



EDLab

Environmental Diagnostics Laboratory



#107295

Air-borne Fungi: A Tool for Indoor Environmental Quality Assessment (IEQ)

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Booth #371

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Air-borne Fungi

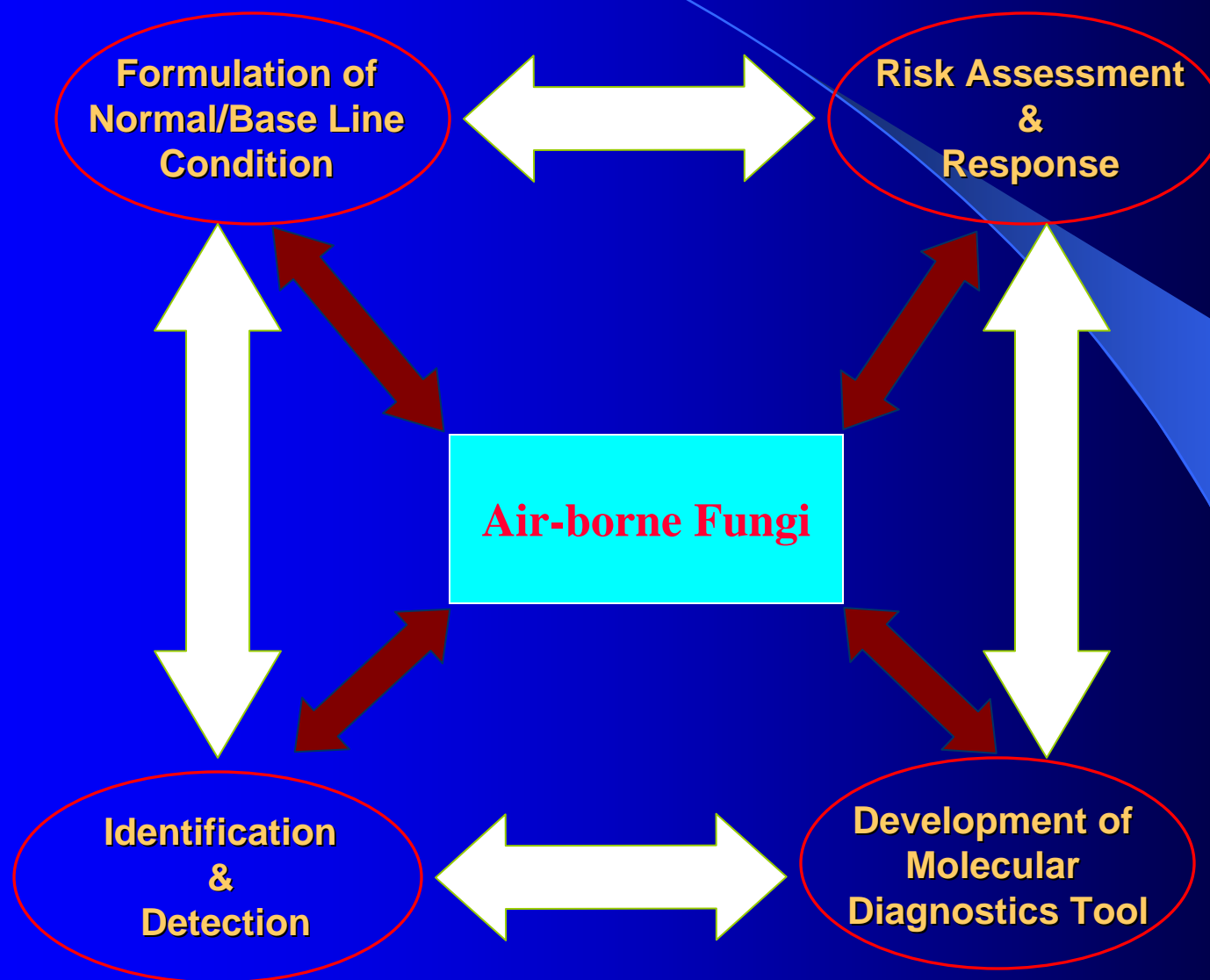
- An IEQ Parameter
- Nature and Extent in Buildings
- Spore Trap Method
- “More pixels....better resolution”

Period of Study: 1995 – 2005

Goals

- Study Air-borne Fungal Diversity in Buildings
- Establish Air-borne Fungal Concentration Levels as an IEQ Tool

Why are Air-borne Fungi Important?



Air-borne Fungi

- Out of an estimated 1.5 million fungal species only 75,000 – 100,000 are described¹
- Over 1,000 new species are described annually
- Not all fungi are distinguishable morphologically²
- Over 90% of the species are aerosolized

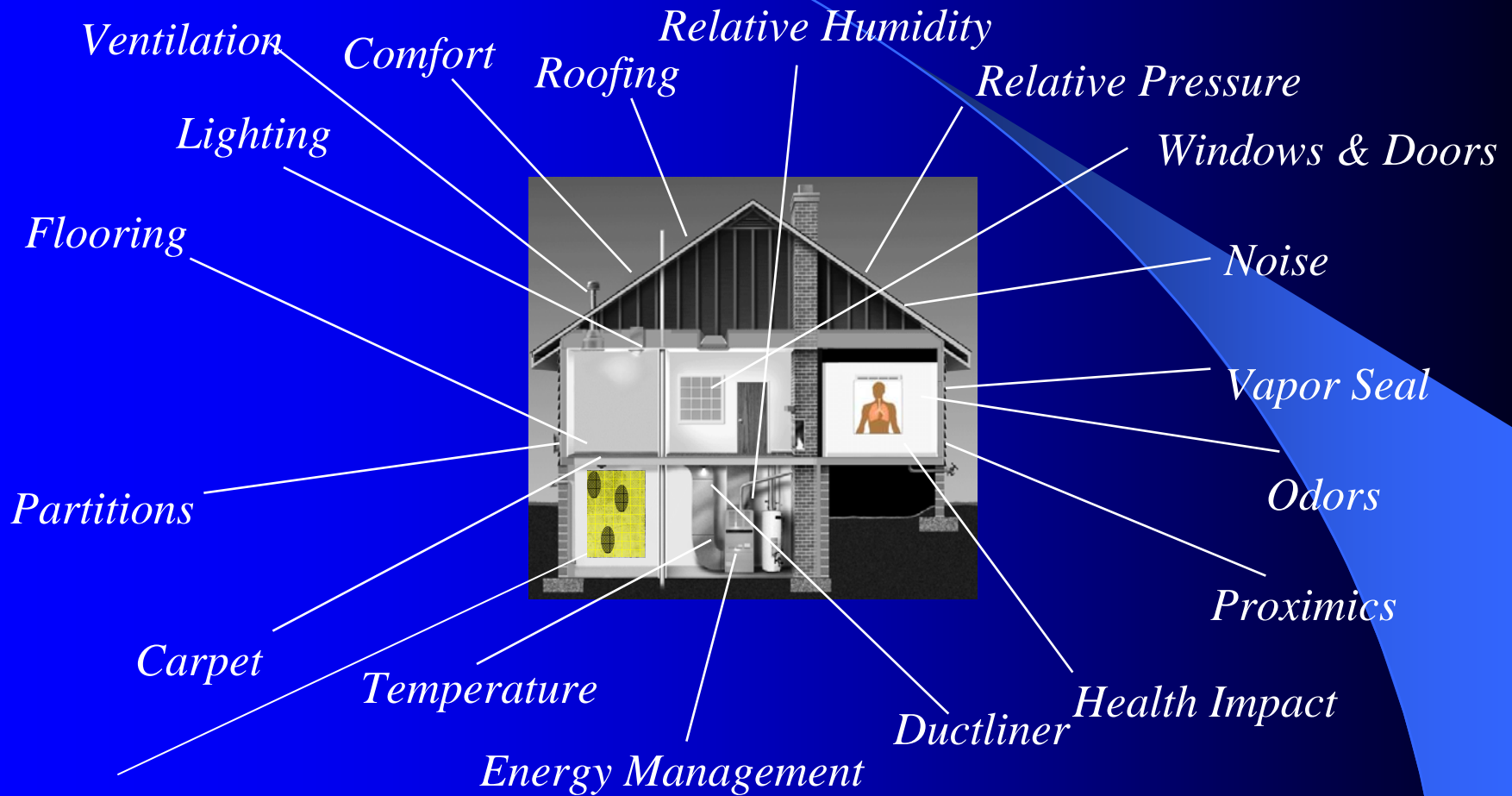
¹hawksworth 2001; Hawksworth and Rossman 1997

