



SCIENCE

of Scrapbooking

Preservation Q&A

Controlling humidity to prevent mold will also help in other ways to ensure that your scrapbooks and photos last a long time.

Q: I AM FROM HAWAII WHERE IT IS VERY WARM AND HUMID ALL YEAR LONG. MANY SCRAPBOOKERS HERE STRUGGLE WITH MOLD AND MILDEW GROWING ON THEIR ALBUMS. IS THERE ANYTHING WE CAN DO TO PREVENT THIS?

— KRYSTI KURASHIGE, ALOHA SCRAPBOOKING

A: Many scrapbookers will never experience mold or mildew in their albums. It is possible though, as Krysti has found out, especially in the warmer, wetter areas of the country. If mold or mildew does begin to grow on and mar your customers' albums, it is in your best interest to already have some helpful solutions to help them through it. Better yet, offer tips now on how to prevent it in the first place.

Note: a special case of mold occurs when there has been a flood. Scrapbookers everywhere are at risk for this type of mold. We'll deal with this as well as other flood issues in a future article.

WHAT ARE MOLD AND MILDEW AND WHERE DO THEY COME FROM?

Mold and mildew are both fungi. Unlike plants that make their food using chlorophyll, fungi get their food by digesting the living or dead organic matter on which they live, and they do not need energy from light to grow. They thrive in areas of high humidity and plentiful foodstuffs. Unfortunately, they are rather partial to eating scrapbooks. The two terms, mold and mildew, are often used interchangeably. Biologists may have technical meanings that separate the two; however, for simplicity's sake, I will use only the word mold.

As mentioned above, molds need both high humidity and food. But like any living thing, it has to be borne from something somewhere. Molds are carried from place to place through the air as spores. These spores are like microscopic seeds that, once planted, develop into a growing mold colony. Even in areas where no mold is visible, spores still exist and are ready to infest your memorabilia. If mold is wet and slimy it is active, but if it is dry and dusty it is probably inactive. Be careful when testing for activity that you don't brush dry, inactive mold into the air where it can spread or be inhaled, or smear wet, active mold across the page.

Mold is not only ugly, but it also excretes enzymes that digest their food-stuff. In the case of paper, this would be the cellulose fibers and organic sizing agents. This digestion weakens the paper, robbing it of its function as a support. Molds can also excrete colored substances that cause stains. In the case of photographs, the harm done would be to the gelatin coating that holds the image. Mold on gelatin is particularly damaging. It digs down into the photo making removal very difficult.

HOW DOES MOLD GROW?

When you plant a flower or vegetable seed, it takes a while before you see sprouts stick up from the ground. It also takes a while for mold spores to begin growing into mold colonies. This period of time is referred to as germination. The time it takes for germination is variable, but it is largely dependent on the temperature and humidity of the environment. The higher the humidity, the faster the germination will occur. This is also true for temperature, but higher temperature won't speed things up as much as higher humidity.

In the table, Figure 1 (see page 134), the effect of humidity on time to germination is very clear. At humidities less than 65% molds usually cannot grow. For those of us whose natural environments are relatively dry (like Phoenix or Denver),

TIME TO GERMINATION (IN DAYS)

	65%RH	70%RH	75%RH	80%RH	85%RH	90%RH
60°F	NO RISK	NO RISK	43	15	7	4
65°F	NO RISK	168	40	14	7	4
70°F	NO RISK	163	38	13	6	4
75°F	NO RISK	157	37	13	6	4
80°F	NO RISK	154	36	13	6	4

Figure 1

mold is not much of a problem. For those whose natural environment is usually wet and hot (like Miami and Hawaii), mold can be a constant struggle. Thankfully, the times listed in the table aren't the times it will take to see a big, ugly mold colony. They simply represent the time it takes for the spores to begin growing into actual mold. It may take a while until you actually see anything yucky.

What about people who live in environments that are sometimes dry and sometimes wet? Most people do not live in consistently dry or consistently wet environments. In my home in upstate New York, it tends to be very humid during the summer months and very, very dry during the winter. This is because I have no dehumidifier during the summer, and the forced air heating system I use during the winter dries the air to 20% RH or less. The question is, are my photos and paper memorabilia sensitive to mold growth during the short, moist summer?

The answer is yes and no. Mold growth will be dependent on whether the moisture is high enough for long enough to germinate and develop the colony. For example, let's say the average temperature will be 70° in my home and that the humidity will be consistently above 75% RH for the month of July. Will that be enough for mold to grow? According to the table, time to germination will be 38 days. If the temperature and humidity drop at the beginning of August, then the 70° and 75% RH for the 31 days in July

would not have been long enough for mold to germinate.

