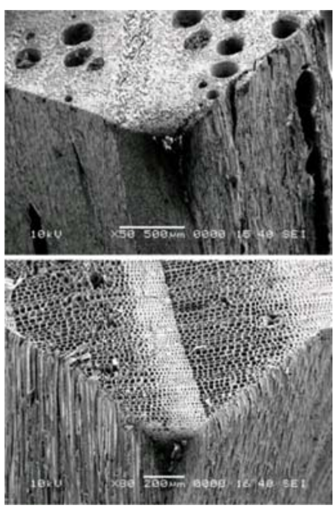
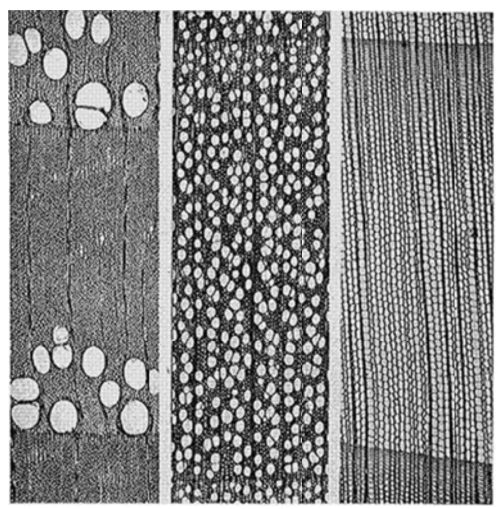
A Subtle Curve

Understanding Wood: The cellulose fibres in wood are bonded together by lignin, a natural plastic. Without lignin, wood is a loose bundle of fibres; without cellulose, it is a porous sponge of lignin. Wood is hygroscopic and absorbs and releases moisture at any time, especially if left unsealed.

Softwood cell structure: 95% of cells are long fibres known as longitudinal tracheids (like long tubes tapering to a close at either end) with small holes or pits in each cell wall which allow fluid to pass through the fibres. 5% are ray cells that radiate outward from the heart to convey sap horizontally.

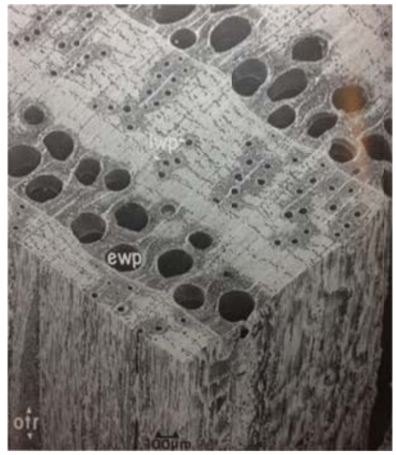
Hardwood cell structure: Fibers in hardwood are shorter than in softwood. Vessels form a type of continuous pipeline in end-to-end arrangement which is used for transporting sap. They have thin walls, and are fairly large in diameter. Their layout determines the strength, drying, working qualities and appearance. Fibers have closed ends are smallest in diameter of all the cells. They have thick walls and contribute to the strength of the wood. The parenchyma (creating the medullary rays) are a hybrid of vessel and fiber cells and their primary role is food storage. Earlywood is less dense, large, thin-walled for sap transportation. Latewood smaller, thicker and adds to the strength of the tree.



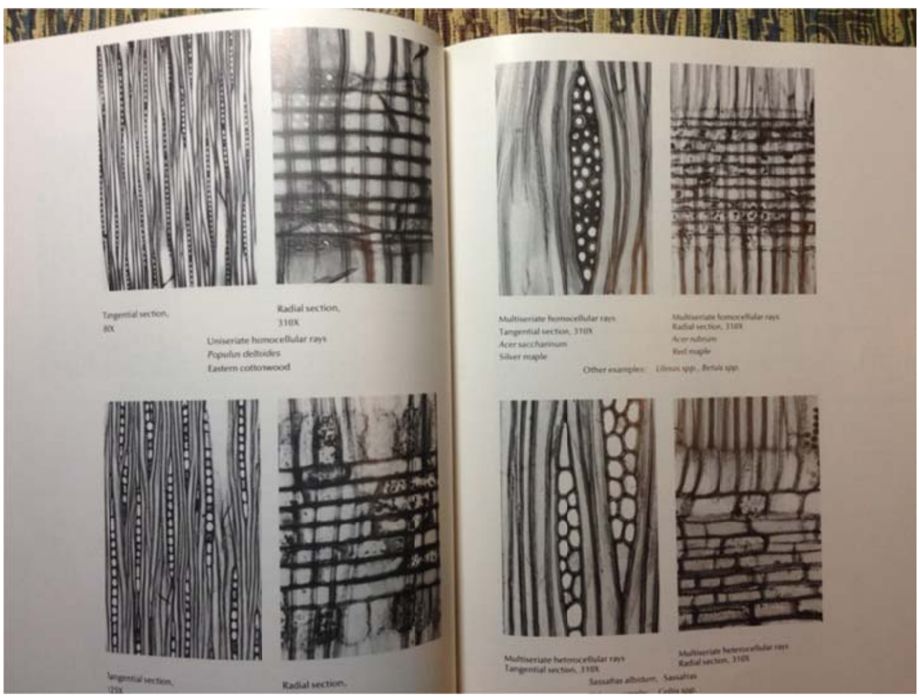


Images of hardwood and softwood taken with a scanning electron microscope (SEM) show the presence of pores in hardwoods (Oak, top left) and absence in softwoods (Pine, bottom left).

