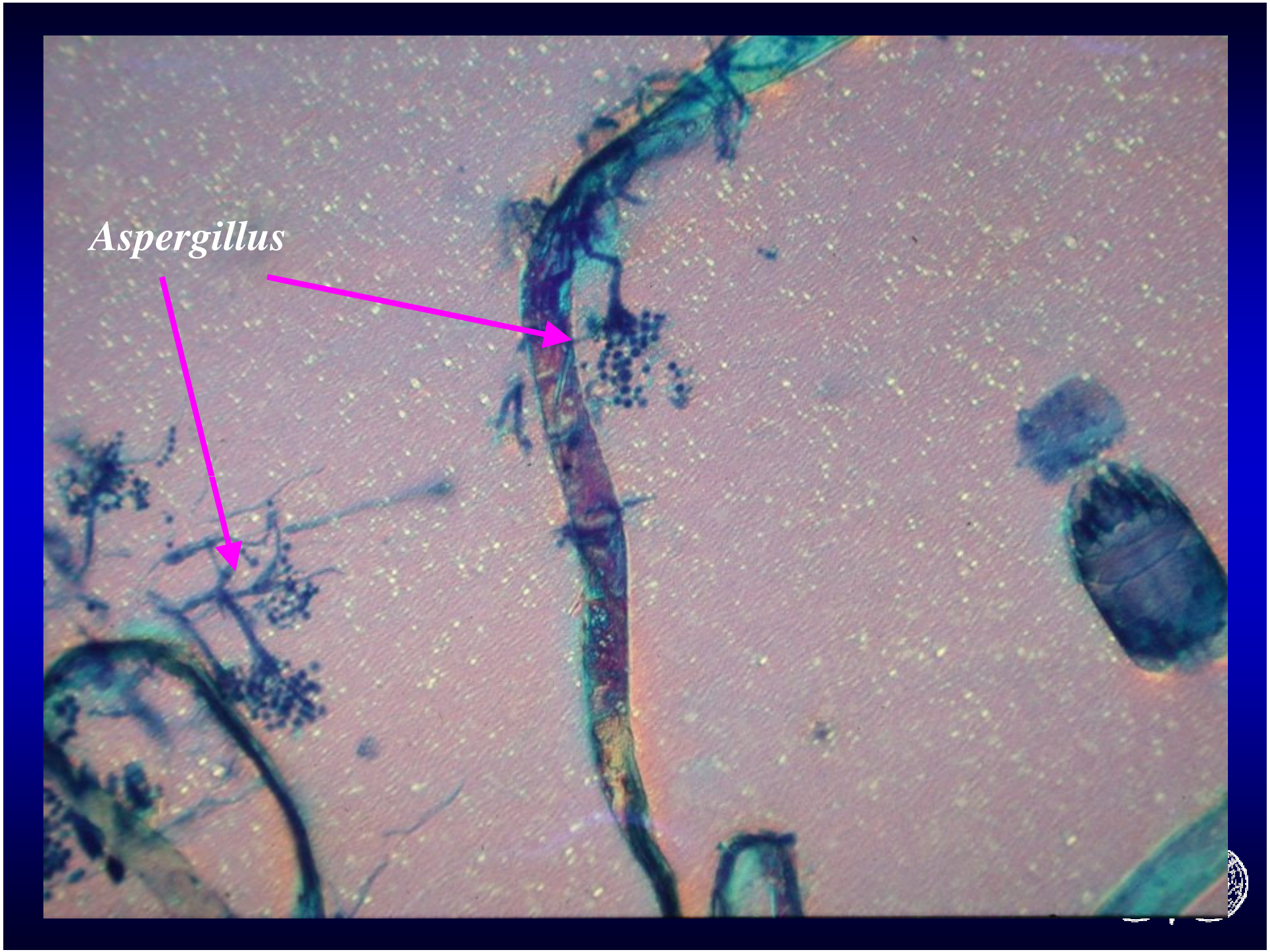
Air sampling

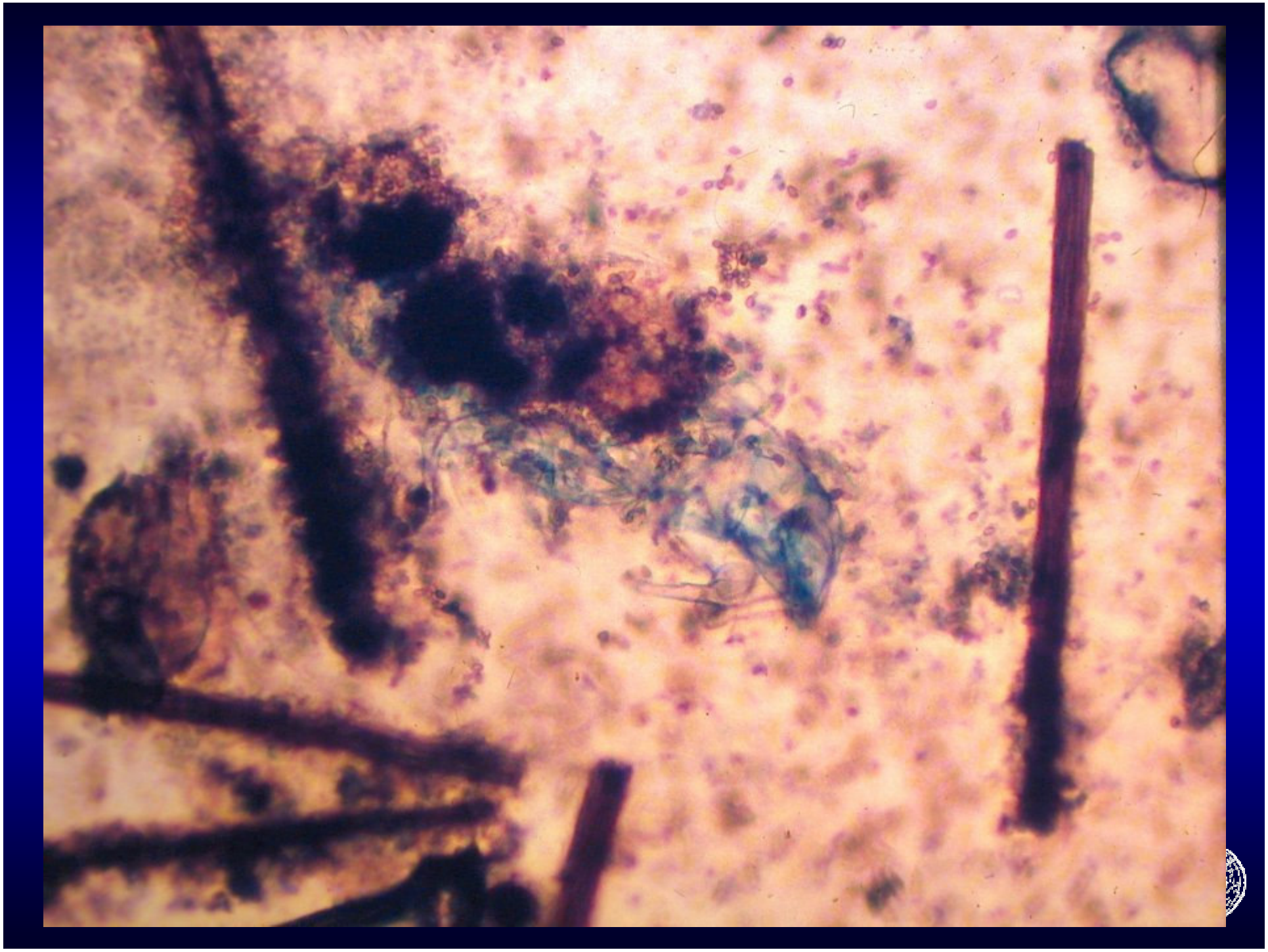
- Non volumetric (e.g. Open Petri dish). This is not very suitable because the spores in the air differ in size and weight
- Volumetric sampler.
  - There are various types and brands
  - There is not very much difference in the results of the various samplers
  - Important is that the equipment is reliable and that the correct media are used
  - The equipment should be handy and practical e.g. battery operated

