

# Lichens

around Mendenhall Glacier



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*Cover: Foam Lichen with Mendenhall Glacier in the background.*

*Back Cover: Pelt Lichen along the shore of Mendenhall Lake.*

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## *Introduction*

The Mendenhall Glacier is truly an awe-inspiring sight: a wall of craggy blue ice flanked by steep snow-clad peaks, with an iceberg-strewn lake at its feet. Towering Sitka spruce and western hemlock march up the mountain sides, and cottonwood, alder and willow thickets fringe the far shores of the lake. Closer to the glacier, where the land is still raw and new, purple-blue lupines dot the flats in the springtime, and showy magenta fireweed blossoms late in the summer. Waterfalls thunder down the mountainsides. Bears, salmon, and beavers splash in the streams and ponds. The occasional deer ambles by, and mountain goats venture down the rocky slopes above the waterfall. Each spring Arctic terns fly all the way from Antarctica to nest in the sandy flats in front of the glacier, then make the long trek south with their offspring in the fall. Gulls nest in the cliffs to the left of the glacier, and the sky is often filled with wheeling, screeching gulls and terns. The life and landscape of the Mendenhall Glacier area exist at a grand scale, and superlatives abound.



*An Arctic tern sits on its nest in front of the Mendenhall Glacier.*

Now draw your eyes away from the vibrant landscape around you, and cast them downward. Down past the dazzling glacier to the branches and trunks of shrubby willows and alder. Down to the ground itself. A closer look at the tiny organisms surrounding the glacier reveals a Lilliputian world all its own. This is the magical world of the mushrooms, mosses, liverworts, and lichens.

In this book we'll explore the rich and abundant world of lichens in the Mendenhall Glacier area. We'll help you understand what a lichen is (and isn't), what lichens look like, where they live, how they get nutrients, and how they



*Foam Lichens growing amidst mosses on the sandy flats near the Arctic tern nests.*

reproduce. We'll also introduce you to some of the vital ecosystem roles lichens play, how animals (including humans) use them, and how they provide nutrients for pioneering plants. We'll show you pictures of common lichens near the glacier, and tell you where to look for them. Be prepared to peer at tree trunks and amid tufts of plants and moss, and even get down on your hands and knees to enter this beautiful and fascinating world.

Our sincere hope is that we inspire you to enjoy the world around you at its many scales. Who knows? Maybe when you get back home you'll take a hand lens (a magnifying glass will work) and head for the hills, the beach, or even a city park.

## ***Lichen Ecology***

### ***What IS that stuff?***

Have you ever wondered what those strange looking tufts of pale green or brown "hair" are doing in the trees near the glacier, and how they got there? Has your eye been drawn to what looks like pale green iceberg lettuce leaves littering the ground? Then you notice some bright lime green lettuce leaves climbing the trunks and branches of shrubs and evergreens. Look, there in the sandy patches near the waterfall and on the Moraine Ecology Trail; what are those clumps of bone white or pale greenish "coral"? Did you see those rocks close to

the glacier? Some of them are dotted with lumpy bull's-eyes, or splotted with what looks like bright chartreuse paint. Now that you're noticing, this stuff is everywhere. They're all lichens.

### ***What IS a lichen?***

This question isn't as easy to answer as one might think. Even lichenologists (people who study lichens for work and fun) don't agree, and with our new ability to study lichen genetics, more questions arise. It might be easier to begin this discussion with a quick overview of what a lichen is not.

### ***What lichens are not***

***Lichens are not plants.*** At first glance some lichens do look like plants, which is part of why we encourage you to take a closer look. Trees, shrubs, and other flowering plants are structurally more complex than lichens. Most plants have a plumbing system that conducts water up from the ground and transports food down from the leaves. How does the food get into the leaves? Most plants make food (energy) when the sun shines on their leaves. This process is called photosynthesis: using light (photo) to make or form (synthesis) energy. This complex plumbing is called a vascular system, so plumbed plants are called vascular plants. In addition to plumbing, plants have a waxy outer layer which helps them retain water. Lichens don't have a vascular system or waxy layer. Instead they're like little sponges, soaking up water from fog, rain, and other moisture they come in contact with, and drying out when water isn't available. One characteristic lichens do have in common with plants is that lichens also make their energy through photosynthesis.

***Lichens are not mosses.*** Mosses are small, usually less than two inches tall, and have stems covered with tiny leaf-like appendages. Mosses are always some shade of green, especially when wet (which is often, since the Mendenhall



*Cladonia Lichens surrounded by moss.*

Glacier area is part of the largest temperate rain-forest on earth). Lichens and mosses are similar because, like plants, they produce their nutrients through photosynthesis. They differ from plants because neither of them have plumbing or a waxy outer layer, so they're called non-vascular (or "unplumbed") plants. Mosses and lichens often grow together in the same kinds of places, especially in the soggy glacier area (see photo left).

The biggest difference between mosses and lichens is that lichens are part fungus and mosses aren't. Lichens don't have leaf-like structures, although they

may be powdery, spiny, lumpy, branched, or have cauliflower-like outgrowths. While mosses are green, most lichens are gray, blue-green, pinkish, tan, brown, or white. Only a few kinds of lichens are green, like mosses and plants, but

when you pause to look more closely you'll start to notice some fascinating differences.



*A dead conifer covered in gray-green Witch's Hair Lichens and less conspicuous brown Beard Lichens.*

**Lichens are not "Spanish Moss"** (which isn't even a moss). Visitors at the glacier often see our long, droopy, grayish green hair-like lichens and think they're Spanish Moss, which doesn't even occur in Alaska. Spanish Moss is a vascular plant that grows on other plants, such as trees and shrubs. Spanish Moss isn't bright green, like most plants are, but is grayish and has the habit of drooping from trees in long strands, it is sometimes confused with lichens.

**Lichens are not parasites** that attack and kill trees and other plants. Lichens often grow on plants, usually trees and woody shrubs, but the lichens are there because the plants provide structural habitat that's off the ground and closer to the sun, not because they are attacking or

parasitizing the plants. In the fall, when some trees lose their leaves, it looks as if the bare trees are suddenly covered in lichens. The lichens were there all along; they were just hidden by the leaves. When a tree dies, lichens that are already on the tree often grow and multiply because they are no longer competing with leaves or needles for sunlight.