²o'donnell et al. 2004

AIR-BORNE FUNGI

- Classified as:
 - Phycomycetes
 - Ascomycetes
 - Basidiomycetes
 - Deuteromycetes
 - Unidentified

Indoor Environmental Quality



Biological

Important IEQ Parameters

Building Conditions

- Worldwide as many as 30% of buildings have indoor air quality complaints¹
- In the united states, as many as 40% of homes have mold problems²
- 115,000 schools have health problems linked to poor indoor air quality³
- Sick Building Syndrome (SBS)
- Building Related Illness (BRI)

¹A 1984 world Health Organization Report

²Brunckreef et al 1989; Spengler et al

³EPA – OAR Recent Additions 2002

Health Implications

1. Immunological Effects
 - Allergy (1 in 4 people worldwide)
2. Toxic Effects
 - Flu-like symptoms
3. Infectious Disease
 - Aspergillosis

Bio-deterioration

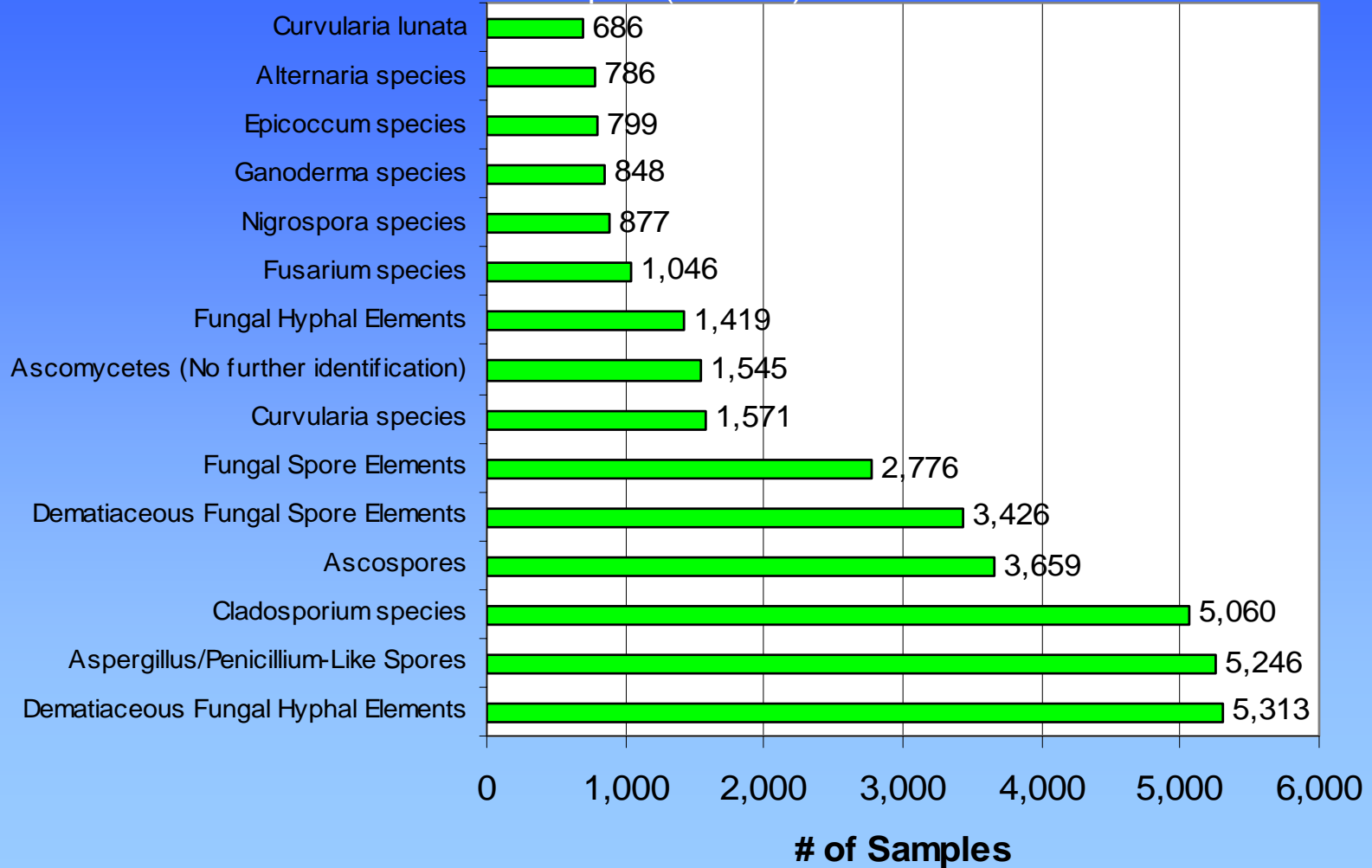
- Deterioration of Building Materials
- Paper, Books, and Other Library Materials
- Paintings and Other Art Works
- In the last two decades, numerous studies have been conducted on bio-deterioration.

