Mould is in the Air

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It can be present in the air we breathe, the water we drink, the surfaces of a variety of materials, inside organisms, on the soil we walk on, and at times in the food we ingest. Fungi has been the object of study by the scientific community for at least 100 years. The notable discovery of penicillin fungi in 1928 by Alexander Fleming won him the Nobel prize in 1945.

At different moments in our lives a large majority of the world's population has become acquainted with some form or another of fungi. Such as enjoying the visual image of a colony of mushrooms clinging to the bark of a tree, or near the path at the foot of the forest during a nature walk; tasting a delicious meal prepared with wild mushrooms; even perceiving a pungent, moist odor in a damp closet, to experiencing a persistent itch on a body part (usually one with no sun exposure). Let's face it, fungi or mould are a part of our world and most likely has been in Nature for at least as long as humanity has been around. In present day terms mould has become a common household word.

In Biology, mycology is the scientific study of fungi and constitute an independent group from plants and animals. Historically Life (capital "L") as we know it was classified into living and non-living objects, then science further divided it into different kingdoms including the simplistic view of the three categories that divided everything to fit into one of the following descriptions: animals, plants or minerals. In the past fungi was placed within the plant kingdom, but in 1969 Robert Whittaker proposed the classification system of life into 5 main kingdoms, giving fungi a kingdom of its own. One author reports that approximately 70,000 species have been named and estimate that 1,000,000 have yet to be identified and independently named.

In science moulds are described as eukaryotic organisms (unicellular and multicellular organisms). Fungi appear to be like plants but are closely related to animals in the sense that they acquire their food by absorbing cellulose material that has been digested by the secretion of enzymes on to their food source, such as wood, plants, namely all carbon-based material. Animals secrete enzymes and digest food within their digestive systems, fungi secrets enzymes onto the cellulose material located outside its system and then absorbs the digested food source through its cell wall membrane.

The birth of modern public awareness of mould

In Cleveland, Ohio in the United States in the mid-1990s, a number of children in a hospital developed pulmonary hemorrhage or bleeding in the lungs. One of the children under study as a result of the pulmonary hemorrhage passed away. A preliminary report containing the laboratory results of air and bulk samples identified the presence of *Stachybotrys chartarum* mould as a common factor in all of these children's homes, and named it a possible cause of the children's illness. At the time, one of the media companies became aware of this story and published it in a local newspaper making it the precursor and igniting factor of a US national witch-hunt for "toxic mould", "killer mould" and "black toxic mould".

In response to the increasing public concern the U.S. Centers for Disease Control and Prevention (CDC) began their own study of this phenomenon and determined that the earlier analyses were in error and that the cause remained unknown. The

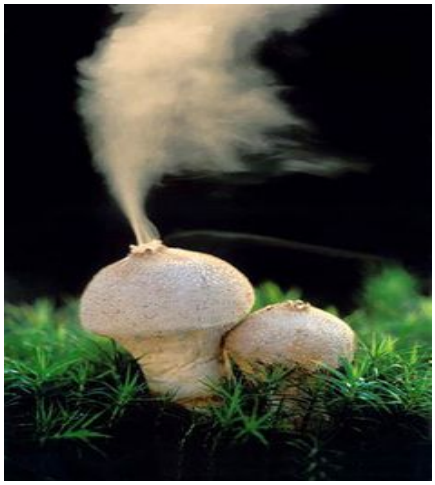
CDC also noted that a similar cluster of cases in Chicago was not associated with mould exposure and that pulmonary hemorrhage was not consistent with what is known of exposure to this fungus. However, the CDC's published report did not get media coverage in the same proportion as the "black toxic mould" epidemic. Authors have described the term "Toxic mould syndrome" as a legal phrase that was coined as a result of the past media-fueled stories and subsequent lawsuits.

In an effort to boil the fungi description down to the utmost simplistic view and fit it into the context of our increasingly busy lives: if we can cook it and eat it we could think of it as fungi, commonly known as mushrooms. If it's microscopic and we can breathe its spores, then we'll call it mould. Placing our culinary experiences aside and after a water leak event inside a building, we found that the following four questions are the common ones that come up in a conversation regarding the air we breathe.

Where does this leave mildew? This type of mould is readily associated with the surface growth that we observe on the window frames and in our bathroom shower areas between the tiles.