**Lichens are not pond scum, either.** Although this is where the story starts to get interesting. Green pond scum is made up of lots of tiny organisms, some of which are algae. Algae can be single cells, goopy blobs, or long slippery strands. Algae is green because it also photosynthesizes. In some ponds and streams you can find dark bluish green blobs that used to be called "blue-green algae". Because we now know that these are really bacteria that can photosynthesize, and because cyan is a snazzy name for blue-green, they are now called cyanobacteria. Green algae and sometimes cyanobacteria are two of the ingredients that go into the lichen partnership.

**Lichens are not fungi.** When most people think of fungi (if they do at all), they think of mushrooms they buy at the grocery store. There are other kinds of fungi, however, that don't produce mushrooms. They produce club-like or cup-like structures with microscopic sacks that shoot tiny spores (sort of like fungus

seeds) into the air. Maybe you've seen those little fleshy, orange cups on the ground or even on a piece of decaying carpet? These are called cup fungi, and are the type of fungi that most often form part of the partnership that becomes known as a lichen. All lichens have a fungal partner.

Now, back to the mushrooms for a minute.

When you find a mushroom in the forest, on your lawn, or in the

store, what you've found is actually the fruiting body, or reproductive part of the fungus. Mushrooms only form when conditions are right for distributing its spores. As the mushroom emerges and matures, it produces spores that fall to the ground and start growing.

Whether or not fungi are fruiting, the threadlike body of the fungus is busy underground, or inside trees and logs, or even in living and dead animals. These tiny threads that make up the fungal body feed on their particular food source and get enough energy to form their fruiting body: mushrooms. Cup fungi do the same thing. They also have a hidden body of tiny threads that needs to find nourishment. So some of these fungi have come up with a brilliant strategy to feed themselves: they join up with simple organisms that photosynthesize and use some of the food their partners produce.

### ***Ok, so what IS a lichen?***

Biologists used to say that "Freddie Fungus and Annie Algae took a lichen to each other", which is true...sort of. A cartoon shows Freddie and Annie smiling and holding hands. But lichens are not just an algae and a fungus living happily ever after. They are a discrete new organism formed by the carefully structured combination of a fungus (or fungi) and green algae or cyanobacteria (or both). You might say that "lichens are fungi that have taken up agriculture" (Goward 1991).

Most of what you see when you look at a lichen is the fungal part. Because fungi need to get nourishment from another source (fungi aren't photosynthetic), these fungi have figured out how to farm. Rather than grow their crop in the ground, fungal crops (green algae or cyanobacteria) grow inside a fungus' body. Algae and/or cyanobacteria are their crop; remember, they are able to photosynthesize, just like plants. When part of a lichen, algae and cyanobacteria are called photobionts because of this ability. Photo means "light" and biont means "living thing." Over very long periods of time, some fungi have joined forces with—or perhaps captured and enslaved—the tiny photobionts. These photobionts live just under the outer layer of fungal tissue, or scattered throughout what is now an entirely new organism, a lichen.



*A non-lichenized cup fungus grows on the ground near the Mendenhall Glacier.*



The two (and sometimes three) different kinds of organisms benefit from becoming a lichen. The fungus provides a nice moist place for the numerous tiny photobionts to live, and the fungus collects rent from the photobiont in the form of food (carbohydrates). Lichens have evolved to the point where the fungal part is dependent on being part of a lichen; it can't get food any other way. The photobionts are more independent and can still make a living without a fungal partner. Many of these different kinds of photobionts are free-living.

Because of the interconnectedness of the partners within a lichen, some lichenologists have started thinking of lichens as complex ecosystems, similar to a biologically and structurally diverse forest or grassland, but on a microscopic scale. Each different part is humming along, doing its job within this complicated community of organisms. Because we really don't understand exactly how this community works, some lichenologists simply define lichens as the organisms that lichenologist study (Goward 2008).

### ***Where do lichens live?***

Lichens are found on all continents, from sea level to the highest mountains. They live in deserts, rain forests and everywhere in-between. Many lichens have a narrow habitat range and are only found under certain conditions. Others are more generalist and have a broader range. They grow on all sorts of things: soil, rock, shrubs and trees, on gravestones and abandoned cars, buildings and billboards. Because many lichens are picky about where they can grow, this characteristic can be useful for identification. Lichens can be seen year-round: you don't have to wait for them to flower and they don't die in the fall.

In the wet Mendenhall Glacier area lichens can be found from the foot of the glacier, to the tips of the highest peaks. They grow on the stone walls leading to the visitor center, on wooden trail signs, and on plants, rock and soil.

Lichens are sensitive to air pollution, some extremely so. There are places in the world where the sensitive species have disappeared, leaving only lichens that can tolerate pollution. And sometimes the air quality is so bad that all the

lichens die and none can live there. Fortunately we have very clean air in most of Alaska, and all sorts of lichens are plentiful.



*Even though these lichens are surrounded by snow, they're able to photosynthesize using sunlight and water vapor from the snow.*

### ***What do lichens eat?***

Lichens don't need to eat because they produce their own food from the sun. The fungal part of the lichen uses carbohydrates from the photobionts living within. In addition to sunlight, lichens need water and tiny amounts of minerals to flourish. Lichens get the minerals they need by absorbing rain-water or runoff directly through



*Although these Witch's Hair Lichens are covered in a thin layer of ice crystals, they get enough sun and moisture to continue photosynthesizing.*

their surface. Lichens also passively absorb the chemicals and tiny particles that are in polluted air. Because lichens don't have a protective outer layer to conserve water, they shut down and just hang out when they get dry. (Not a common occurrence near the Mendenhall, where there always seems to be plenty of moisture!) When it rains or snows, or humidity is high, the lichens fire back up again.

### ***How fast do lichens grow?***

That depends on the lichen species, its shape (or growth form), and the conditions where it lives. Lichens need moisture and sunlight to survive, so in general, the wetter the habitat, the faster

a lichen will grow. In places where moisture is scarce, like deserts and windswept mountain tops, the lichens grow very slowly. Around the glacier where there is usually abundant moisture, some lichens, especially encrusting lichens that look like paint, also grow relatively slowly. Others, like Lung Lichens, Pelt Lichens, Witch's Hair Lichens, Methuselah's Beard, and other Beard Lichens, grow much faster. We describe how to tell these types of lichens apart later in the book.