Materials and Methods

- Period of Study : 1995-2005
- Building IEQ Surveys (Based Upon Request)
 - 1,855 buildings
 - 8,406 test sites
 - 45 States
- Air-O-Cell™ (Impaction due to suction)
 - 9,232 Samples Analyzed
- Standardized Protocol
 - Air flow rate
 - Exposure time
 - Trained Technicians
- Microscopy
 - Light Microscopy
 - Experienced Microscopists
 - Samples Analyzed by EDLab (AIHA EMPLAP #107295)

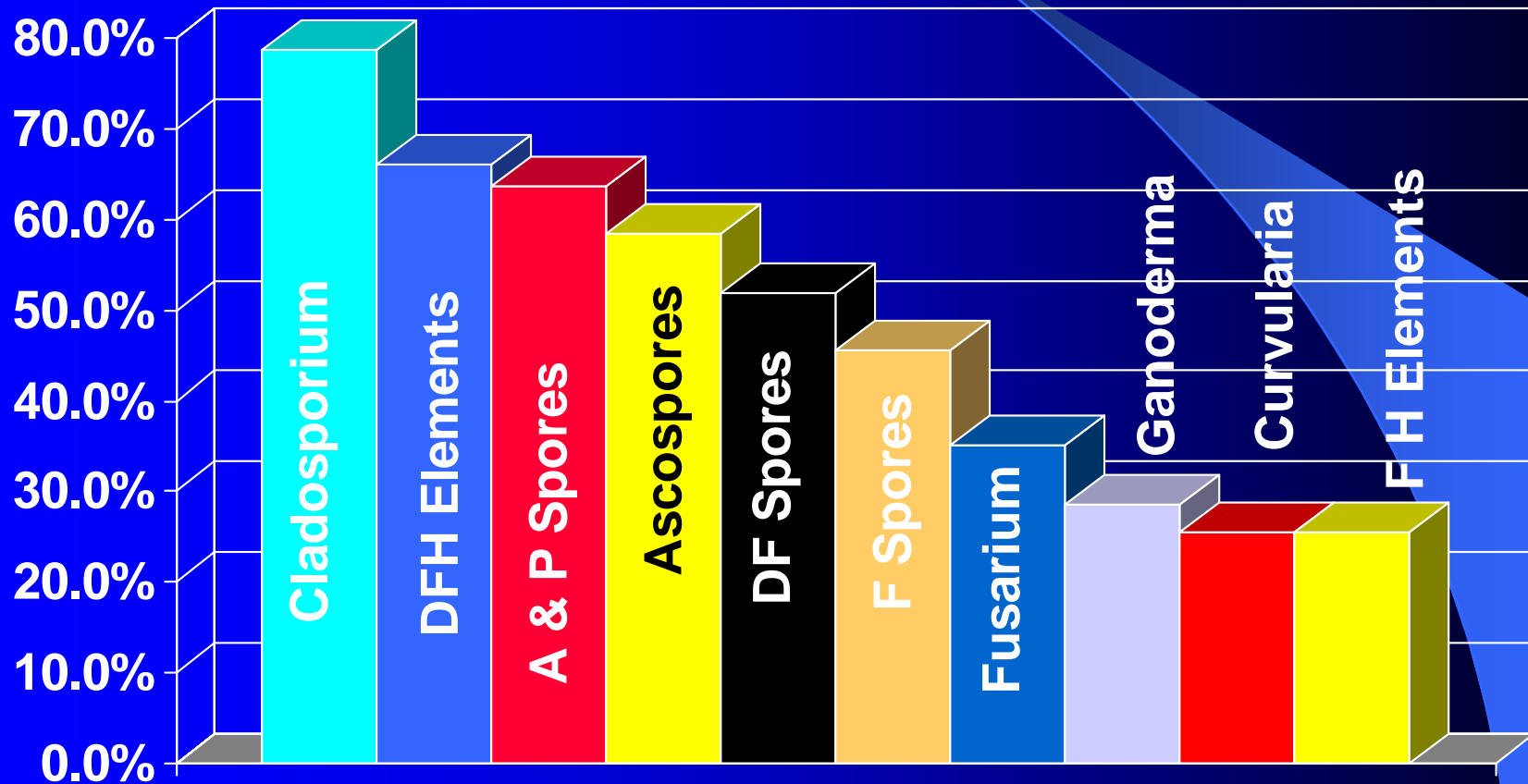
Spore Trap (Air-O-Cell) - Fungal Elements/Spores Predominant Species

All Samples (n=9232)



Note: Total Number of Air-borne Fungi Identified : 117

Prevalent Air-borne Fungi (Outdoor)