However, it is possible for mold to begin growing from spores at high humidity and then continue to grow even though the humidity drops somewhat. It is also possible for some spores to remain dormant for years until they have enough moisture to begin mold growth. Spores are really resistant to great variations in temperature and humidity, so, while dry air may kill the mold, the spores will survive in a dormant state.

HOW CAN YOU PREVENT MOLD?

Our controls over mold are humidity, airflow, and cleanliness. Reducing the moisture in the air around our scrapbooks will significantly reduce the chance that mold will grow on our scrapbooks. Moving air encourages evaporation of moisture from the surface of scrapbooks and memorabilia. Keeping storage area surfaces clean and dry will also help prevent colonies from developing.

HOW TO MEASURE HUMIDITY

Determining how the temperature and RH behave over time will help you use the time-to-germination table to determine if your scrapbooks are at risk. Calling your local weather station for temperature and humidity data would only tell you what was going on outside your home. To measure the temperature and humidity inside your home you will need special

Not all mold is actively growing and consuming food. If the mold is wet and slimy it is active, but if it is dry and dusty it is probably inactive.

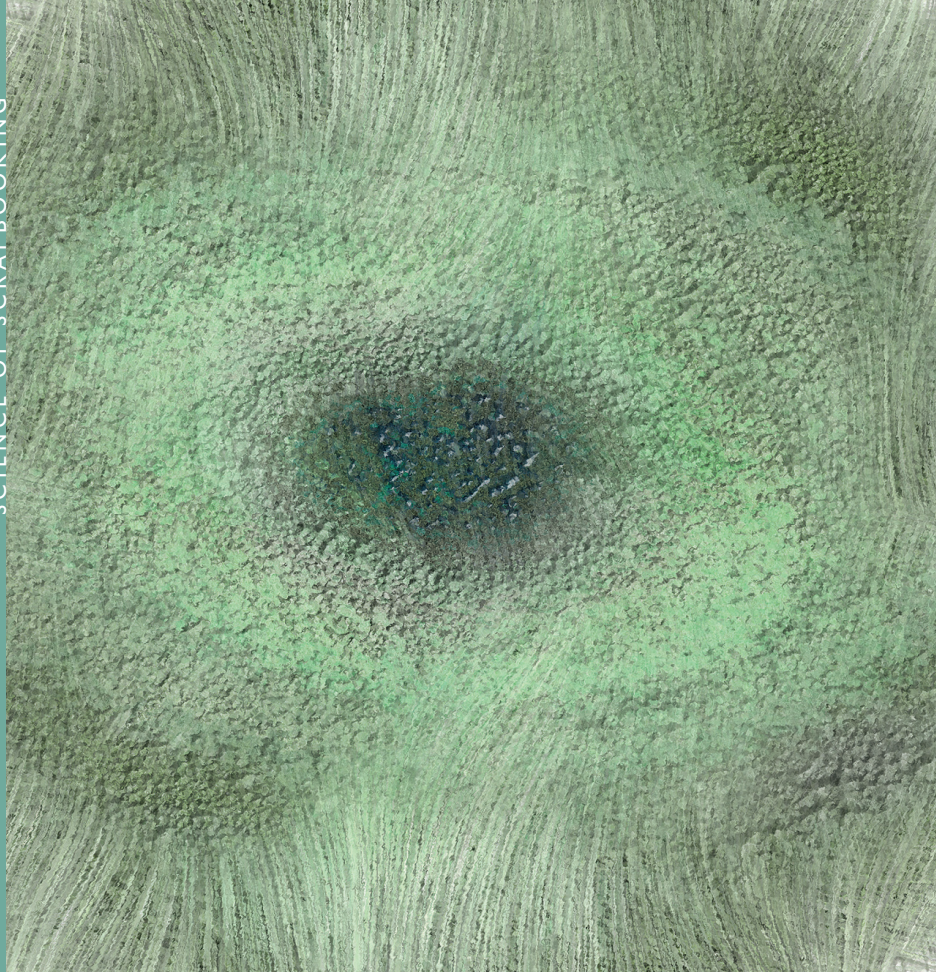
tools. But don't worry. They are not too expensive, and they are easy to use.

There are many devices available to measure the humidity inside your home or storage area (such as a closet). You know that a thermometer measures temperature, but a hygrometer is what is used to measure relative humidity. Weather instrument supply stores (there are many on the Web) sell a variety of thermometers and hygrometers. The easiest to use, and probably most accurate, are the digital, electronic versions. Combination temperature/hygrometer units are available. Some even have remote sensors for measuring temperature and humidity outside or in different rooms around the house. This is what I use. Keeping a remote sensor with your scrapbooks and photos can help you keep an eye on high moisture threats to your memorabilia.