### ***How do lichens reproduce?***

Sometimes lichen reproduction is really simple. A big wad or coral-like branch will break off an existing lichen and start to grow wherever it lands—provided it gets enough sunlight and moisture. Or a hiker or animal will step on lichens and unknowingly carry lichen fragments on the bottom of their boots or feet to a new home.

Many lichens make clones of themselves (asexual reproduction) by producing tiny peg-like outgrowths, or grains of powder. Each of these little bundles contains bits of each partner, enough to produce a whole new lichen individual. Some clonal bundles are outgrowths that look like tiny round fingers, or coral, or teeny flattened lobes. Others are grains of powder that develop in elongated tears or roundish dents on the "parent" lichen's surface, edges, or raised ridges. These various bundles break free when the wind blows, the rain falls, a bird lands on a branch, or a squirrel runs up a tree. Lichenologists use this seemingly endless variety of bits, pieces and powder to categorize and identify different lichen species. While most of these structures are visible to the naked eye, their rich variety in form comes alive under magnification.

How lichens reproduce sexually remains an unsolved mystery. The fungal parts of lichens reproduce sexually by forming microscopic spores in cup-like or globular outgrowths, but no one has actually observed this and the process remains their secret (Purvis 2000). These lonely spores (just the fungal parts, which can't survive on their own) have to find and reunite with their proper photobiont so they get nourishment. It's a risky business indeed, and probably explains why so many species just skip the dating game and clone themselves instead.

### ***How do lichens disperse?***

As we mentioned, some lichens spread when clones are carried by the wind, birds, insects or other animals. Others spread when a big piece breaks off and starts growing wherever it lands. Tiny fungal spores can be carried even farther because they're much smaller, but the problem of reuniting with the right kind of photosynthetic partners remains. Fungal spores have been found in the jet stream, somewhere between 23,000 and 52,000 feet above the earth. And lichen pieces and spores have been transported thousands of miles on the feet of migrating birds.

### ***Importance of lichens***

In the Mendenhall Glacier area lichens are very important pioneers because they colonize the newly exposed surfaces created by the retreating glacier. Once established they help pave the way for mosses, plants, shrubs and eventually old-growth forests that develop over hundreds of years. They do this in two important ways.

***Lichens as soil developers.*** Lichens play an important role in breaking down rocks left by the retreating glacier. They do this physically and chemically, but without sledge hammers or laboratory jackets. The fungal parts of some lichens grow directly into the rocks, which physically breaks minerals into smaller particles and leads to soil formation. The rocks develops cracks where mineral particles accumulate, which creates tiny footholds where mosses and other plants can get established. Lichens also produce chemicals that react with rocks and slowly break them down through chemical weathering.

***Nutrients for pioneering plants.*** The rocks and rock particles near the glacier provide few nutrients for mosses and plants to grow. In particular, the soil lacks nitrogen, which is an essential nutrient that enables plants to grow healthy stems and leaves. Lichens that contain cyanobacteria are able to absorb, or "fix," nitrogen from the air. This nitrogen accumulates in a lichen's body in a form that is available to plants. The nitrogen is released as rain washes over the lichens, when insects excrete digested bits of lichens, or when lichens die and decompose on the ground. As a result, the lichens help prepare the soil for plants in what would otherwise be a nitrogen-poor environment.

### ***Human uses of lichens***

Humans have also used lichens for food, shelter, bedding material, and in fine perfume. Arctic explorers and soldiers have occasionally eaten rock tripe as an emergency food. At Valley Forge, George Washington's hungry troops boiled and ate rock tripe, which contains about one-third more calories than an equal amount of honey, corn flakes, or hominy (Encyclopedia Britannica

2009). Because of its very slow growth rate, relative rarity, and because it is an important winter food for mountain goats and other animals, rock tripe can't be used as a food crop (Encyclopedia Britannica 2009).

At least one person has used lichens as a bed. In a 2009 interview, the French Master Perfumer for Hermès said that at age 16 he worked the night shift as an apprentice making essential oils for the perfume industry. Distilled lichen substances are an important ingredient in expensive perfume, where they're used as a binder to hold other scents. One lichen used in large amounts is called oakmoss (a shrubby lichen whose relatives grow near the glacier). After the apprentices' work was done, the 16-year old would lie down and sleep on a bed of these lichens (Sharnoff 2009).

Native people from British Columbia historically used braided strands of Horsehair Lichen to make shirts, shoes, and hats (Sharnoff 2009). Pictures of these garments, which are now in the American Museum of Natural History in New York, can be seen at:

[http://www.sharnoffphotos.com/lichensNH/human\\_uses\\_misc.html](http://www.sharnoffphotos.com/lichensNH/human_uses_misc.html)

Historically, lichens were an important trade item for the Chilkat Tlingit Indians who still live about 90 miles north of the Mendenhall Glacier. They traded with natives living inland, on the other side of the icefields and mountains, to get Wolf Lichen (*Letharia*) which grows in the dry interior but can't grow in the rainforest that carpets Southeast Alaska. Wolf Lichen, which is poisonous if eaten, makes a fine yellow dye when heated in a water bath. The Chilkat used the yellow Wolf Lichen dye on mountain goat hair, which they wove into their famous Chilkat Blankets. Today some Tlingit and other weavers are once again using Wolf Lichens in their Chilkat blankets.



*Beard Lichens (Usnea) produce a substance called usnic acid. Usnic acid has antibiotic properties, and is used in some antibacterial creams, soaps, and deodorant.*

### **Wild animal uses of lichens**

Around the Mendenhall Glacier lichens play a variety of important roles for several different animals. Lichens provide food for mountain goats, Sitka black-tailed deer, northern flying squirrels, red squirrels, mice and voles. Several bird species use lichens as nesting material or as camouflage—some would say decoration—on the outside of their nests. Insects seek shelter and lay eggs under lichen lobes, and birds forage for insects among the lichens.