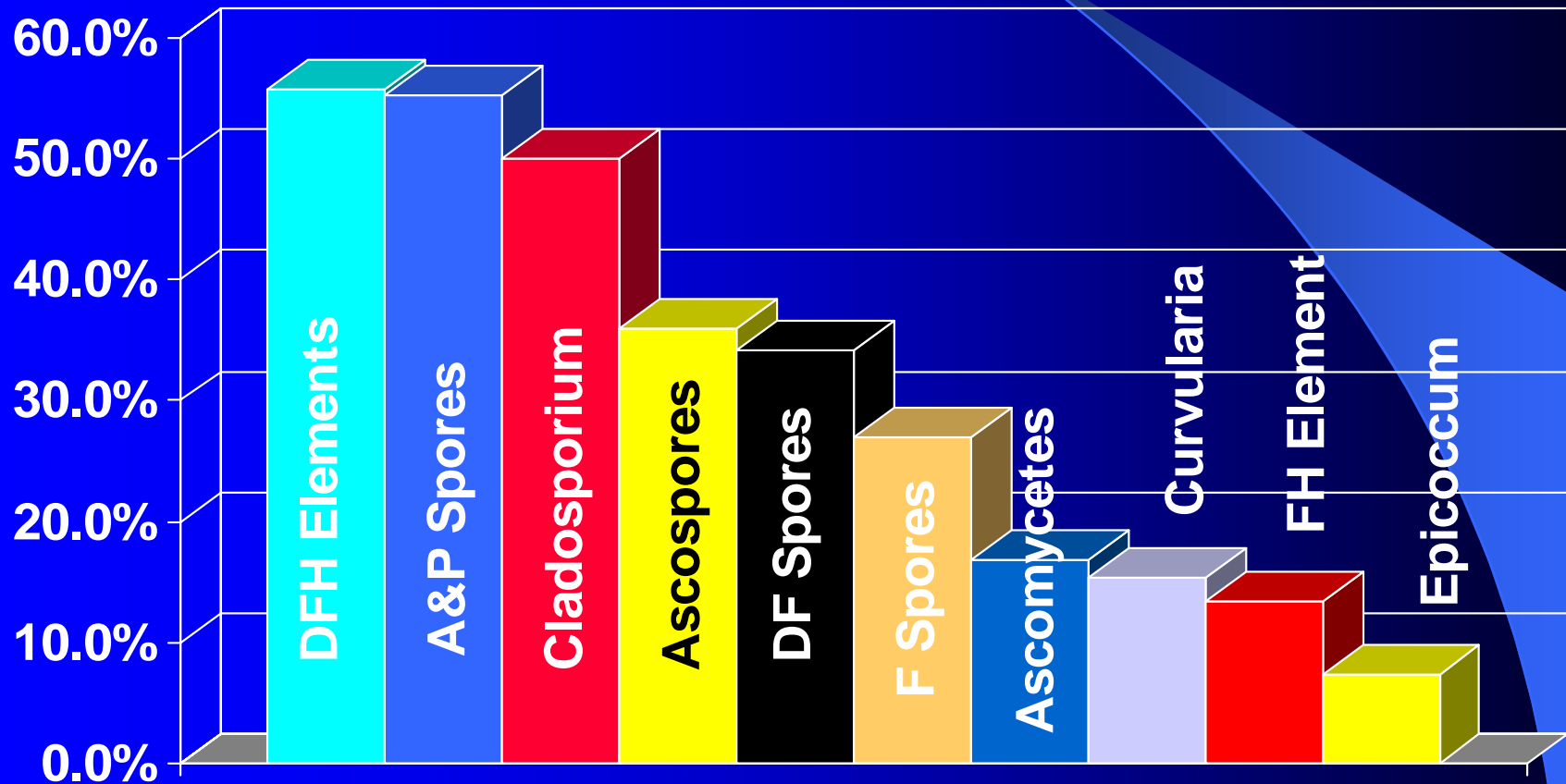


DFH=Demetacious Fungal Hyphal

A&P=Aspergillus and Penicillium like

Name of Taxa

Prevalent Air-borne Fungi (Indoor)



DFH=Demetacious Fungal Hyphal

A&P=Aspergillus and Penicillium like

Name of Taxa

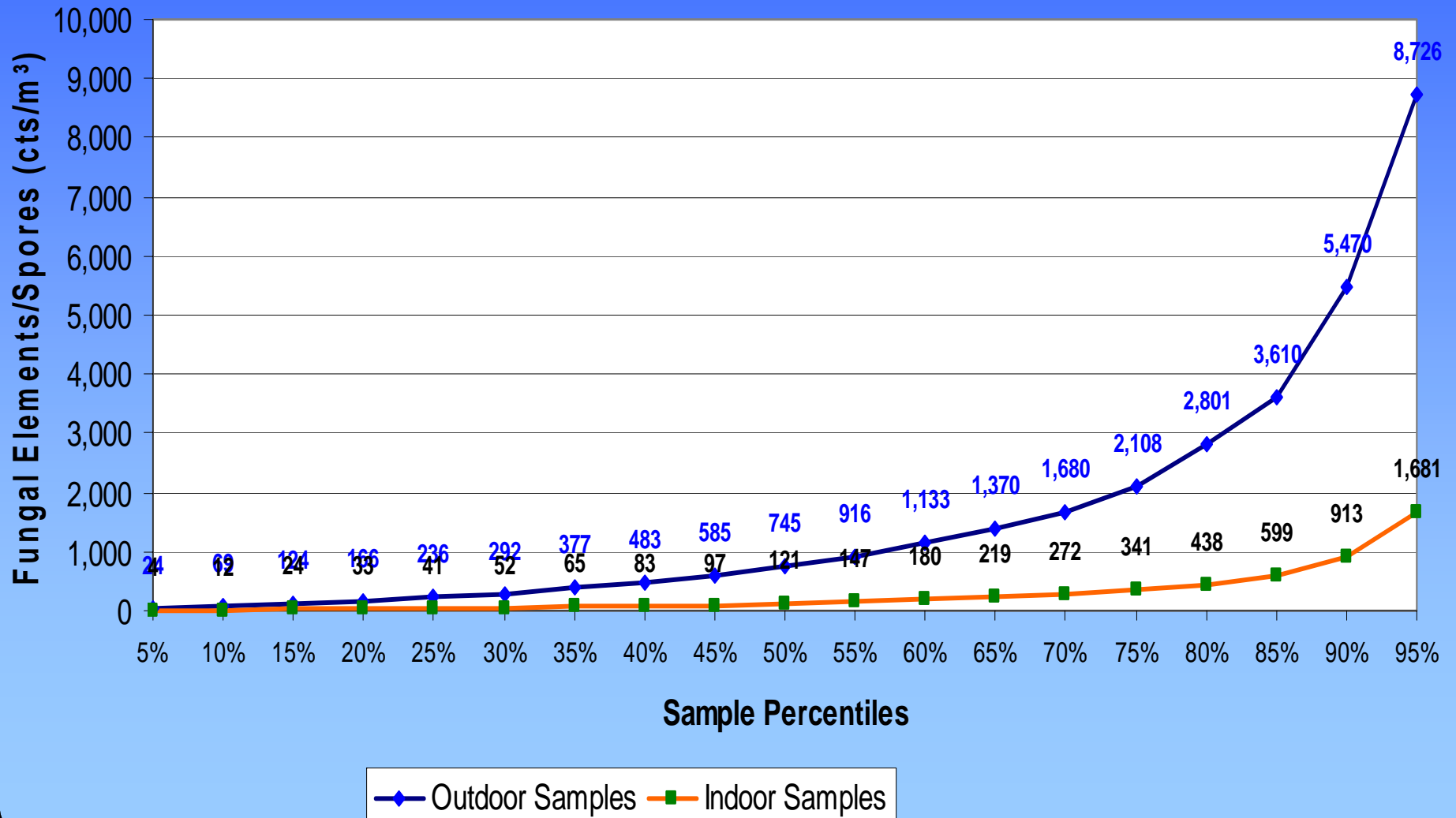
Concentration of Fungal Spore Elements

Counts per cubic meter of air (cts/m³)

USA, 1995 - 2005

| Sample Sites | Numbers | | | | Counts per cubic meter of air (cts/m ³) | | | | | | |
|--------------|---------|-------|-------|--------|---|--------|---------|--------|------|-----|-------|
| | Samples | Sites | Bldgs | States | Median | Mean | Trimean | Avg. | Mode | Low | High |
| Indoor | 7738 | 7120 | 1837 | 45 | 121 | 382.8 | 156.0 | 269.4 | 24.0 | BDL | 8097 |
| Outdoor | 1494 | 1285 | 1166 | 45 | 745 | 2027.9 | 958.5 | 1493.2 | 24.0 | BDL | 29159 |

