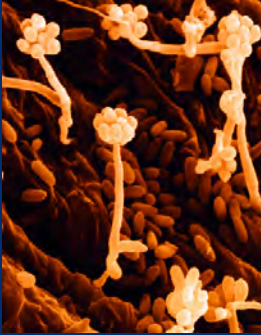


Significance of indoor molds

- Biodeterioration of the building
- Health implications
 - Allergy
 - Pathogens (e.g. *Aspergillus fumigatus*)
 - Toxins (e.g. Black toxic mold)

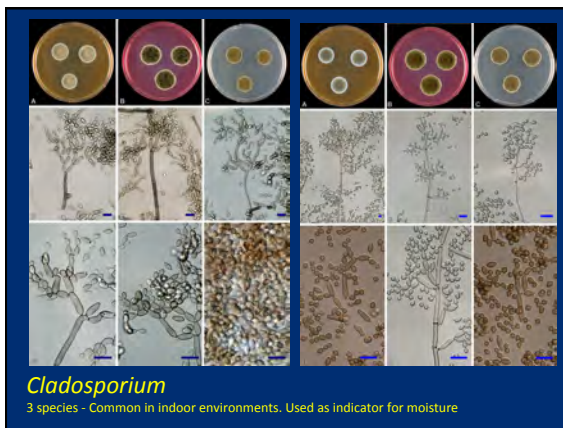


Ecology of indoor fungi

Current concepts

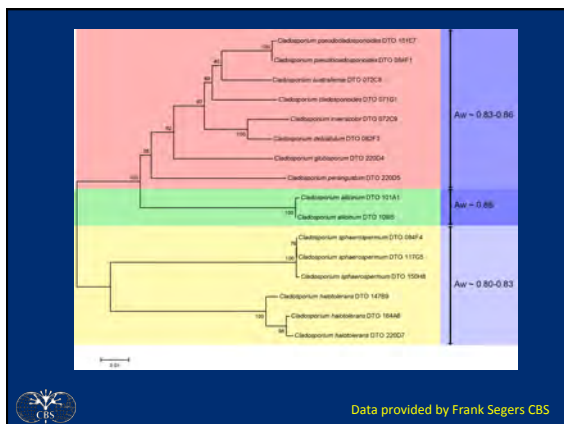
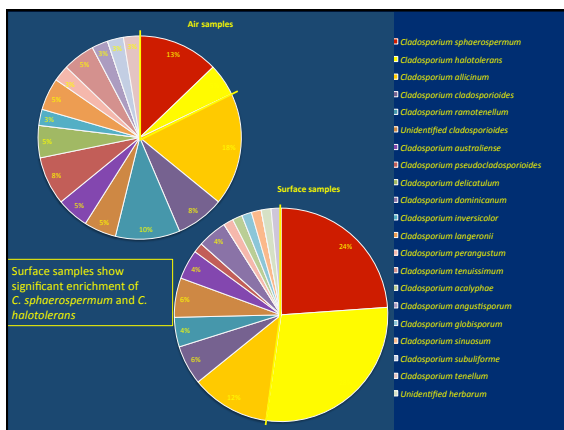
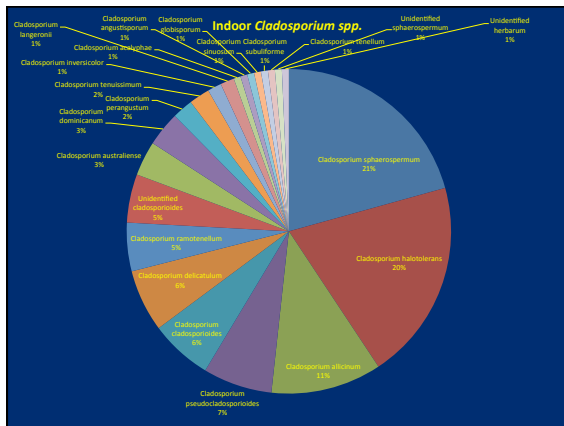
- The mycobiota of indoor environments is known (ca. 120 species) and is different in its composition from outdoors (phyllloplane fungi)
- The mycobiota is very similar to that occurring in food
- Many species are xerotolerant or xerophilic
- Indoor fungi cause allergy and can produce toxic metabolites on building materials