*Mountain Goats around the Mendenhall Glacier eat Beard (Usnea), Cladonia (Cladonia), Iceland (Cetraria), Lung (Lobaria), Pelt (Peltigera), Rock Tripes (Umbilicaria), Witch's Hair (Alectoria), and Whiteworm (Thamnolia) lichens.*



*Sitka black-tail deer eat Beard (Usnea), Coral (Stereocaulon), Horsehair (Bryoria), Lung (Lobaria), Rag (Platismatia), and Tube (Hypogymnia) lichens, especially in winter when plants are scarce. Sometimes deer tracks can be seen along the lakeshore.*



*Northern flying squirrels are no doubt fairly common residents of the large trees along Thunder Mountain and Nugget Creek. In some areas flying squirrels make their nests out of Horsehair Lichens (Bryoria), and Horsehair Lichens are a major part of their diet.*



*Other small mammals that live around the glacier also feed on lichens. These include the red squirrel (above), the Keen's deer mouse (left), and the red-backed vole (below).*





*This downy woodpecker is probing amongst the lichens for insects to eat. Studies have shown that the number and biomass of insects associated with trees is related to the number of lichens present. Greater lichen cover means more places for insects to hide. Woodpeckers appear to be increasing in the Mendenhall Glacier area.*

*A female rufous hummingbird sits on her nest, which is covered with Shield Lichens (Parmelia). Several other bird species that nest in the Mendenhall Glacier area also use lichens as building material for their nests.*





## Types of Lichens

### **How many kinds of lichens are found in the glacier area?**

A surprising variety of lichens can be seen from the easily accessed trails near the Mendenhall Glacier Visitor Center and in the surrounding area. In an early study of lichens of the Mendenhall Valley a total of 93 species were identified (McCullough 1965). During a lichen inventory on the Tongass National Forest, which includes the Mendenhall Glacier area, over 500 different kinds were found (Geiser et al. 1998) and others have been found since then. New lichens get added to the list when lichenologists visit new habitats and parts of the forest, and when species concepts change by becoming more narrow, separating slightly different lichen forms into additional species.

### **How can I tell the different lichens apart?**

It's fairly easy to identify many lichens to their common group (or genus). These common groups (genera) may include several close relatives (species). Getting to the species level can be difficult since this often requires chemicals and a dissecting microscope or good hand lens. In this book we use visible characteristics, including a lichen's growth form, color, texture, the presence or absence and types of clonal bundles, and where the lichen grows, to identify lichens. We illustrate 23 different groups of lichens using their common names and genera.

If you want to dive deeper into identifying lichens, you'll need some magnification. A 10x hand lens (which makes things look 10 times bigger) is best, and can be found in most college bookstores or online. You can also use a magnifying glass. Magnification allows you to enter a whole new world. You can explore clonal outgrowths and powders, fungal spore-producing bodies, and differences between the top and bottom of a lichen. You'll probably get startled by a scurrying bug or two. And you'll get distracted and start exploring everything in sight: mosses, flowers, rocks, your fingernail... You'll also need a more detailed book such as *Macrolichens of the Pacific Northwest* by McCune and Geiser (2009).

### **Basic Lichen Growth Forms**

Lichens come in a broad spectrum of different shapes and textures. Lichenologists have artificially divided this spectrum into three major categories, even though you can find growth forms that don't easily fit into one category or another. One category is the crust lichens, which resemble paint-like splotches. Crusts, as they're called, grow so tightly on rocks or bark that they can't be pried loose without destroying the lichen and what it's growing on. This is because parts of the lichen actually grow right into the rock or bark, with the photobiont near the surface so it can still photosynthesize. The next category includes lichens that don't have a distinct top and bottom. These can be hairlike or shrubby, and are usually more or less round if you make a cross-section. This category is technically called "fruticose," but we'll just call them "hairlike or shrubby". The third category is the leafy or strappy looking lichens with an obviously different top and bottom. These are called leafy, or foliose, lichens. Leafy lichens are

often attached to their substrate by long or short hair-like projections called rhizines.

**Using growth forms to identify lichens**

For ease of identification we've grouped the common lichens around the Mendenhall Glacier into four large groups based on similar, easily observed features. This arrangement doesn't necessarily follow groupings in more technical books, but we think you'll find it useful. The groups are:

- Hairlike, Hanging Lichens
- Shrubby or Stalked Lichens
- Leafy Lichens
- Crust-or Paint-Like Lichens

To identify a lichen you've found, start by using the following key to place your lichen in the group that best characterizes its growth form. You'll see that the key is a series of paired descriptions, or choices. Each pair is called a couplet. A couplet has the same number, but the two choices are called "a" or "b" (1a & 1b, 2a & 2b, and so on). Read both parts of the first couplet and pick the choice that best describes your lichen. Your choice will lead you to the next couplet, or (if you're lucky) your lichen's group name. Once you've decided on a group, flip to that part of the book and make sure your lichen fits that description. If not, come back to this key and try again. Once you feel certain you've found the correct growth form group, use the key at the beginning of that group to determine the genus, or groups of similar species, your lichen belongs to.

**Key To Common Lichen Groups**

This key will help you determine which of the four common groups your lichen belongs to. Once you find its group, go to that section and key your lichen to determine which genus it belongs to.

- 1a. Lichen not paint-like; slightly raised or hanging from its substrate ..... (2a)
- 2a. Lichen looks the same on all sides
  - 3a. Lichen hairlike and hanging .....(page 18)
  - 3b. Lichen not hairlike and hanging; usually upright or lying on the ground.....Shrubby or Stalked Lichens (page 24)
- 2b. Lichen has obviously different top and bottom, more or less leaf-like or strap-shaped..... Leafy Lichens (page 32)
- 1b. Lichen paint-like, impossible to lift off its substrate..... Crust-Like Lichens (page 44)

## Hairlike, Hanging Lichens

As their name suggests, lichens in this group hang in hairlike tufts and strands. The strands of most groups are round and don't have different colored tops and undersides. (One group has flattened branches but both sides are the same color.) Many are a conspicuous shade of pale yellowish-green, but if you look closer among the trees you'll notice clumps of pale to dark brown strands. Most hair lichens drape over tree branches, while other kinds attach themselves to tree trunks and branches with a thick, often blackened, basal stalk.