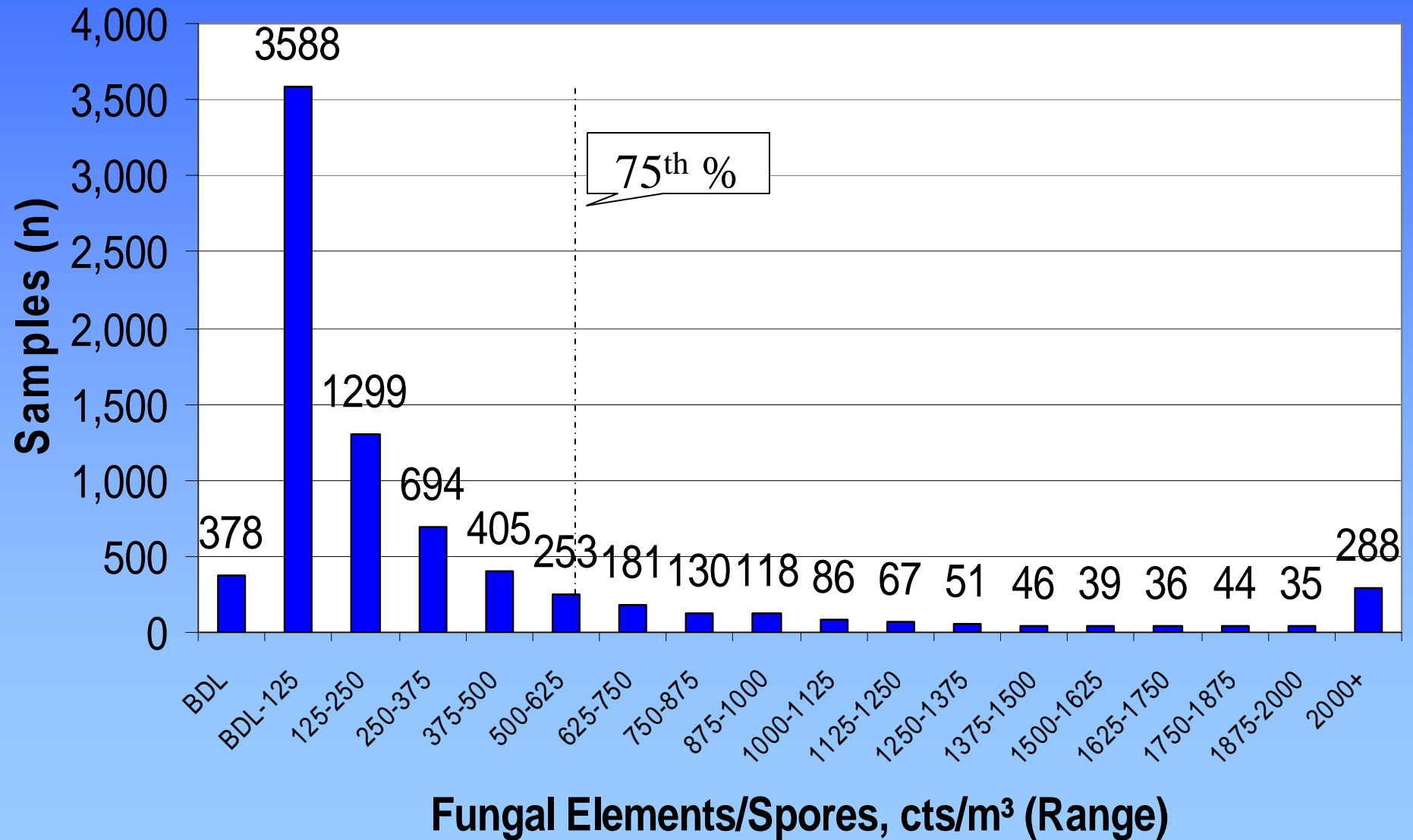
Concentration of Air-borne Fungi (Percentile)



Spore Trap (Air-O-Cell) - Fungal Elements/Spores

Indoor Samples (n=7,738)

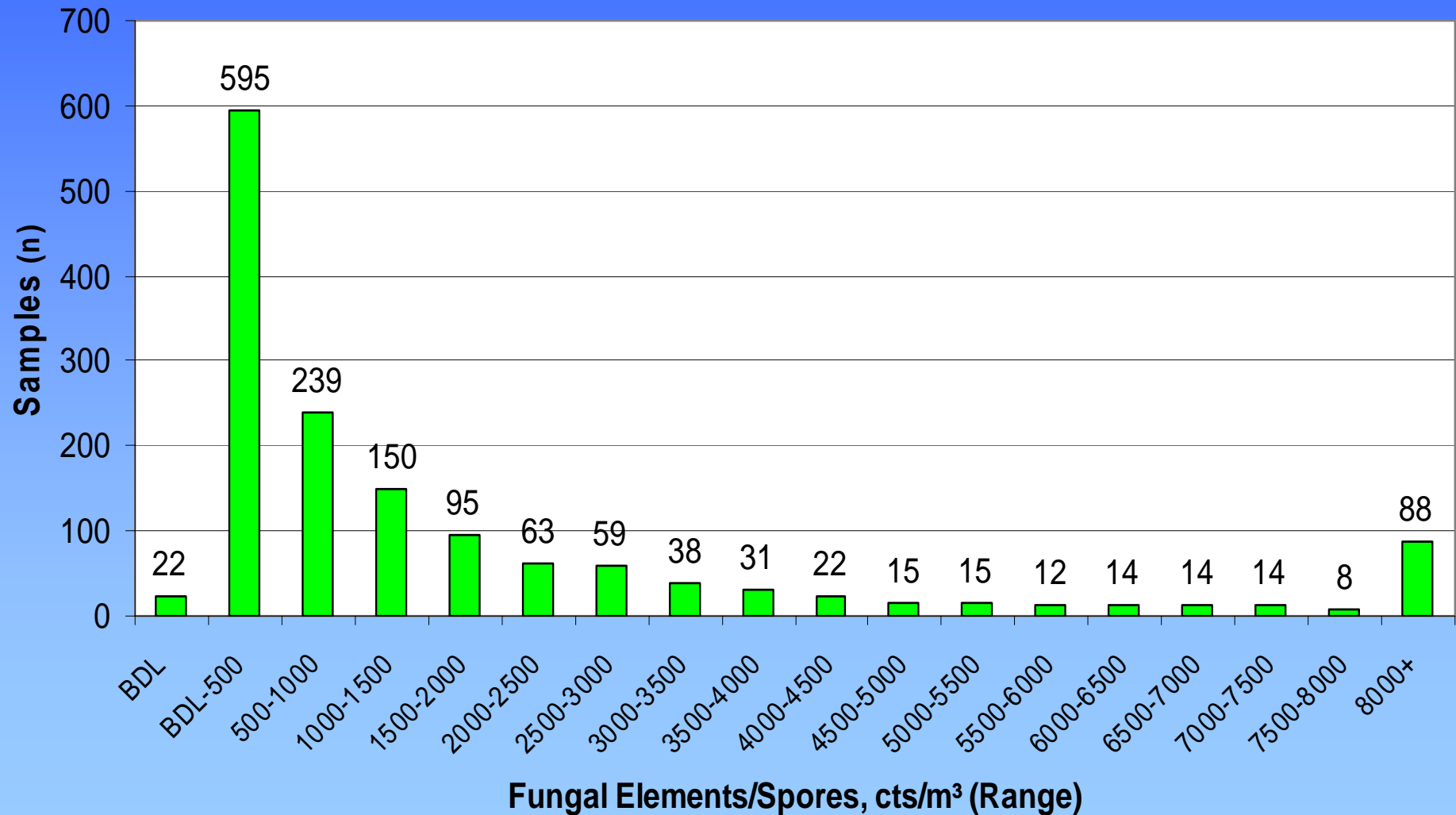
Histogram of Sample Frequencies



Spore Trap (Air-O-Cell) - Fungal Elements/Spores

Outdoor Samples (n=1,494)

