HOW DOES WOOD ROT?

The life forms on this planet may be generally divided into two basic groups, animal and vegetable. The animal life forms are characterized by their inability to absorb light energy from sunlight, although these definitions are simplified. Vegetable life forms (plants, broadly speaking) are generally rooted in one place and get their energy from sunlight, whereas animal life forms are generally capable of movement and get their energy from what (who) they eat.

A mushroom is rooted in one place although it does not absorb sunlight for energy, relying instead on the energy content of its food. In recent years the scientists who classify things have decided that fungi are different enough from plants that they should get a third, separate category. Life forms now are "animal" and "vegetable" life forms, some of which are called "plants" and some called "fungi". We are not going to get any more complicated than that.

There is a *"food chain", wherein some life forms* eat *others. Each life form is seeking survive, and all life survives by exchanging energy with other life. In some cases the exchange may be rather one-sided, in that not everyone who comes* to *dinner goes home.*

The ultimate source of life energy is sunlight. It is captured by plants who store most of it in their physical and chemical structure and use up the remainder. They are eaten (usually while alive) by animals, and sometimes by fungi. Some of those animals are eaten by other animals. Some of the plants and animals who were lucky to not be eaten entirely by others, eventually die. Various fungi and plants and animals feed on the corpses, and others feed on them. Ability to move, grow and/or multiply faster favors survival. For example, fast growing plants that scatter many seeds [weeds, for example] flourish. Humans move quickly, even though they do not grow the fastest nor multiply the fastest. Life span is also obviously a factor. Every life form has some factors that combine to favor its survival.

Each time one life form eats another; some of the stored energy is used in maintaining its own life, and the remainder is either excreted as waste (for that organism, perhaps, but for another perhaps as fertilizer) or stored as chemical energy within its own tissues.

We love sugar for the fast energy rush it gives (not to mention it tastes good) and so it is easy to see there is usually something in one life form, which another life form craves as its sugar. This is why some life prefers to eat certain other life. As a defense, some life survives best when it tastes bad to whomever is trying to eat it at that moment. This is why some kinds of wood are more resistant to fungal attack and rot than others; those trees taste the worst and they were the ones that survived. Different trees taste bad to different predators or parasites. Life is diverse.

Fungi are one of the oldest and most primitive life forms on this planet. Fungi feed on just about anything whether dead or alive. Fungi move by growing more fungal cells that spread further by growth; they don’t have legs or wings or swimming fins as some other life does. When a cell of fungus is iIn contact with something, the cell secretes digestive enzymes onto what it touches. The enzymes usually can break down the surface and dissolve it, and the cell absorbs the digested material as food. The stomach of a fungal cell is its outside surface; if a human body worked that way, our stomach would be on the soles of our feet, and if we wore shoes all the time we'd either starve to death or learn to eat our shoes.

Plants and fungi reproduce either by scattering seeds, which are a kind of egg, or by sending out shoots, runners, buds or branches (some kind of extension of the main body which is capable of taking root and becoming independent). Fungi may form new cells at the tips of old ones, spreading in branching strands everywhere they can find something edible. Fungi also create seeds, called spores. The spores are smaller than can be seen with the human eye, and they drift invisibly on the wind. They are in the air, everywhere. When it rains, they are carried everywhere

rainwater leaks into.

Fungi need both water and air. As the surface (or piece of wood) slowly dries out and gets into the moist-to-damp zone the fungal spores hatch and become very fast-growing baby fungal cells who and eat whatever surface they are on, and grow up. When the surface dries and cannot support fungal life, the adult fungal cells make many spores and leave them scattered around and the life cycle continues. Eventually someone comes along and kicks that piece of rotten wood and zillions of fungal spores drift away on the wind.

There are also bacteria, a different kind of microscopic single-cell life form. They are more like an animal than a plant, and more like a fish than an air-breathing animal. Bacteria tend to prefer the wood more damp than do fungi, but there is a humidity range where both can live. Many can survive drifting through the air until they contact a wet surface. Some bacteria live completely immersed in water. Most bacteria can move about. Some wiggle, others have many small legs they use to crawl about with, or to swim through the water in search of food or company.

Wood is said to breathe because the natural humidity of wood, perhaps five to fifteen percent by weight (once it has sat around in your garage for six months) can go up and down a bit as the humidity of air varies. The air humidity ranges from maybe ten percent in a dry summer to perhaps ninety-five percent in a humid summer.

Humidity (of air) means how much water vapor is dissolved in the air. Ten percent humidity means the air is holding ten percent of its maximum capacity. Ninety percent atmospheric humidity means that the air has, dissolved in it, ninety percent of its capacity. At one hundred percent humidity it is raining.

Wood can actually be placed in a box and exposed to the hot steam from boiling water. After a few hours the wood becomes flexible and can be bent into a new shape. If the wood is held in that shape as it cools down and dries back to its natural humidity at room temperature, it holds its new shape. The curved ribs for many small boats are made by this "steam-bending" process.

Wood holds a little water very strongly and more water with less strength and even more water rather casually. When there is less humidity in the air, wood loses some of its water to the air by evaporation. When atmospheric humidity is high, damp wood may lose some of its water but really dry wood will actually capture some water from the air. You may have noticed that small branches of plants are very flexible. That is because the wood is full of water. As wood dries out it becomes stiffer. Old wood found in the desert is not only hard but brittle. You may have noticed how brittle is a dead branch of wood in the summer.

Wood, microscopically, consists of bundles of large hollow tubes with doors across the tubes every so often. These tubes are the walls of living cells, long since dead with only the skeleton remaining. The hollow tubes, the cell walls, are the skeletons of those cells. As the fungi eat away those cell walls, they open up the spaces between those tubes, and as the fungi dissolve the doors between one wood cell and the next, the wood porosity is opened up more and more. This allows more rainwater to be more rapidly absorbed in the wood, thus providing more humid wood which is more favorable to rapid fungal growth, thus accelerating the decay of the wood. As the wood becomes more porous it holds enough water to favor growth of not only fungi but bacteria, and between them they eat first the porous summer growth rings and then the harder winter growth rings, and finally there is nothing left.
And that is how wood rots.

Steve Smith is the chemist at Smith & Co., since 1972 a manufacturer and distributor of restoration products, primers and coatings for wood, metal and other surfaces.