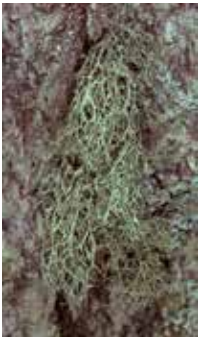
- 1a. Inner elastic cord present when lichen is gently pulled apart; side branches at right angles to main stem.....Beard Lichens (*Usnea*)
- 1b. No inner elastic cord present; side branches not at right angles to main stem
  - 2a. Lichen pale greenish
    - 3a. Strands round, solid (never hollow or with holes) .....Witch's Hair Lichens (*Alectoria*)
    - 3b. Strands usually flattened with oval powdery patches, branches sometimes hollow and dotted with tiny holes.....Ramalina Lichens (*Ramalina*)
  - 2b. Lichen pale brown to dark brown.....Horsehair Lichens (*Bryoria*)



Beard Lichens p 19



Witch's Hair Lichens p 21



Ramalina Lichens p 22



Horsehair Lichens p 23

# Beard Lichens

*Usnea*



*Beard Lichens form yellowish-green hairlike strands that drape over tree branches (above) or attach to bark by a dark thickened base (next page). Beard Lichens vary from a few inches to several yards in length and they can be long and pendulous or shorter, stiffer, and tufted. The side branches are usually shorter than the entire length of the lichen. The last branches often bristle out perpendicular to the main strand, like a bottle brush.*

**Look-alikes:** *Witch's Hair* looks similar to Beard Lichens, but its branches are v-shaped, like blood veins or the channels of rivers or streams, rather than perpendicular. *Ramalina* are pale greenish yellow, like Beard Lichens, but *Ramalina* branches are usually flattened. *Horsehair Lichens* also are hair-like and grow in clumps, but they are pale to dark brown.



*Beard Lichens are the only lichens with an elastic central cord. If you pull a strand lengthwise the outer layer will break into segments, revealing a central cord (a) that stretches like a thin rubber band. The central cord is most elastic and stretchy when the lichen is wet. Stretched Beard Lichens remind some people of “pearls on a string.” All Beard Lichens have this central cord, and this characteristic separates Beards from other lichen groups.*

## Beard Lichens

*Usnea*



*This type of Beard Lichen (above) forms a wiry tuft of strands that attaches to bark by dark, thickened bases. These stiff tufts tend to be shorter than the pendulous strands that drape over tree branches (previous page). We've noticed more of the shorter, tufted Beards in the Mendenhall Glacier area than the long, pendulous type. The long, pendulous type tends to grow in showy, localized patches with yards of lichens, while the short tufted variety tends to be more widespread and scattered, not localized.*

# Witch's Hair Lichens

## *Alectoria*



These **hairlike, pale yellowish-green** lichens hang in clumps from trees in the glacier forelands and on the hillsides. Their **fine round strands branch several times** and clumps of strands are often **twisted like tangled yarn**. A wet strand will stretch when pulled but breaks apart **without a central cord**.

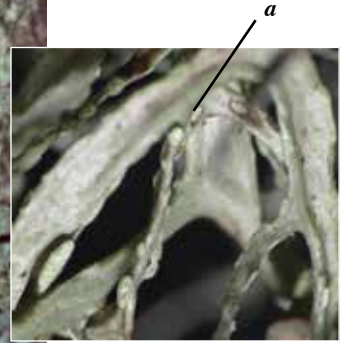
Pale strands of Witch's Hair Lichens are obvious on this dead conifer (right). The lichens did not kill the tree. They are taking advantage of a perch with no competition from conifer needles.

**Look-alikes:** Beard Lichen strands have an elastic central cord and perpendicular side branches. Horsehair Lichens form pale to dark brown hairlike tufts. Beard and Horsehair lichens tend to be stiffer and more coarse than Witch's Hair Lichens.



# Ramalina Lichens

## *Ramalina*



*Ramalina* Lichens are **pale green or grayish** and grow in hanging clumps or stiff tufts attached to trees. Their **branches are usually flattened and hollow** with **oval powdery patches (a)**. These powder grains are asexual reproductive structures, not spores. Wet *Ramalina* Lichens sometimes appear translucent.

**Look-alikes:** None of the other hair lichens are flattened. Sometimes Hair Lichens will have white oval powdery patches, but Hair Lichens are always pale to dark brown, not green or grayish.

# Horsehair Lichens

*Bryoria*



***Horsehair Lichens form clumps of pale to dark brown hair-like strands on conifers around the glacier. Horsehair Lichens can be long and pendulous or short and shrubby, but they almost always hang down. They are often coarse and tangled.***

***Look-alikes: Witch's Hair and Beard Lichens are pale to yellowish green, never brown.***



## Shrubby or Stalked Lichens

- 1a. Lichen more or less flattened.....Iceland Lichens (*Cetraria*)
- 1b. Lichen more or less round
  - 2a. Lichen white, cream or gray colored
    - 3a. Stalks hollow, pointed, looks like spaghetti or white worms scattered on ground; occasionally grows upright.....Whiteworm Lichens (*Thamnolia*)
    - 3b. Stalks solid, blunt, looks like froth-covered upright tufts; small fleshy brown or tan nodules often present at branch tips .....Foam Lichens (*Stereocaulon*)
  - 2b. Lichen pale green, yellowish green, brown, tan or pinkish
    - 4a. Stalks solid (not hollow), pale green or pink to deep tan, sometimes with round spheres on branch tips.....Coral Lichens (*Sphaerophorus*)
    - 4b. Stalks hollow
      - 5a. Surface like tiny cobwebs, stalks richly branched, tips pointed..... Reindeer Lichens (*Cladina*, a sub-genus of *Cladonia*)
      - 5b. Surface variable but not cobwebby, stalks simple or with few branches, tips blunt, sometimes with red or brown fleshy caps or cups.....Cladonia Lichens (*Cladonia*)



Iceland Lichens p 26



Whiteworm Lichens p 27



Foam Lichens p 28



Coral Lichens p 29



Reindeer Lichens p 30



Cladonia Lichens p 31

## Iceland Lichens *Cetraria*



*These semi-erect lichens have flattened narrow branches that roll into channels, like a straw split lengthwise. The Iceland Lichens by the Mendenhall Glacier are brown and shrubby with eyelash-like projections on their edges. They grow on the ground (sometimes on the base of blueberry bushes) and can be difficult to spot amid the moss. They rarely get more than two inches tall.*



**Look-alikes:** Iceland Lichens are the only brown lichens near the glacier with flattened, channeled lobes and eyelash-like projections.

