How Wood is Made

The early years of the Wood Collectors Society newsletter were full of excellent material. There were a lot of wood scientists, experts, and collectors who for the first time had a outlet for their literary skills.

The following article is one of those gems. Written by IWCS member #14, Dr. Emanuel Fritz, this article is an excellent example of how complex science used to be so well simplified that even the most casual student could understand the subject. Dr. Fritz was a legend in California, and when he passed away in 1988 at the age of 102, the Los Angeles Times ran this obituary.

Emanuel Fritz, 102, a forestry and conservation authority who was known as "Mr. Redwood." Fritz helped create California's forest program and was co-founder of the Regional Parks Assn., the forerunner of the East Bay Regional Park system near San Francisco. He was a professor of forestry emeritus at UC Berkeley, having joined the faculty in 1919 and retired in 1954. Fritz lived the longest of any professor at Berkeley, the university said. Fritz's contribution to the field of forestry was honored this year by the Redwood Region Logging Conference 50 years after he founded it. He advised elected and appointed officials on the need to balance demands for lumber in a rapidly growing state with the need to preserve old-growth groves, replant logged areas and set aside areas for protection. On Thursday in Berkeley.

Here is his article from the November, 1949, edition of the newsletter of the Wood Collectors Society.

<u>How Wood is Made</u>

<u>Dr. Emanuel Fritz, Member #14</u>

Wood is a complex aggregation of millions of cells. Essentially the individual cell of wood is not much different from the cell of any plant. Each has walls and a cell cavity. Each, when formed, contains protoplasm and other substances, essential in the life process. Wood cells are often large enough to be visible without the aid of the microscope -- for example, sugar pine and redwood among the conifers, and oak and chestnut among the hardwoods. More often, the cells are so small as to require a hand lens to make them distinguishable. Even in a wood like oak or redwood, some cells are large, others quite small.

Cells are generally box-like, closed all around except for the "pits", window-like openings, on side and end walls. Where a window has glass to close the "opening", the cell has a very thin membranous tissue, much thinner than the cell wall around it.

When the cell is first formed, its wall is extremely thin and the cell itself has still to grow in size. As the cell grows to its final size, its walls thicken. This thickening occurs inward; that is, more tissue is piled up or added to the inner surface. Cells in the summerwood portion of a wood like Douglas-fir or longleaf pine have much thicker walls than the cells in the springwood of the same growth ring. Such extra thickening causes the cell cavity, or "lumen", to be very much smaller in the cells of the summerwood.

All wood cells come from the "cambium". As they are generated - by cell division - they become specialized, or differentiated, and several types of cells are thus developed. Some will function primarily for strength; others for conduction; still others for food storage. (These will be discussed in a later paper.)

The cambium is a remarkable organization. Nature causes it to do things that make it appear almost human in intelligence. When nature steps on the gas in the spring, the cambium jumps into action and keeps in action until the season's tank is dry. Then the cambium rests, like a car in a garage. The cambium is really a single row of cells between the wood and the bark. This row of cells belongs as much to the bark as it does to the wood. It is common to both. But it is the only layer on the trunk of a tree that has the power to multiply and yet remain the same. Each cambium cell splits in half. These two small halves each begin to grow larger. One of them will grow into another cambium cell like its predecessor. Another will grow into a wood cell, a ray cell, a vessel segment or another type of cell. This is where "intelligence" comes in. How does the tree, (or the cambium cell), know when it is time to make wood or bark, or any one of the several types of cell making up wood and bark? Don't write me about it. I don't know.

When the cambium is engaged in the above business, naturally, there are some freshly created cells that are not yet fully grown either as to size or wall thickness. But there is only that uni-cellular row which we call cambium and which can continue the business of making new cells. Collectively, all the young cells hatched from the cambium, from the most recently created to the one still finishing up its growth, make up what we call the cambium (or cambial) zone. This zone of course will be several cells thick. It is quite weak, and for that reason the bark is easily peeled from a tree in the spring time. Don't confuse the cambium (or cambial) zone with the cambium. Only the latter possesses generative tissue, i.e., the ability to give birth to new cells. The cambial zone includes the cambium itself and the new and incomplete cells recently born from it.

The new cells stay put, once they have reached their full size. But the new cambium layer itself moves farther and farther away from the center of the tree. It's a sort of centrifugal displacement.

Obviously, the new wood cells pile up against the outside of last year's growth ring. But the new bark cells are formed against the inner face of the older bark. The bark moves outward. It can't stretch as the circumference of the trunk increases, so the older parts crack and the result is the grooves or fissures one associates with the bark of pines, cedars, oaks, hickories, etc. (The bark of the beech, birch, eucalyptus, and madrone are somewhat different, but they too move outward as the wood cylinder increases in diameter.)

The above is in non-technical terms. We crawl before we walk. If the editor is satisfied with this modest note, maybe we can later add some technical terms from time to time. But first of all we ought to look at a cross section of a tree trunk and discuss it. That would make this note too long, so we'll take it up next time.