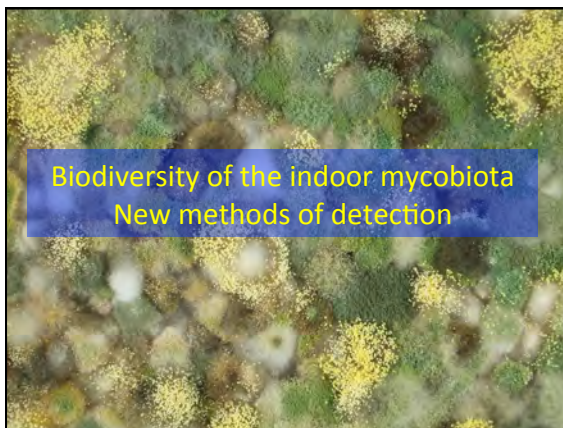
The genus *Cladosporium*

- The taxonomy of the genus *Cladosporium* based on multigene sequences
- Three main species complexes
- Bensch *et al* (Stud Mycol 2012)

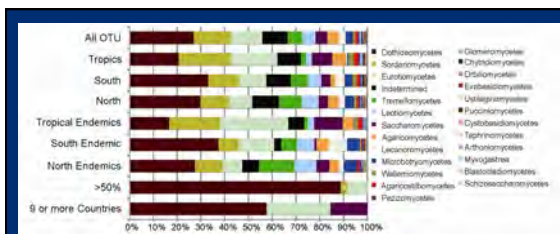


Cladosporium in indoor environments

- The most common indoor *Cladosporium* species are *C. halotolerans* and *C. sphaerospermum*
- These fungi can grow at lower water activities (0.80 – 0.83) which was been previously not known
- *C. herbarum* is rare or not found indoors

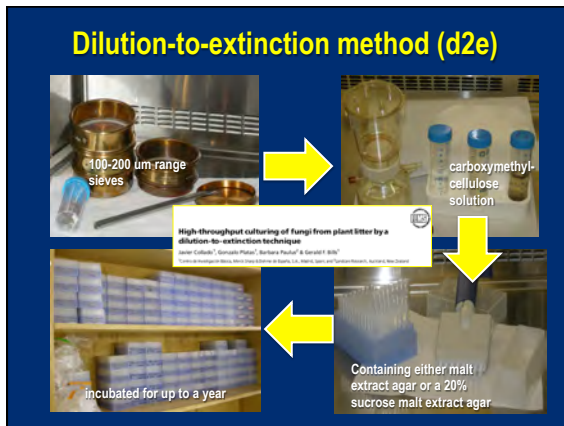


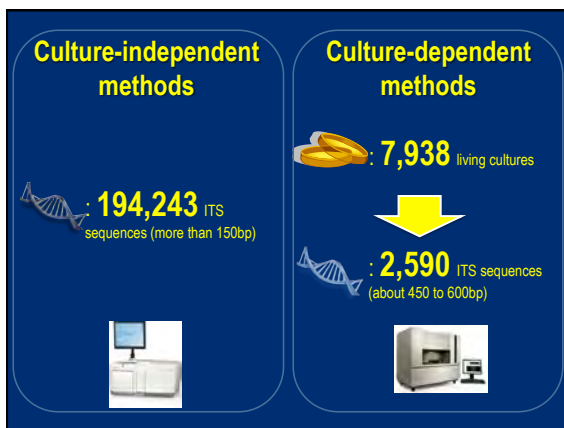
Biodiversity of the indoor mycobiota New methods of detection



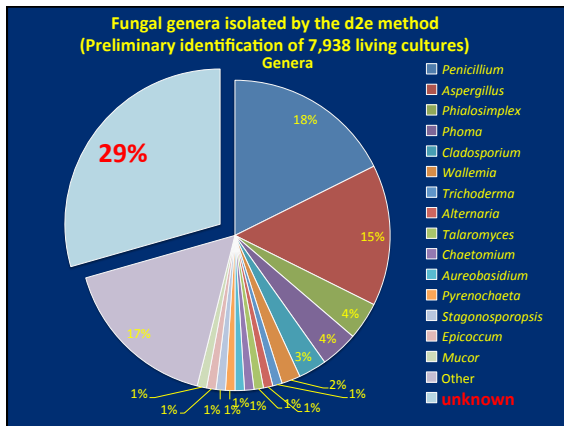
- Settled dust samples (n = 72) from buildings on six continents were collected and pyrosequenced in multiplex using 454 Titanium technology
- A high diversity of indoor fungi
- The diversity is higher in temperate zones than in the tropic
- Building function has no effect on composition of the indoor mycobiota
- The most cosmopolitan OTU's were dominated by Dothideomycete taxa