Q#1 - How do fungi reproduce?
Through spore dispersion in the air. Fungi's survival mechanism includes mould spores aerodynamic design that allows them to remain airborne for extended periods of time so that aided by a slight breeze can travel as far away from the parent mould organism and colonize. A large number of spores are efficiently dispersed through the air by each individual mushroom by way of different means. Some spores are gently released into the surrounding air; some spores are propelled into the air by the mould's fruiting body mechanism; some are eaten by different insects and carried away from the fungus within their digestive tracts, later to be deposited via the insect's feces.

Macrofungi refers to the fungi that we can observe with the naked eye. In the case of the more common fungi/mushrooms the spores are contained between the gills on the underside of the mushroom cap, where slight movement of the cap will dislodge the spores located between the gills. Other types of macrofungi release an odour to attract insects to enter its core where they then are enveloped in coatings of spores, to be carried with them to other locations. Microfungi refers to the independent fungal organisms that can only be observed through a microscope. Microfungi mould spores land on a food source and if enough moisture is available, tendrils called hyphae will reach out from the spore and develop mould colonies. Mould is visible to the naked eye when the colony has had time to grow given the right conditions (temperature, food source and moisture). Mould spores are then released into the surrounding air to be carried away from the parent colony, land on surfaces and begin the reproductive cycle again.



Q#2 - Where are moulds found in the environment?
They are found everywhere in Nature. Fungi are an important part of nature's decomposition cycle. Rumor has it that we would be swimming in garbage were it not for the presence of moulds in Nature. Fungi and mould break down and decompose wood products, dead animals and plants. Fungi do not require photosynthesis for growth. It is common to find mould in a damp basement area where the sun's rays are never available. Moulds have also been found living within the roots of trees and plants underground.

Mould spores can travel on currents of air allowing them to come into our buildings through doors or open windows. They can also be transported on our clothes, shoes or on our pet's fur coat and from there dislodge themselves and land on every horizontal surface available in the home.

Q#3 - Our daily breath of mould spores and health issues

Mould spore diameter ranges from 1.5 to 50 µm (micrometers). The mould spore diameter found in spore trap samples using the impaction method is approximately 3µm. In comparison to a human hair with an average diameter of approximately 75µm. One cubic meter of air is equivalent to 1,000 liters. Human lung capacity varies between 3 liters to 7 liters of air, so chances are that even at concentrations of spores below 50 spores per cubic meter, one or more spores will enter the lungs following a few breaths of air. Therefore we would be safe to assume that a daily intake of mould spores into our respiratory system has been part of our lives since leaving the maternal womb.

Human health issues are diagnosed by medical doctors or government-appointed health officials only. There are no published reports that establish a correlation between health issues and living or working in mould contaminated environments. However the quality of our lives can diminish given the presence of visible surface mould growth as well as perceiving a damp odor within the areas where we spend most of our time. The symptoms reported by individuals that have been exposed to areas of visible mould growth and airborne elevated mould spore counts include: respiratory illnesses such as allergies, asthma, cough, sinus conditions and runny nose. Other symptoms reported include dizziness; headaches.

Q#4 - How do we keep mould outside our homes

Mould spores are present everywhere in Nature. The mould reproductive cycle requires an abundance of moisture, a food source and, a temperature range to continue. The temperature range where mould grows coincides with the human comfort temperature range, therefore our indoor environments are potential thriving grounds for mould growth provided the right conditions. Abundant sources of moisture in our buildings can be found in standing water (from children playing or over-watering of potted plants); hidden water supply line leaks; roof leaks; condensation from cooking and bathing activities; excessive moist-laden air brought into our indoor space from the exterior of the building; and, other possible sources such as deficient landscaping around the building perimeter.

Preventing mould growth within our homes and work spaces requires the active prevention of water leaks by following a minimum maintenance routine to our buildings, providing adequate ventilation into spaces and minimizing condensation issues. Other unforeseen activities require the prompt removal of standing water, and drying materials that can retain moisture for long periods of time such as clothes, carpets and furniture. Additionally to promoting mould growth, moist environments contribute to conditions that sustain dust mite population growth. Dust mite feces and mycotoxins produced as a byproduct of the mould life cycle are potential allergens. By actively controlling moisture in our environments we diminish the potential for mould growth within our buildings.