one bush or tree and drop off early; the fertile catkins on other. The white willow, which grows to the size of an immense tree, has similar long, narrow leaves, and the sterile tree is known from the fertile one by the early dopping of the tender spikelets, that then lie in the grass like hairy caterpillars. This tree was planted extensively by the early settlers from Europe.

The needle-leaved trees usually bear cones as their peculiar form of fruit; the scales of these open and allow the seeds to fall out.

The white pine is the most valuable of all American trees for its lumber. The needle-leaves are clustered *five* in a sheath.

The pitch pine has only *three* leaves in a sheath, and are from three to five inches long.

The scrub pine has its leaves in *twos*, but only one inch long. The red pine also has its leaves in *twos*, but they are *five* or *six* inches long.

The spruces have their leaves singly all around the branch or shoot, and the cones hang down. There are three kinds, the black, white and red spruce.

The hemlock leaves are short, and look as if arranged along two sides of the shoot, making a flat frond. The cones are very small with thin scales. The long, slender tips of the young branches always hang down gracefully, instead of standing up erect, or straight out, like those of a spruce.

The balsam fir has much larger, flat needles, arranged as in the hemlock, so that the shoots are like nothing more than a double-toothed comb. The cones are long, cylindrical, and stand *erect* on the branches like candles, the balsam running down their sides, and when the cone ripens, its scales fall off, leaving a bare, straight, erect peg like a short wire, or as if the candle-wick remained. GEORGE LAWSON.

Halifax, 29th March, 1881.

For the REVIEW.

The Physiology of a Tree.

The higher plants and the higher animals are so manifestly and strikingly unlike each other in externals, that to those who look no deeper, they seem to have but little in common. Yet under all their elaborate diversity they have this fundamental and all-important connection, that both live. Both therefore must obey all the laws which control living matter: and these laws are the same for both. Hence it is that plants have a "Physiology"; and like animals, including ourselves, Trees must eat, drink, digest, breathe, grow and reproduce, and they must have organs to carry on these functions. It is our present purpose briefly to examine both organs and their functions.

THE PHYSIOLOGICAL ORGANS OF A TREE. Nearly everybody knows that all vegetable structures are made up entirely of *cells*. A typical plant cell is in size too minute to be seen by the naked eye; in form, it is a sphere bounded by a thin transparent elastic wall. Just inside of this wall comes a lining of the living matter, Protoplasm, a jelly-like substance in which reside all the vital properties and powers of the plant. And filling the remainder of the hollow of the sphere are various contents, as sap, sugar, starch, crystals, etc. These are the simplest cells; but in order to perform special duties, they may become altered greatly in size, shape, thickness and composition of the walls, nature of the contents, etc.; but out of them, however modified, the entire tree is built up.

An attempt to classify the varieties of cells soon shows that they fall naturally into three systems, each of which has its own particular work to do. These are

(1) *The Epidermal system*, which consists of a thin tough sheet of flat transparent cells, thoroughly waterproofed by the presence in their walls of the same substance which makes ordinary cork waterproof. The cells may grow out into hairs or scales wherever the plant has use for such structures. The epidermis forms a complete coating over all parts of the plant, perfect except that its waterproofing diminishes on the youngest roots, and unbroken except for tiny openings in the green parts, (called stomata) guarded by special cells having the power to close them. In old trees, the epidermis on the stem is replaced by the tougher corky bark, which even better serves the same purposes. The use of this system is to prevent the evaporation of the precious water, and to protect all the interior tissues.

(2) *The Fibro-vascular system*, consists of long tough fibres, each a cell, for strengthening and supporting the tree-structure, and of water-passages or ducts, made by the removal of the contact-walls of long chains of cells, for conveying liquids. These mingled together form all the mass of the wood of the tree, the fibrous part of the inner bark, and extend out into the leaves as the veins. The cells in it are variously thickened and stiffened to make the whole structure firm.

(3) *The Parenchyma system*, is made up of cells little altered from the typical simple form described above. It includes the pith, the green part of the bark, the cambium or growing-layer, the medullary rays or "silver-grain," all young growing roots and buds and all the green parts of young stems and leaves. Its uses are varied, as will presently be seen.

It will greatly assist our readers in understanding what follows, if they will try to form a vivid mental picture of the tree as made up of these tissues as we