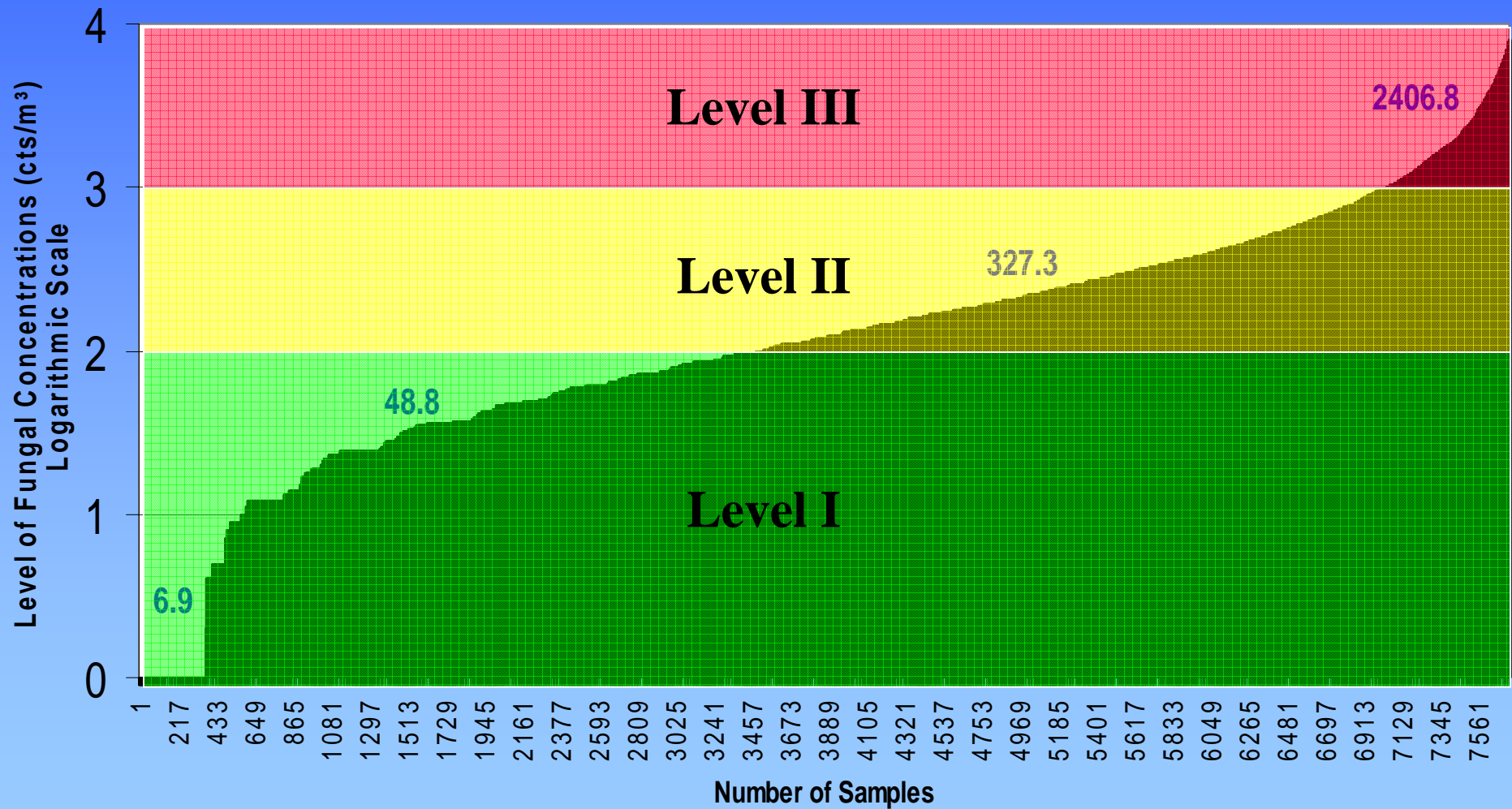
Histogram of Sample Frequencies



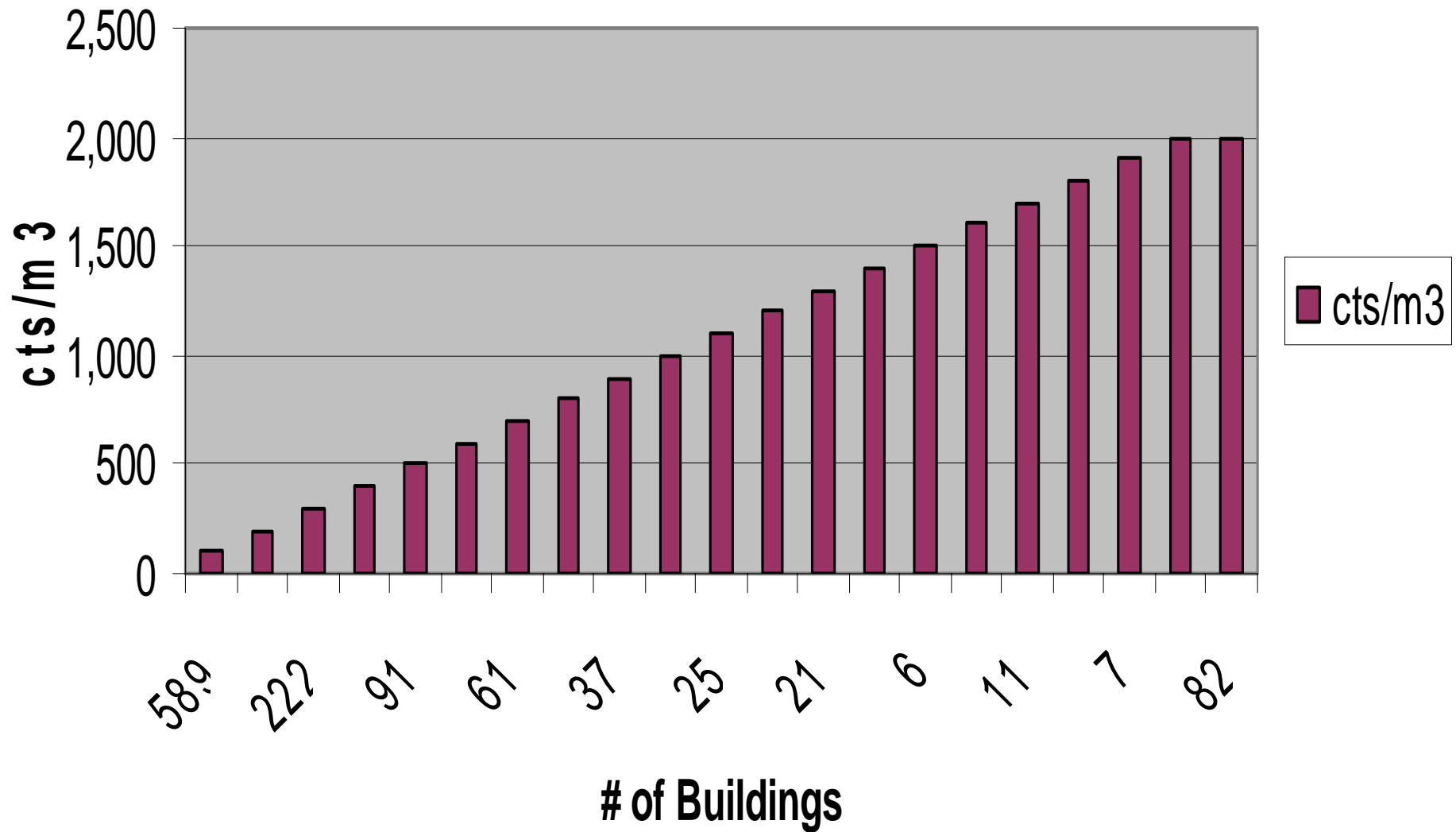
Spore Trap (Air-O-Cell) - Fungal Elements/Spores