# Whiteworm Lichens

## *Thamnolia*



Whiteworm Lichens grow flat on the ground, resembling **pieces of broken spaghetti** (above). Occasionally a patch will grow straight up out of the ground (right). The stalks are **bone white, smooth, round, hollow and narrow, and have pointed tips**. We have seen them in sandy patches along the Moraine Ecology Trail in open areas away from trees. Whiteworm Lichens also grow on the bedrock cliffs by the path to the visitor center and Photo Point.



**Look-alikes:** Whiteworm Lichens are the only bone white ground lichen in the Mendenhall Glacier area. Foam Lichens are occasionally pale gray but have cauliflower-like side projections. Coral Lichens are usually some shade of pink, are not obviously pointed, and grow on trees. Cladonia and Reindeer Lichens are gray or yellowish green, not bone white. A narrow, pointed Cladonia would be brown, gray or yellowish green, and not flat on the ground unless the stalks had been broken.

# Foam Lichens

## *Stereocaulon*



*These white, cream or gray-green lichens form clumps of erect, branched stalks. They have tiny cauliflower-like projections on their stalks and branches, and often produce fleshy brown structures on their tips. The irregular texture of the cauliflower-like projections makes these lichens look like foam or froth. We often see them on sandy soil or rocks along the lakeshore.*

**Look-alikes:** *Some Cladonia Lichens form flattened leaf-like scales at their base or on their stalks, but these never look like cauliflower. Cladonia scales may give the stalks a feathered look, but they never appear frothy or foamy.*

# Coral Lichens

## *Sphaerophorus*



Coral Lichens form **erect, fragile, shrub-like clumps**, and grow on trees. They are fairly **stiff** and often look **shiny**. They are round and solid in cross-section and form **many smaller branches that are easily broken off**. When growing in sunlight Coral Lichens become **dark orangish-tan**. If growing in the shade they are **cream-colored, or light gray or green**. Sometimes **round structures form at branch tips**; these spheres split open revealing sooty black masses of spores.

**Look-alikes:** *Ramalina* Lichens are usually some shade of green rather than orange or pink-tinged, and often have flattened branches. If *Ramalina* are round they are irregularly dented, not cylindrical like Coral Lichens. Foam Lichens have lumpy, cauliflower-like projections. *Cladonia* only branch a few times. Reindeer Lichens have many branches, and a cobwebby, soft texture rather than a smooth and shiny one.

# Reindeer Lichens

*Cladina* (a sub-genus of *Cladonia*)



The surface of Reindeer Lichens appears to be made of **tiny cobwebs**. The stalks are **hollow, stiff, richly branched** and end in **narrow pointed tips**. Reindeer Lichens are **white or pale gray, occasionally green or yellowish-green**. Near the glacier they usually grow on sandy soil where they eventually get overgrown by faster-growing mosses. In our rainforest you can find an occasional Reindeer Lichen growing on a tree branch or on rotting wood.



**Look-alikes:** *Cladonia* are never richly branched and don't form narrow pointed tips. Foam Lichens have cauliflower-like projections while Reindeer Lichens only form branches. Coral Lichens don't grow on the ground, and are shiny rather dull and cobwebby.

# Cladonia Lichens

## *Cladonia*



*This is a very large and variable group. Cladonia can be gray, pale to yellowish green or bright green colored, have smooth, frilly, rough or granular stalks, and end in blunt tips, red or tan or brown fleshy lumps, or cups. Tiny green scales with white undersides usually grow at the base of Cladonia; sometimes these scales extend up the stalks. Cladonia grow on the ground and on trees. The Reindeer Lichens used to belong in their own genus Cladina, but due to recent molecular studies they've been lumped with Cladonia.*

**Look-alikes:** Reindeer Lichens are more richly branched than cladonia. They grow mostly on the ground or in patches of moss. Their cylindrical stalks are hollow and stiff. Reindeer Lichens may be whitish, gray, greenish or yellowish green.



*The tallest Cladonia in North America can be found at the Mendenhall Glacier (Geiser et al. 1998). This pointed brownish lichen, appropriately called Cladonia maxima, can grow up to six inches in height (Brodo 2001).*



## Leafy Lichens

- 1a. Rubbery, gelatinous, and translucent when wet; dark or bluish gray, dark brown or black when dry.....Jellyskin Lichens (*Leptogium*)
- 1b. Not gelatinous and rubbery when wet; not translucent
  - 2a. Underside with tiny sunken pits or craters, or with raised white or yellow flecks
    - 3a. Underside with tiny sunken pits or craters.....Moon Lichens (*Sticta*)
    - 3b. Underside with raised white or yellow flecks
      - 4a. “Fingernails” on tips of underside; raised white flecks below.....Kidney Lichens (*Nephroma*)
      - 4b. “Fingernails” lacking; white or yellow raised flecks below.....Specklebelly Lichens (*Pseudocyphellaria*)
  - 2b. Underside lacking tiny sunken pits or craters, and raised white or yellow flecks
    - 5a. Looks like bright to pale green or brownish iceberg lettuce.....Lungworts or Lung Lichens (*Lobaria*)
    - 5b. Doesn’t look like iceberg lettuce leaves
      - 6a. “Fingernails” at tips of upper OR lower surface
        - 7a. “Fingernails” at tips of upper surface; raised “veins” and hair- or peg-like projections on underside.....Pelt Lichens (*Peltigera*)
        - 7b. “Fingernails” at lobe tips on lower surface.....Kidney Lichens (*Nephroma*)
      - 6b. “Fingernails” lacking
        - 8a. Tiny black “hairs” or fuzz below, or attached by single short stalk
          - 9a. Attached by single short stalk below; on rock.....Rock Tripes (*Umbilicaria*)
          - 9b. Not attached by single short stalk.....Shield Lichens (*Parmelia*)
        - 8b. Tiny black “hairs” or fuzz lacking (or very sparse and random)
          - 10a. Lobes hollow and inflated looking; never with hairs or fuzzy.....Tube Lichens (*Hypogymnia*)
          - 10b. Lobes not hollow and inflated looking; occasionally with hairs or fuzz.....Rag Lichens (*Platismatia*)

Leafy Lichens are more or less flattened, and have easily distinguished upper and lower surfaces. In more technical terms this group is referred to as foliose lichens.