Amend AS, Seifert KA, Samson RA, Bruns TD (2010) Indoor fungal composition is geographically patterned and more diverse in temperate zones than in the tropics. PNAS 107: 13748-13753





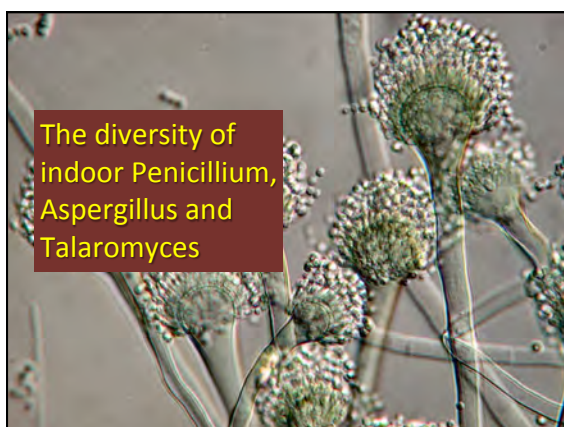


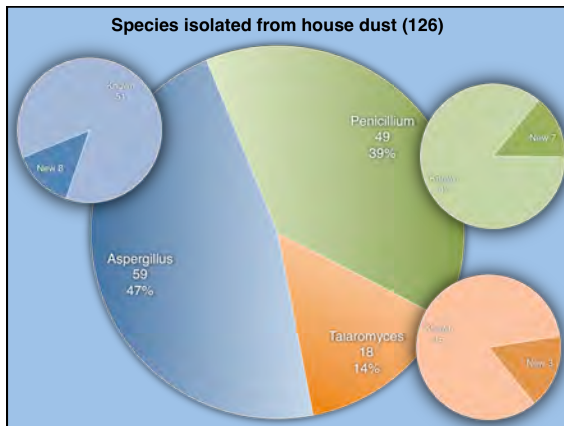


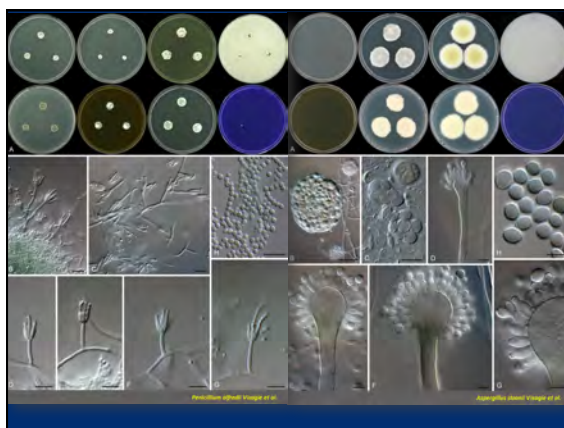
About 1/3 of the OTUs are undescribed or not sequenced and 7.5% of OTUs represent unknown or unsequenced higher taxa

Our estimated diversity → **~1790 species**

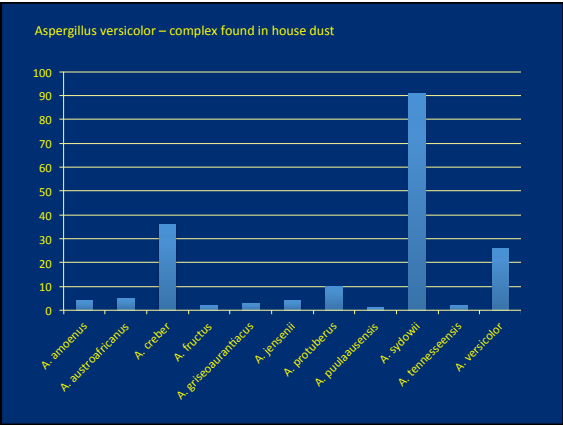
New or unsequenced species → **~600 species**
(~135 higher level taxa)