CONTROLLING HUMIDITY

The easiest way to control the humidity around your scrapbooks is simply by avoiding putting them in areas that are naturally humid in the first place. The most humid place in the home is usually the basement. The moisture levels in the basement can be significantly higher than the rest of the home. Dehumidifiers can do a good job of preventing mold from growing in a basement. You do have to keep an eye on them. If they break down, even for a few days, the moisture level in the basement can become so high that molds germinate and begin to form

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colonies. It is for this reason that it is still probably best to keep scrapbooks and memorabilia out of the basement and in the living areas of the home.

Use venting fans in the bathroom and kitchen to eliminate moisture that is created in bathing, showering, and cooking. The moisture in these rooms tends to move into other areas of the home, either quickly through obvious openings such as doorways or slowly through the walls. It's also a good idea to vent clothes dryers outside the house. In the winter though, venting inside the home can help prevent conditions that are too dry. Just make sure to change back in the spring.

DEHUMIDIFIERS

There are two ways that dehumidification systems can remove moisture from the air: desiccation and refrigeration. Desiccation is not a good method for reducing humidity in homes. That would involve using huge amounts of a desiccant like silica gel to trap moisture out of the air. You may already be familiar with silica gel, as it is used in some pharmaceutical containers to help preserve the medicine or vitamins. It is also used in the packaging of many electronic devices to keep sensitive instruments dry. In room-sized dehumidification systems, silica gel can be used, but because such large amounts are needed and because it has to be occasionally recharged it's not practical for the average scrapbooker. For home use, the next method, refrigeration, is more appropriate.

Air conditioners and refrigeration dehumidifiers operate on the same basic principles. In these mechanisms, coolant flows through a matrix of flat pipes causing the surface of the pipes to be colder than the air in the room. Blowing air across the cold pipes cools the air and therefore the room. But because the pipes are colder than the dew point of the air (the temperature at which water vapor condenses) being blown across them, water condenses from the warm intake air and forms droplets on the pipes that then are drained out of the air conditioner or dehumidifier. The amount of air moisture is thus reduced.

Air conditioners are different from dehumidifiers in two ways. First, the heat generated by the mechanism in an air conditioner is dissipated outside the home, while the heat from a dehumidifier stays in the home. The reason that the heat from a dehumidifier is not vented outside is that it is used to reheat the cold air back up to room temperature. Dehumidifiers cannot cool your house. So why would you use a dehumidifier as opposed to an air conditioner? There are times where air conditioners won't be able to handle the moisture load. A dehumidifier will be more reliable. If you

monitor your indoor humidity, you will be able to tell if your air conditioner is sufficient to keep the humidity down.

I am often asked if small packets of silica gel could be placed inside boxes with photo materials or albums to keep the humidity down and reduce the chance of mold. It is likely that this method will not prove successful. For it to work there would have to be enough silica gel to not only dry out the air in the box but also pull out all the moisture in the scrapbooks and photos themselves. Scrapbooks are hygroscopic, meaning that they naturally absorb and retain water from the atmosphere. It would take more than a little pack of silica gel to dry them out. The box too, would have to be completely sealed. If it weren't completely sealed, the silica gel would attempt to dry out not only the air inside of the box but the air out of the box as well. Another option would be to keep the albums inside large sealed Ziploc® bag (that would be attractive wouldn't it?) with packets of silica gel. Of course, if the album were originally created in high humidity, the silica gel would still have to be strong enough to pull out any moisture already stored in the album.

KEEP THE AIR MOVING

Another way to reduce the moisture around your scrapbooks is to keep the air around them moving. Air circulation helps prevent mold growth through evaporation. This is how fans cool your body in the summer. The air blowing across your skin evaporates your sweat and cools you down. Moving air may also help keep small, local areas sensitive to high humidity get drier air from adjacent places in the home. The average humidity of the entire area will go down. Other places to watch for are closets, especially those with walls adjacent to the outside. Cold walls can cause higher humidity or even condensation. If the door to the closet is kept closed, humidity can build up. Also avoid closets adjacent to bathrooms or kitchens where humidity can be high. I personally had some boxes containing photos damaged

by moisture moving through the wall from my bathroom into the closet. Luckily, I caught it before the photos inside the boxes were damaged or mold could begin to grow.

One recommendation is to put the moldy surface out in sunlight for 30 minutes. Longer periods may begin to fade colors and damage paper fibers.

KEEP THINGS CLEAN

Mold can also grow inside air conditioning units. They need to be kept clean. Change filters and clean coils. Mold can also grow in ductwork. These too should be kept clean. Quality air purifiers can help reduce the number of spores in the air, but keep in mind that while keeping things clean is important, reducing humidity is still the priority. Mold can still grow in a clean, but wet, environment. A good example is the mold growth that occurs in bathrooms.