One *Aspergillus* conidiophore producing numerous conidia



Alternaria colony with abundant mycelium but only with few conidia


Aspergillus

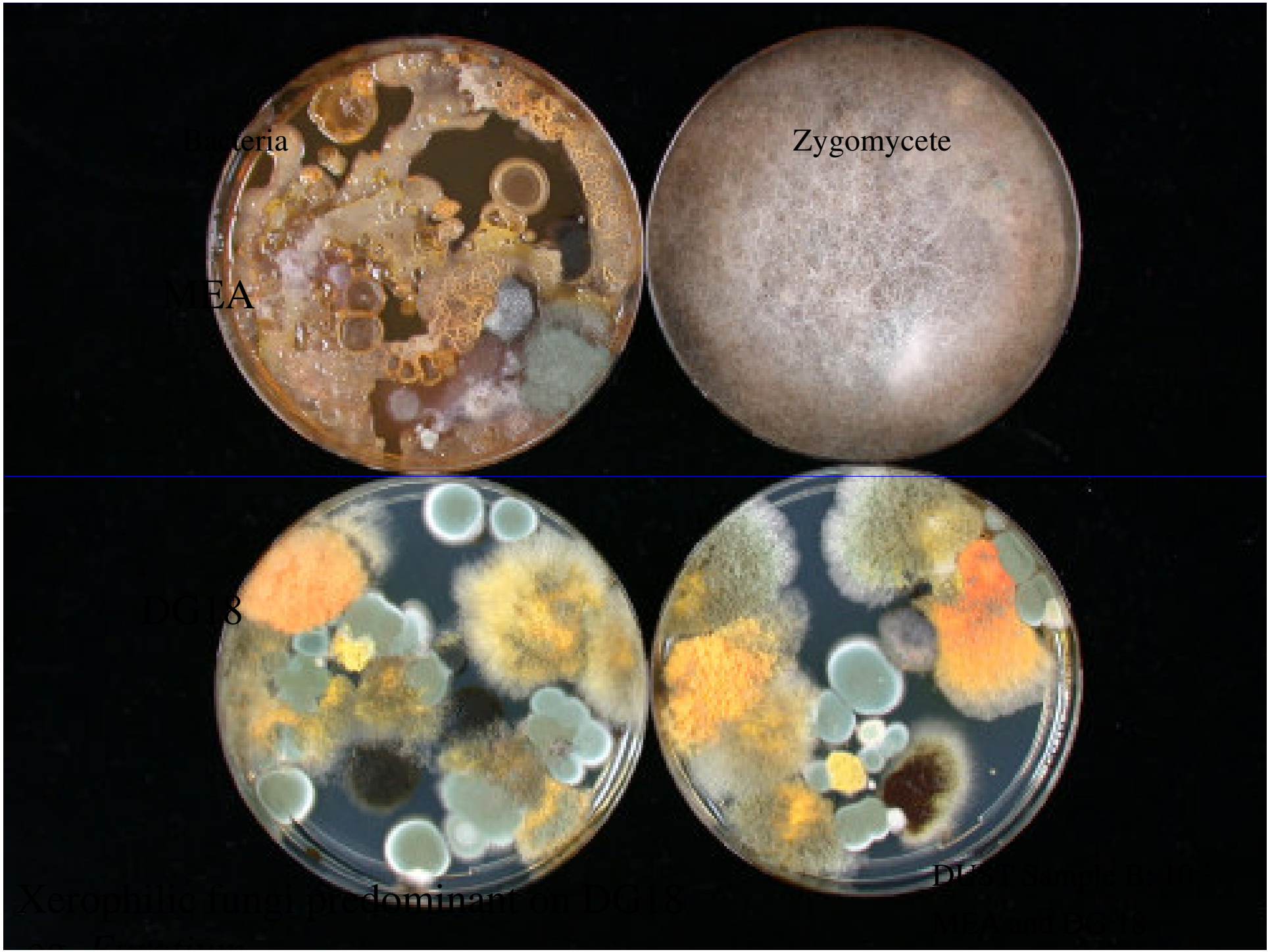


Quantitative estimation of airborne moulds

- Mould colonies can produce many different propagules which become airborne
- There is much difference in the way and the degree of sporulation
- Spores may occur singly, in chains, in groups or in slimy aggregates
- In samples mostly the viable propagules can be detected
- The number of airborne propagules vary in time and depends on factors such as wind, movement etc.

Detection: media and incubation

- Media
  - moist and wet environments:
    - malt extract agar
  - dry environments:
    - DG18 agar
    - malt extract agar
- Incubation
  - temperature: 25°C (or higher)
  - time: 5 days for counting, longer for identification


Bacteria
Zygomycete
MEA
DG18
Xerophilic fungi predominant on DG18

Identification of the fungi

- The identity of the species will reveal important information:
  - Dominance
  - Pathogenicity
  - Toxicity
  - Conditions of growth

Summary

- There are no standards for measuring fungi in indoor environments
- Most methods only detect viable fungal propagules and the significance of dead fungal fragments should not be underestimated
- Quantitative estimation can provide an indication but is not a precise method
- Identification of the fungi is important

Symposium

- Fungi and Health
- 13 en 14 november 2008
- Trippenhuis KNAW Amsterdam
- Sessie on Living in healthy environments
  - sprekers: Flannigan, Warscheid, Adan & Samson
- www.cbs.knaw.nl