

One of the most common and serious causes of damage to books, paper and photographs is mould. Mould can weaken paper, making it soft and fragile, and can discolour and stain paper, parchment and leather permanently.

Mould is a general term used to describe various species of fungi, usually those that appear fine and powdery and grow on foodstuffs and building surfaces. Like all fungi, mould needs dead or living organic matter for nutrition, as well as a certain level of moisture.

The air contains billions of mould spores, which germinate and bloom when conditions are suitable. Mould grows more easily and quickly in an environment with high humidity, warm temperature, stagnant air and dim light, but many species can also grow in colder conditions – hence the mould on food in your fridge.

A musty odour, stains and furry or downy growth on the surface of an object are very strong indications of a mould outbreak. Collection material most frequently becomes mould-affected through direct water damage, but severe cases of mould also occur when books and papers have been stored in humid conditions over a longer period of time.

Damage due to mould is largely preventable. Storing your collection in clean, dry and stable conditions and ensuring good air flow will help prevent mould outbreaks in your collection.

Health issues

Mould spores, whether alive or dead, are an irritant to the human respiratory system. Some fungal species pose more serious health risks than others, but the general effects of exposure can include lung, skin and eye irritation. The severity of a person's reaction to mould is a combination of several different factors, including the concentration of spores in the air, the length of exposure, and the person's level of sensitivity to mould allergens.

Any mould-affected material should be handled with the protection of disposable rubber gloves, disposable or hot-water-washable garments, eye protection and a face mask. HEPA (High Efficiency Particulate Air) filtered respirator masks are capable of filtering particles as small as mould spores and offer the best protection for your lungs. If these are not available, disposable dust masks provide some protection; dust masks labelled as 'P2' offer more protection than normal dust masks, particularly if they can be shaped around your nose.

However, if you suffer from allergies or respiratory problems you should avoid contact with mould. Treatment of affected material, including brushing off dry spores, should be carried out by a professional conservator.

Shelving and clothing contaminated by contact with mould should be washed immediately in hot soapy water, rinsed and allowed to dry completely. Disposable gloves and dust masks should be disposed of in sealed plastic bags.

Chemical treatments

In the past, chemical treatments such as ethylene oxide fumigation were used to kill mould outbreaks. In most cases this is no longer recommended, as the chemicals used may leave hazardous residues. Also, fumigation does not eliminate the need to physically clean the mould off items, as dead mould still poses a health risk.

Procedures for dealing with mould

Follow these procedures at the earliest sign of mould:

- Deal with mould-affected material as quickly as possible to limit damage and to prevent contamination of other material. Isolate the material prior to treatment by moving it to a dry place, but handle affected material carefully to prevent the spread of spores.
- If mouldy items are dry, store them in sealed plastic bags while awaiting treatment. (Inactive mould is dry and powdery.)
- If mouldy items are damp or wet, remove them to a well-ventilated and isolated area for drying. Rest them on shelving or surfaces protected by waste paper, and allow them to dry. Using fans to hasten drying is probably not a good idea, as they will spread mould spores through the atmosphere. Similarly, avoid drying mouldy materials in a space where the mould spores could contaminate a shared air-conditioning system. Materials that feel cool or show evidence of moisture need further drying time.

- When items are dry, gently remove mould spores from the surface. The best way to do this is by using a HEPA-filtered vacuum cleaner, fitted with a micro-vacuum attachment. Do not use your domestic vacuum cleaner, in case of contamination. A soft brush can also be used to remove spores. In either case, the treatment should be carried out in a fume cupboard by a conservator with the equipment to do this work safely.
- Before reshelving the treated material, try to figure out what caused the outbreak and take steps to ensure it won't happen again – for example, a leak may have caused a localised area of high humidity. Make sure that the collection material and the storage area are clean and completely dry. Shelves should be cleaned with hot soapy water, rinsed and allowed to dry completely.
- Monitor the affected material after the mould clean-up to check for new outbreaks.

Unfortunately, the disfigurement from stains caused by mould is usually permanent, and stabilisation and repairs are often required for mould-damaged items. Consult a conservator to discuss appropriate options.

Prevention

The best means of preventing mould growth is to deny spores the moisture necessary for germination.

- Do not shelve books or store paper materials directly against an outside wall, as they may become damp. Sheds, attics, garages and basement areas are also unsuitable storage areas.
- Allow air to circulate between the wall and storage cabinets to enable any moisture to evaporate.
- Do not over-pack shelves. Allow room for air to circulate.
- Do not store books or any collection material on the floor, as this is the first place water will pool.
- Store your collection in a stable environment with limited fluctuations in temperature and humidity.
- Regularly inspect your collection for mould.
- Keep the storage area clean and dust-free to minimise opportunities for mould growth.
- Ensure that any building maintenance work minimises the possibility of water damage. Cover your collections with plastic sheeting or remove from the work site until the work is complete.

Further information

Heritage Collections Council, 1998, *reCollections – Damage and decay*. Canberra: Collections Australia Network. See collectionsaustralia.net/sector_info_item/24 (accessed June 2013).

Florian, ML, 2002, *Fungal facts: solving fungal problems in heritage collections*. London: Archetype Publications.

Oxford University Library Services, 2005, *Conservation and collection care – mould*. See bodley.ox.ac.uk/dept/preservation/training/mould/intro.htm (accessed June 2013).

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