Jellyskin Lichens p 34



Moon Lichens p 35



Kidney Lichens p 36



Specklebelly Lichens p 37



Lungwort Lichens p 38



Pelt Lichens p 39



Rock Tripes p 40



Shield Lichens p 41



Tube Lichens p 42



Rag Lichens p 43

## Jellyskin Lichens

*Leptogium*



*Jellyskin Lichens (and their cousins the jelly lichens) are the only lichens in the glacier area that become **gelatinous, rubbery, and translucent when wet**. These lichens are pea-size to almost three inches wide. They are **often leafy but sometimes curl into rolled tubes or look like tiny bristly cushions**. **Dark gray, bluish gray, brown or black when dry, becoming olive green to blue-black when wet**. Upper surface of various textures. Lower surface bare or with whitish hairs. Usually on bark or wet mossy surfaces.*

# Moon Lichens

## *Sticta*



Moon Lichens get their name from the **rimmed crater-like pits on their lower surface (a)**. These pits are surrounded by light to dark brown fuzz. **Moon Lichens are the only group of lichens in our area that produce these pits.** These leafy lichens are **black or brown on the top**, and sometimes produce powdery granules or clusters of tiny, shiny black cylindrical projections. Moon Lichens are small (up to an inch, occasionally more), and at the Mendenhall Glacier area are most common on older willows near water.

Wet Moon Lichens often have a surprisingly **strong fishy or shrimp smell**. Specklebelly Lichens are the only other lichen near the glacier that sometimes produce this smell.

**Look-alikes:** The bare, oval, raised patches on Lung Lichens, and speckles on Specklebelly Lichens are easy to distinguish from the crater-like pits on the undersides of Moon Lichens.

# Kidney Lichens

## *Nephroma*



*Kidney Lichens have broad, round lobes, and lack veins or light patches on their undersides. One kind of Kidney Lichen near the glacier has white dots below. Lobe edges are often raised and curled back, exposing pea- to thumbnail-sized fruiting bodies at tips of the lower surface (a). The common name refers to these kidney-shaped fruiting bodies. Kidney Lichens may be gray, green, or brown. They grow in moss, over rocks, on the ground, and on wood.*



**Look-alikes:** Pelt Lichens produce fingernail-like fruiting bodies at the tips of the upper surface, rather than the lower surface (like Kidney Lichens). Pelt Lichens have veins and hair-like projections on their lower surface, while Kidney Lichens may be fuzzy or dotted below, but never have veins or hair-like projections.

# Specklebelly Lichens

## *Pseudocyphellaria*



*Specklebelly Lichens have **conspicuous white or yellow unrimmed, sometimes raised, specks and dense fuzz on their underside**. As the name suggests, Specklebelly Lichens are the only group with these **speck-like tiny tears** in their undersurface. Their **upper surface** varies from gray, gray-green or blue-green to brown, and is **often textured by a network of raised ridges**. The raised ridges can become covered in white or yellow powder, and brown cup-like fruiting bodies are sometimes present. These medium to large leafy lichens can be found on all types of trees near the Mendenhall Glacier.*

**Look-alikes:** Moon Lichens have rimmed, craterlike pits, not protruding speckles. Lung Lichens have large, white, usually oval bare patches, not speckles, surrounded by brown fuzz. One type of Kidney Lichen has raised white bumps below, but these are raised bumps not specks protruding from a tear in the lower surface. Kidney Lichens almost always have kidney-shaped fruiting bodies below, while Specklebelly Lichens never do.

# Lungworts or Lung Lichens

## *Lobaria*



Lungworts are some of the **showiest lichens** around the glacier, often covering tree trunks in 1-2 foot leafy displays. Their lobes are often **broad, even squarish, with a coarse network of raised ridges above** (like the lung tissue they were named after). Their **lower surface has large, raised, pale oval patches that are surrounded by sunken channels of darkish**

**fuzz** (upper right photo). Lungworts are **often stippled with raised orangish cup-like fruiting bodies**. Most Lung Lichens are **greenish gray or green when dry, and become pale to bright green when wet**.

Large hunks of Lung Lichens often get blown to the ground where it looks as if someone has spilled **mounds of lettuce leaves**. We do have several less showy Lungworts that are smaller and easily confused with Specklebellies, until you check the undersides.

Lung Lichens are important soil fertilizers. Studies in Oregon have shown that **Lungworts and other nitrogen-fixing lichens contribute up to 25% of the available nitrogen in oldgrowth forests** (Pike 1978). They are just as important in Southeast Alaska's rainforest and in the nutrient-poor soil left by the retreating Mendenhall Glacier.



**Look-alikes:** Pelts, Specklebellies and Kidney lichens might be confused with Lung Lichens, until you look at the undersides. Lung Lichens are the only ones with large raised pale oval patches surrounded by channels of dark fuzz below.

# Pelt Lichens

## *Peltigera*



*Pelt Lichens are the only group that produces fingernail-like fruiting bodies on top of lobe tips. The lobe tips are often pointed, raised, and rolled inward, partially concealing the fingernails. Their upper surface can be smooth, felty, shiny, scaly, or dotted with tiny dark flecks, depending on the species. These dark flecks are balls of nitrogen-fixing cyanobacteria. The dark blue-gray Pelts have nitrogen fixers throughout.*

*Pelts have raised or flat “veins” and conspicuous hair-like projections on their felt-like lower surface. These projections can be almost a half-inch in length. Pelt Lichens are usually green, gray-green, or brownish and have very broad lobes. Pelt Lichens form large flat or ruffly patches on the forest floor or on moss-covered rocks and stumps, or they climb up the bases of trees.*



*Raised veins on the lower surface distinguish Pelt Lichens from other leafy lichens.*

**Look-alikes:** *Raised veins on the lower surface distinguish Pelt Lichens from other leafy lichens. Kidney Lichens usually have fingernails on the lower surface. Lung Lichens have raised white patches below.*



*Pelt Lichens' reproductive structures (apothecia) resemble fingernails (a) and are always on the upper side of the lichen.*



## Rock Tripes

### *Umbilicaria*



At first glance, Rock Tripes appear to be attached to rock. A closer look reveals lobes that are slightly raised above the rock. Rock Tripes are dime- to quarter-sized, roundish, leafy lichens and can be recognized by the **single holdfast below that closely attaches each individual to a rock**. These **holdfasts resemble an umbilical cord**, hence their scientific name. Viewed from the top, Rock Tripes often appear to have a **belly button from a holdfast that makes a bump on their upper surface**. Edges can be smooth, tattered, and even fringed with eyelash-like projections. The upper surface may be brown, gray or black, and smooth, ridged or wrinkled. If you look closely, you may see **tiny black specks on top**. A magnifying lens reveals the **beautiful contorted texture of these fruiting bodies**. The lower surface is pale brown to black, with or without rhizines (hairlike growths) or other protrusions. Rock Tripes can be common on bare rocks close to the glacier.

