exposure to passive smoking is concerned, two issues have to be considered. The first, which has been developed in the preceding section, is that passive smoking could act to disclose an asthmatic state that was so far asymptomatic. The second issue lies in the natural history of asthma. Following Martinez *et al.*'s publications,[20] it has become obvious that transient wheezing could occur in non-atopic infants exposed to passive smoking. Because the relationships between passive smoking and asthma are mostly demonstrated in infants and young children, and have a tendency to weaken with increasing age, one cannot discard the hypothesis that passive smoking is responsible for transient wheezing, not for an asthmatic disease. In this field also, prospective long-term studies are clearly needed.

In conclusion, the relevance of such risk factors as allergen exposure, air pollution and passive smoking is far from being clear. Because the implication of such risk factors has enormous social consequences, such a clarification is strongly needed. More carefully designed epidemiological investigations should obviously be performed.

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Fungal allergies

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Introduction

Inhalation of fungal spores may induce a wide range of allergic diseases: rhinitis, dermatitis, allergic bronchitis, asthma, allergic broncho-pulmonary aspergillosis, and even hypersensitivity pneumonitis.

Asexual fungal spores are among the most numerous and diversified airborne microoorganisms that we breathe. Filamentous fungi are disseminating their spores in the air by thousands and, in temperate zones, hundreds of species are continuously invading our environment.

Few surveys are carried out to define the airborne fungal flora in indoor spaces. Results are often incomplete and should require further investigation. As a matter of fact, a lot of mould species grow only on specific media and, depending on the temperature of incubation, the results will be completely biased by the selection. Moreover, sedimentation sampling methods are still currently used too often (contact plates left open); they only give a restricted overview of the mycoflora since numerous species do not grow in these conditions. Furthermore, many researchers do not identify moulds up to species level. And as far as allergy is concerned, specificity is the key element when making a diagnosis.

How many allergenic species are there?

Indoor moulds and their adverse health effects

Indoor moulds grow abundantly in dark, moist, warm and ill-ventilated places. These ideal conditions are found not only under warm and moist climates, but nowadays also in temperate zones. Indeed, excessive insulation after the oil crisis has markedly favoured condensation areas (cold bridges) from cellars to attics, which rapidly become the centre of intensive mycelial growth. A parallel change in lifestyle has led

to increasing production and accumulation of moisture in homes (frequent showers, new cooking methods, inadequate airing of bedrooms, etc.).

From 1981 to 2000, the Scientific Institute of Public Health sampled more than 500 home environments of allergic and/or asthmatic patients in urban or rural areas throughout Belgium. Results showed that more than 150 fungal species, among them *Cladosporium, Penicillium* and *Aspergillus*, were collected in 90–98% of the sampled environments. *Cladosporium sphaerospermum* was found in 60% of the dwellings, with the highest levels of contamination especially in bedrooms and bathrooms (hundreds of spores/m^3). *C. sphaerospermum* is often associated with *Aureobasidium pullulans, Phoma* sp., *Acremonium strictum* and some yeast on window frames, whereas *Cladosporium herbarum*, which is an outdoor mould, does not grow in dwellings. However, its spores invade home environments through open doors and windows, mainly during the summer months.

Aspergillus versicolor, Penicillium chrysogenum, Penicillium aurantiogriseum, Penicillium spinulosum, Penicillium brevicompactum, Chaetomium globosum, Stachybotrys chartarum, A. strictum and *Alternaria alternata* are sometimes found in huge quantities on walls in bedrooms, living rooms and kitchens, most frequently inducing allergic asthma.

Mattresses are also often badly looked after, and the concentrations of dust are often quite important: 10^3–10^7 spores/g of dust. In temperate regions, moulds, like mites, are thriving in environments that are excessively moist because of a lack of ventilation and new living conditions. In tropical zones, the conditions that stimulate the growth of moulds are found naturally. Among the most frequent species, *C. sphaerospermum, A. alternata, Epicoccum purpurescens, A. pullulans, Aspergillus restrictus* and *A. versicolor*, various species of *Mucorales* and *Trichoderma* should be pointed out. Mould strips due to *C. sphaerospermum* can even sometimes be seen at contact point of mattresses and fixed bedslats.

It should also be noted that some Basidiomycetes grow mainly in enclosed spaces. *Serpula lacrymans* or *Merulus lacrymans* is the dreadful dry rot responsible for considerable damage in dwellings. This fungus attacks damp wood and can very rapidly grow across timber and even walls. It only develops in enclosed spaces. For about 20 years now, lack of ventilation in present dwellings has made this fungus active again, and cases of sensitization have been diagnosed.

Mycotoxins associated with moulds are secondary metabolites with low molecular weight compared with allergens. It is well known that ingestion of mycotoxins (ex. aflatoxins) can cause illness and even prove fatal for Man. According to various studies, it has been established now that inhalation of the same amounts of mycotoxins is even more toxic. Trichothecenes produced by *S. chartarum* and various *Fusarium* spp., patulin, and penicillic acid produced by various *Penicillium* have shown acute toxicity. Large areas contaminated by *S. chartarum* and *A. versicolor* can sometimes be seen on damp walls in dwellings. Great care should thus be exercised with patients living in 'musty' dwellings and complaining of irritation symptoms and nausea when at home.

B1–3 glucans, components of the walls of moulds, act as potent inflammatory agents. Their role as asthma exacerbator in musty homes should not be neglected.

In summary, moulds are linked at different stages to allergic reactions and more especially asthma:

- Some moulds (*Alternaria*, for example), like pollens, are potent allergens that can cause severe asthma, calling for emergency treatment.
- A lot of moulds produce secondary metabolites that accumulate in airborne spores. Inflammatory reactions, which play an important role in asthma, are consequently exacerbated by the inhalation of these spores.
- Some moulds produce toxins that directly work on and sensitise the bronchus and lungs.

In fact, people should not be allowed to live in environments contaminated by moulds and fungi.

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Environmental allergen exposure and asthma: prospects for primary prevention

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Why are asthma and atopy increasing – relevance for prevention

The observed increase in asthma prevalence cannot be genetic in origin.[1] Many aspects of modern life