What do you do with moldy scrapbooks, photos, and paper memorabilia?

Here are some steps to deal with mold that has already developed. Wear rubber gloves when handling moldy materials. Dust masks may reduce, but won't eliminate, the potential for inhaling mold spores. Special HEPA filter masks are needed. Isolate affected memorabilia. Replaceable items should be discarded. Throw away infected storage materials such as boxes. Determine the source of moisture. Measure the humidity and check for standing water or condensation. Find a drier storage area or reduce the moisture levels of the original area through ventilation and/or dehumidification. Clean walls, floors, and shelving using mold killing cleaners like Lysol® or Clorox®. Just make sure to use these safely and keep the area well ventilated. Active mold should not be wiped as the staining may spread.

THE LEAST YOU NEED TO KNOW:

- Retailers should be prepared to deal with customer mold problems.
- The first sign of mold infestation may be a musty odor.
- Mold is dependent on humidity.
- The paper and photos in scrapbooks are good sources of food for mold.
- Mold may be a health hazard.
- The greatest risk for mold in the home is in the basement.
- High humidity also causes paper degradation, metal corrosion, photo sticking, and ink bleeding.
- The best way to prevent mold and to slow other scrapbook decay processes is to keep the air dry.

Deactivate mold by moving the moldy objects to a drier area or exposing it to UV radiation (see below). After deactivation, clean the mold from the surface (see below). A professional conservator should treat valuable, fragile, or seriously damaged heirlooms. Professional conservators can be found through the American Institute for Conservation by phone (202) 452-9545, ext. 1 or on the Web at <http://aic.stanford.edu/faic/refer.html>. An open box of baking soda can help remove odors. Finally, monitor for mold regrowth.

HOW CAN YOU KILL MOLD?

Sunlight reduces mold growth. It is the ultraviolet radiation (UV) in sunlight that kills many molds. The UV from fluorescent bulbs will do the same thing. But remember, UV does not kill spores; it only kills active mold. One recommendation is to put the moldy surface out in sunlight for 30 minutes. Longer periods may begin to fade colors and damage paper fibers. Taking your precious memories outdoors is risky, though, especially if it's really humid.

There are some chemicals that can be used to kill molds. However, if the conditions that caused the mold still exist, it will only return again. Also, the chemicals may not be safe for your scrapbook, and most of these products are poisonous. Using dry air to kill mold is the best approach. Do not attempt to dry the mold quickly with a hot air source like a hair drier, as that can cause materials to become deformed. Find a dry, room-temperature environment instead. Monitor the mold until it becomes inactive.

HOW TO CLEAN MOLD FROM SURFACES

After deactivation, a vacuum can be used to pull most of the mold from the surface of the scrapbook or photo. Place the pages, sheets, or photos under a wire screen so that you don't destroy the page. Home vacuums are powerful enough to crumple paper sheets. Test the process with either the most badly affected or the least valuable. Make sure the vacuum cleaner bag can trap mold spores. If in doubt, do the vacuuming outside. You don't want to spread them around your house. Dispose of the vacuum cleaner bag promptly.

MORE HIGH-HUMIDITY PROBLEMS

High humidity can cause many other problems besides mold for your scrapbooks and photo collections. These include paper degradation, metal corrosion, photo sticking, and ink bleeding. Paper degradation and metal corrosion occur slowly over the long-term. Photo sticking, called blocking, can occur relatively quickly at high humidities. This occurs when high humidity and temperature cause the surface of the photo to soften and become tacky. It then acts like glue adhering to any smooth surface it comes in contact with. Sometimes this happens in frames, if the photo was mounted directly in contact with the glass. When this occurs, it is often impossible to separate the photo from the glass. It can also happen to photos in contact with page protectors, but not as easily because of lubricants on the surface of the plastics.

When it does happen, very gently lifting the plastic up from the surface of the photo will usually separate them.

High humidity can also cause inks to bleed. These can be inks applied to the page by pens or stamps, or it can be inks from computer printers. Inkjet printers often use dyes that are sensitive to high humidity. These dyes are used for text, graphics, and photographic images. Bleeding inks can transfer the image to adjacent materials or migrate across the surface of the print making the picture look fuzzy. The same thing can happen to pen and stamp inks. Controlling humidity to prevent mold will also help in other ways to ensure that your scrapbooks and photos last a long time.

Daniel Burge is a Research Scientist at the Image Permanence Institute at the Rochester Institute of Technology. He has been investigating the potentially harmful interactions between photo storage products and photographs for the last 12 years. He is also active as a member and educator in the Scrapbook Preservation Society.