Exometabolites in *Versicolores*

<i>A. austroafricanus</i> :	St, Or, aniduguinolones, calbistrins
<i>A. jensenii</i> :	St, Or, calbistrins, cyclophenols, sh, versicolamides, versicotides
<i>A. protuberus</i> :	St, Or, cottoquinazolines, cyclophenols, sh, versicolamides, versicotides
<i>A. puulaauensis</i> :	St, Or, brevianamide M, insulicoides, sh, versicolamides
<i>A. amoenus</i> :	St, Or, kipukasins, versicolamides
<i>A. creber</i> :	St, ---, aniduguinolones, versicolamides
<i>A. cyjetkovicii</i> :	St, ---, brevianamide M, cottoquinazolines, epi-deoxybrevianamide E, 1,3,6,8-tetrahydroxyanthraquinone, versicolamides, versicotides
<i>A. venenatus</i> :	St, Or, epi-deoxybrevianamide E, versicolamides
<i>A. fructus</i> :	St, Or, anthcolorins, glyanthrypine, tryptoquivalins
<i>A. subversicolor</i> :	St, Or, "unique exometabolites"
<i>A. tennesseensis</i> :	St, Or, brevianamide M, brevianamides J,K,Q,R,T-W, cottoquinazolins
<i>A. versicolor</i> :	St, Or
<i>A. sydowii</i> :	---, Or, 5'-deoxy-5'-methylamino-adenosine, butyrolactones, sydonic acids, sydowinins, WIN 64745 & 64821
<i>A. tabacinus</i> :	---, Or

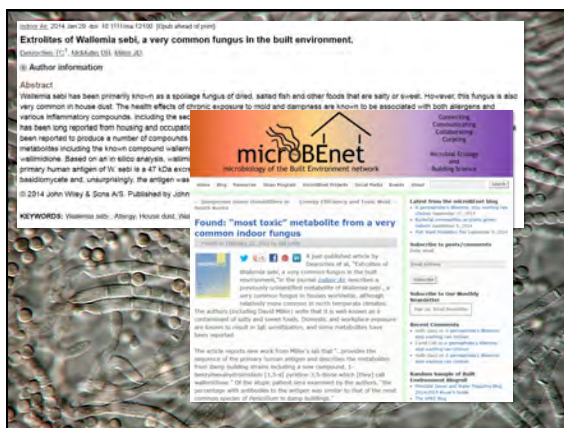
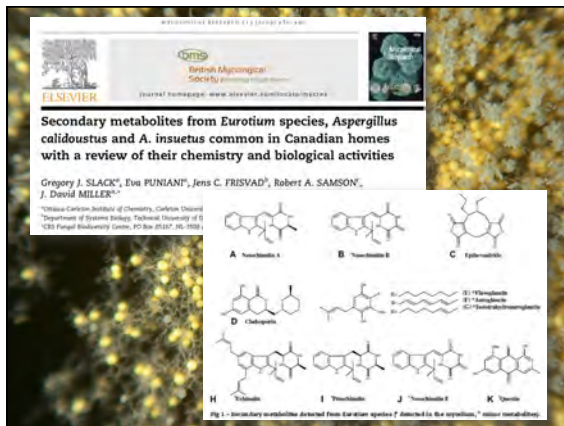
St = stigmatocystins, Or = Orsellins & violaceols, Sh = shamixanthone der.

Data from Jens C. Frisvad

Indoor fungi and toxin production

Indoor moulds	Growth on building material	Toxins on building materials
<i>Alternaria spp</i>	yes	No toxins found
<i>Aspergillus flavus</i>	Yes but very wet	No aflatoxins
<i>Aspergillus niger</i>	Yes but very wet	No toxins found
<i>Aspergillus versicolor</i>	yes	Sterigmatocystin but not produced at aw<0.9
<i>Aspergillus calidoustus</i>	Yes but poor growth	No toxins found
<i>Chaetomium globosum</i>	yes	Chaetomins and chaetoglobins
<i>Cladosporium spp</i>	yes	No toxins found
<i>Penicillium chrysogenum</i>	yes	No toxins found
<i>Stachybotrys chartarum</i>	Yes but wet	Trichothecenes, satratoxins
<i>Ulocladium spp</i>	Yes but wet	No toxins found

Data from Kristian Nielsen - DTU



Summary

- There are many genera/species which were not expected indoors and are unknown to science
- Some fungi which occur commonly prove to be taxonomically complex (e.g. *Scopulariopsis*, *Phoma*)
- How can we deal with all the new species and what is their significance?
- What does it mean that there are many xerophilic species
- Which species are responsible for allergy or toxins??



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