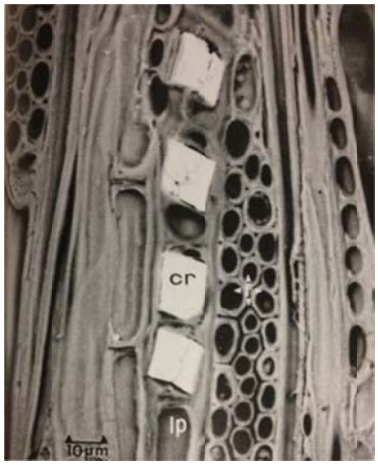
Porous and nonporous: The open end of a vessel is called a pore. Because softwoods do not have vessel elements, they are referred to as nonporous, whereas hardwoods are sometimes called porous. Hardwoods like chestnut, ash and oak have a significant difference in pore size between late and earlywood growth and are called ring-porous. Beach and birch have pores that are more evenly distributed and are known as diffuse-porous.



The presence of tyloses in Black Locust (upper left) and absence in Red Oak (upper right). Red Oak has pores too large and walls too thick for tyloses formation in earlywood pores. The minimum diameter of a pit susceptible for tyloses formation must be approximately 8-10 micrometers. Tyloses are membranous materials that occlude the vessels as a result of growth of protoplasm into the empty vessel under growth or pressure exerted by a living paranchyma cell. Tyloses develop at the time of heartwood formation in the tree or as a result of injury.



Homocellular rays top left (Eastern Cottonwood) and right (Silver and Red Maple). Heterocellular rays bottom left (Black Willow) and right (Sassafras). Normal rays may be composed of all procumbent cells, all upright cells, or of both upright and procumbent cells. If all cells are alike the rays are called homocellular and if both shapes of cells are present in a ray the rays are heterocellular.



Crystals in Black Walnut above. The absorption of salts and calcium are ultimately deposited in the cells as silica. While deposits are not common in domestic commercial woods, silica is found widely in tropical hardwoods and is a source of machining problems, quickly dulling tools. (Interestingly, although crystals are sometimes found in Black Walnut, they have not been observed in Butternut.)

Experiments in White Oak: Face Grain

When considering the best type of wood to use to make an extremely thin form that was resilient, transparent, with a consistent and predictable structure, I chose to work with White Oak. The ring porous growth creates interesting visual pattern and texture with smaller, more irregular and more abundant earlywood pores than Red Oak. The homocellular rays provide consistent and predictable structure perpendicularly through the vertical growth rings creating the ability to carve thin undulating forms that - with care - wouldn't break on earlywood rings.

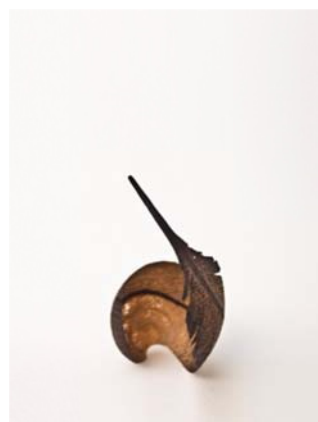


Experiments in White Oak: End Grain

After realizing the resulting strenth with face grain oriented work, I chose to test the theory with a series of end grain oriented feathers. The structure was just as strong, but impossible to carve the whisps towards the bottom of the quill. I chose to hammer a copper nail into a thin knife and wrap it with nichrome wire to burn/cut through the wood.






I have also experimented with thin feather forms in Wenge, Northern Silky Oak, Paulownia and Wych Elm Burl knowing of their various inappropriate qualities for this type of work – but doing it anyway with no dearth of frustration along the way.

Tools I find useful for this type of work:

Short Sloyd Knife by Pinewood Forge

Sharpening strop with Rich Notto's White Gold compound (aluminum oxide)

Mini Scrapers (Oval and Concave/Convex) - Stewmac.com

Ultimate Scraper - Stewmac.com

Micro-Pro by Mastercarver (quite, no vibration, forward + reverse, quick tip change)

Graeme Priddle's custom pyrography pen (does not get hot, tips extend further from handle, draws more current)

Scalpel (replaceable blades)

Other invaluable items:

Mirka Abranet sand paper (does not leave bits of abrasive in wood)

Mirka Abralon sanding pads – up to 4000 grit (does not leave bits of abrasive and can be washed and reused several times)

PFEIL Swiss Made Double Bevel Skew + Straight Chisels

Microplane, round and flat

Hook Knife by Pinewood Forge

Dragon Rasp – Stewmac.com