Indoor Samples (n=7,738)

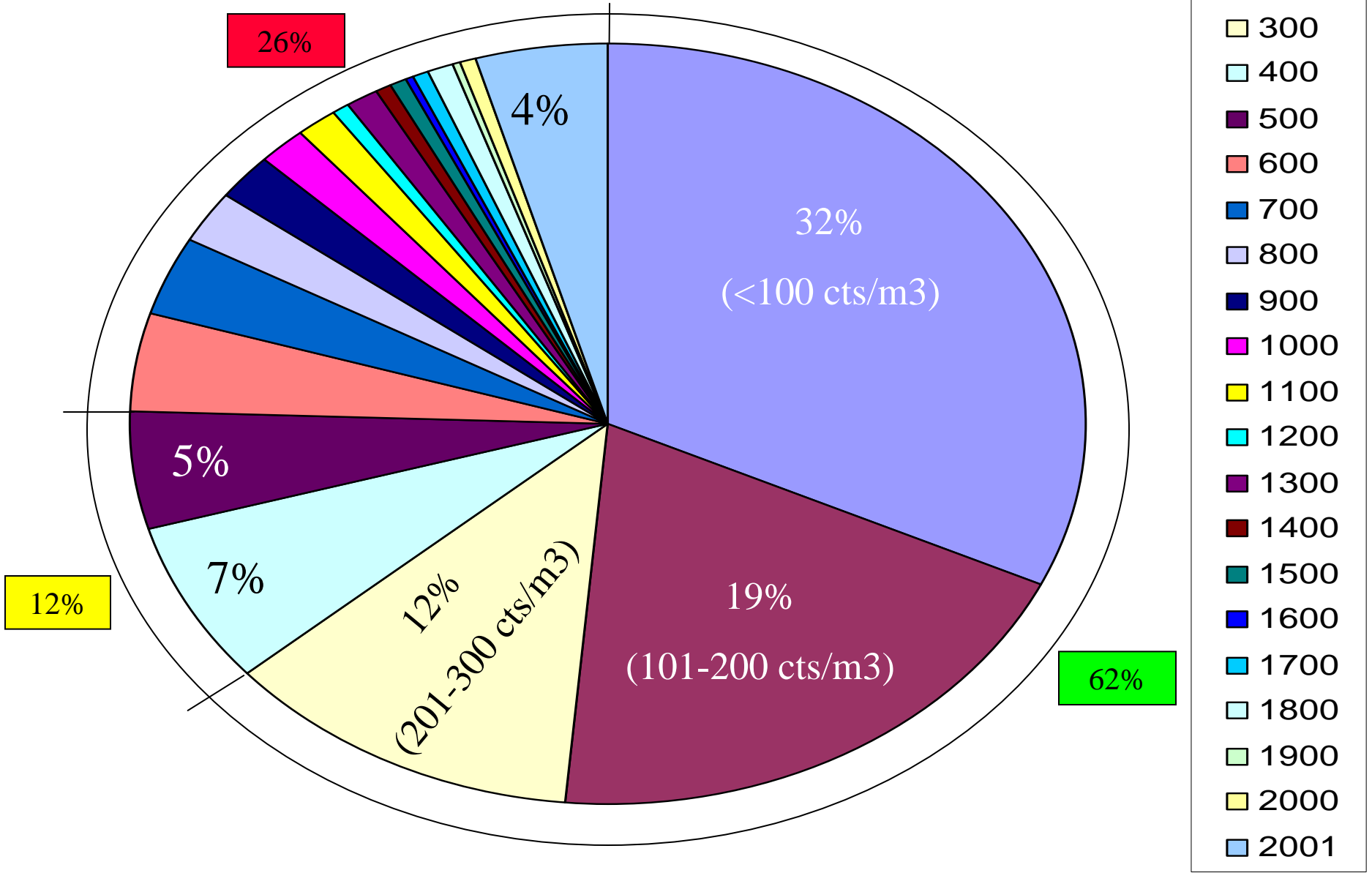
Histogram of the log of Fungal Counts/m³