**Look-alikes:** No other lichens have a single stalk-like holdfast underneath, or a belly button on the upper surface.

# Shield Lichens

## *Parmelia*



Near the Mendenhall Glacier, Shield Lichens are medium-sized (an inch or two) with **pale angular markings on the upper surface**. These distinctive markings are more angular than the networks of ridges on other leafy lichens. These **markings and lobe margins often develop powdery-granular patches or clumps of shiny cylindrical pegs**. Lower surface is black with many small **hair-like growths (rhizines)**. Rhizines can be **straight, forked, or bottle-brush shaped**. Shield Lichens range from gray or white to greenish gray or brownish and often have the appearance of hammered metal. In the Mendenhall Glacier area they grow on wood and mossy rocks.

The underside of a Shield Lichen has many small hair-like growths.

**Look-alikes:** Rag Lichens can be the same color and size as Shield Lichens, but rags lack the dense hair-like growths below and are not as closely attached to the substrate. Rag Lichens are usually much larger, with broader lobes than Shield Lichens.

# Tube Lichens

## *Hypogymnia*



Tube Lichens have **narrow, hollow, tube-like lobes that appear to be inflated (a)**. Some species have swollen areas that resemble **knobby knuckles**. Tube Lichens can get quite large (saucer-sized) and drape off branches in lovely cascades. They can produce **pea- to dime-sized cups that flare up almost half an inch**. They are often so closely attached to **branches** that when removed, the lower part of the tube stays on the branch exposing the frequently dark interior. Tube Lichens are usually greenish-gray to brownish-gray. Their upper surface is often rimmed with black from the lower surface, which is **black and often greatly wrinkled or puckered**. Tube Lichens grow on trees.

**Look-alikes:** No other common, showy lichens near the glacier form hollow inflated-looking tubes. Tube Lichens lack dots, craters, bumps and rhizines.



# Rag Lichens

## *Platismatia*



Rag Lichens are golf ball- to grapefruit-sized with **tattered, unkempt-looking edges** that range from **frayed to irregularly fringed**. Their upper surface can be nearly smooth to wrinkled or ridged. The edges lift above or drape below the trees they grow on. Rags are pale gray-green to brown and may have pale wrinkles or ridges and powdery patches or shiny protrusions. Their **lower surface is splotched in some combination of black, brown, or white, with an occasional rhizine**. Rags grow on conifer trunks, branches, and twigs, and are often found on younger trees or newer growth.

**Look-alikes:** Shield Lichens look like small Rag Lichens until you notice the tiny black root-like rhizines below. Although rags can be highly variable, they all look ratty.

## Crustlike Lichens

Many rocks, and the bark of mature smooth-barked trees such as alders, are literally covered with paint-like “crustose” lichens (called crusts). These lichens penetrate the surfaces they grow on and can’t be lifted without dislodging pieces of both the lichen and the surface. The white “bark” of alders is actually a mosaic of crustose lichens—bare alder branches are green. There are dozens of crust groups on rocks and trees in the Mendenhall Glacier area; identification requires microscopes, chemicals, and patience.

Over time, pioneering rock crusts are overgrown by mosses, faster growing non-crustose lichens, and vascular plants. Meanwhile the crusts become established on more recently exposed rock surfaces. As trees age their crusts can also become overgrown by mosses or lichens. Below we introduce you to three common crusts you’ll see in the glacier area.

- 1a. On bark; irregular yellowish tan to pale brown splotches with scattered raised scale-like blisters that resemble barnacles.....Barnacle Lichens (*Thelotrema*)
- 1b. On rock; some other color
  - 2a. Rounded black blotches covered by a mosaic of bright yellow or yellow-green flecks; exposed black background resembles a road map.....Map Lichens (*Rhizocarpon*)
  - 2b. Rounded wrinkled patches; color varies from pinkish-brown to whitish-gray when wet.....Bulls-eye Lichens (*Placopsis*)



Barnacle Lichens p 45



Map Lichens p 46



Bull's-eye Lichens p 47

# Barnacle Lichens

## *Thelotrema*



*Barnacle Lichens form noticeable pale yellowish tan or gray crusts with **round blister-like fruiting bodies that resemble barnacles or small volcanoes.** Barnacle Lichens are very common on the bark of trees near the glacier.*



## Map Lichens *Rhizocarpon*



Map Lichens grow in **bright roundish patches** that look as if they're part of the rock. **Raised bumps, usually yellowish, are surrounded by leading edges of black, creating a squiggly pattern rather like a road map.** Look for Map Lichens on bare rocks that were exposed about 30 years ago by the retreating Mendenhall Glacier. Scattered tufts of fireweed, small willows, mounds of moss and Foam Lichens are often present in the rock cracks.

## Bull's-eye Lichens

### *Placopsis*



*Bull's-eye Lichens grow in rounded patches on rock. These distinct lichens are easily recognized by the large, wart-like clumps of cyanobacteria that cluster in the center of the pinkish to pinky-brown patches. Bull's-eye Lichens often become very green or whitish-green when wet, making the raised pink tinged clumps more obvious. Bull's-eye Lichens are among the first organisms to become established on rocks newly exposed by the retreating glacier. They can also be found on rocks in open areas that haven't been covered by moss, and on cobbles and boulders on exposed bars in the Mendenhall River.*





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This beautiful Pelt Lichen was found along the shore of Mendenhall Lake

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