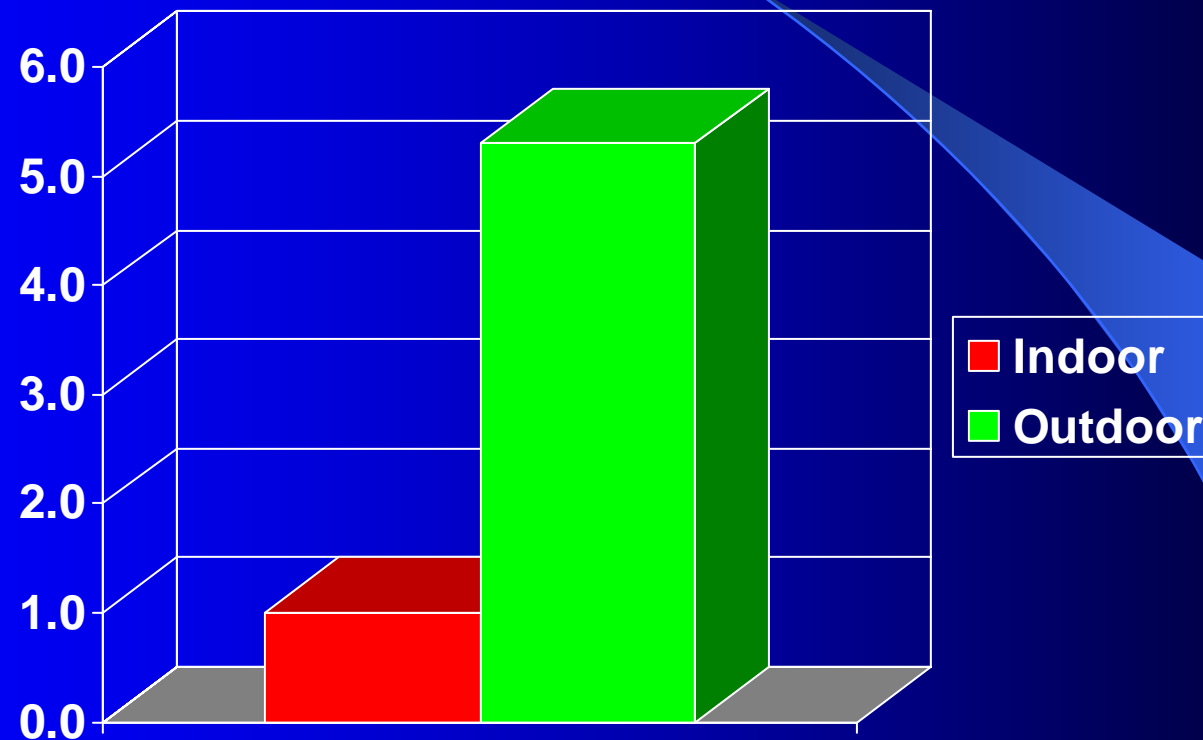
Total Counts of Air-borne Fungal Spores in Buildings



Buildings Grouped by Fungal Concentration



Indoor vs. Outdoor Ratio



Based on Total Fungal Concentration

Fungi In Indoor Environments

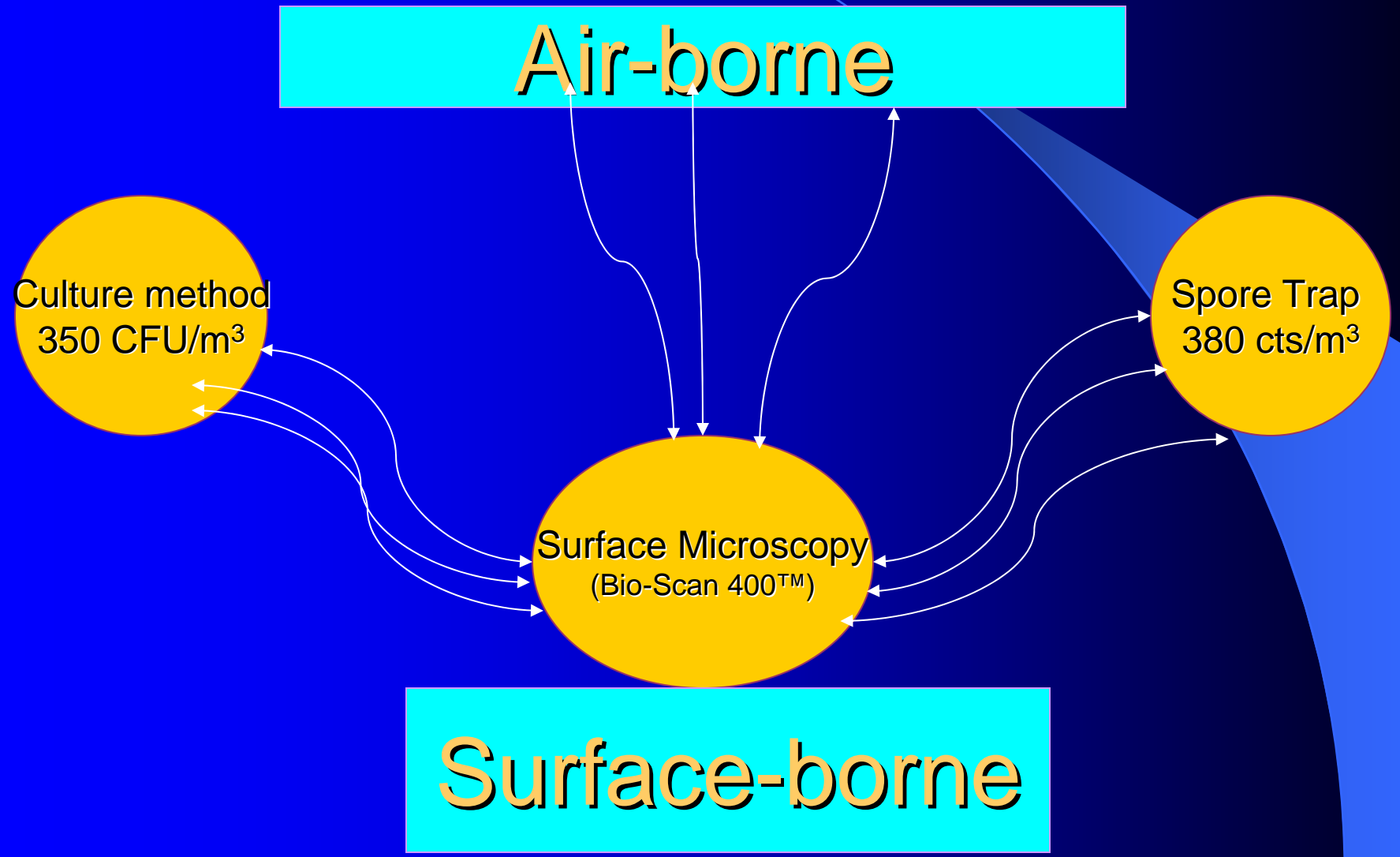
Air-borne

Culture method
350 CFU/m³

Spore Trap
380 cts/m³

Surface Microscopy
(Bio-Scan 400™)

Surface-borne



Summary

- Period of Study: 1995-2005
- Number of Buildings Tested: 1,855
- Number of Samples Analyzed: 9,232
- Number of Air-borne Fungi Identified: 117
- **Reference Number** : ≤ 380 cts/m³

“More pixels...better resolution”

- Fungi is one of the important parameters to assess Indoor Air Quality
- Assay types play a pivotal role in understanding fungi
- Other factors...

Acknowledgements

Alan Wozniak, President/CEO

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Review Committee Members:

- Dr. Monroe King, Associate Professor, USF
- Mark Wozniak, CIAQP
- Francisco Aguirre, CIAQP
- Cyndy Bailey, Operations Mgr.
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- Mark Wiemer, IT

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Care for Health...Respect for Environment

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End of Presentation

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