74,000 of its seeds are contained in one ounce The greatest number of these braird when covered with not more than a quarter of an inch of soil, only about one half as many come up when the covering is from three quarters to one inch, and two inches of earth effectually buries the whole of them. Such is the size, form, and weight of timothy seed, that it is invariably placed with that of the clovers, or "heavy division," in assorted seed mixtures. As the young plants grow rapidly, they soon acquire sufficient strength to secure them against the effects of weather and ravages of insects When sown alone, from ten to twelve pounds of seed per acre will suffice, in mixtures a much smaller quantity will generally be sufficient. Old timothy seed is easily detected by the dulness of its color, and the absence of that fine silvery lustre which fresh new seed possesses.

There are some interesting varieties of the species, the most noticeable among which are the medium sized plant generally grown in America, and a very promising kind sent from British Columbia by Mr. Brown, collector for the British Columbia Association, and plants of which, grown in the Edinburgh Botanical gardens last year, exceeded five feet in height, while some of their panicles, or heads, were more than six inches long, and the root foliage was from fifteen to eighteen inches in length. Two other varieties are smaller than the preceding, more knotty, less upright, and more generally found in a wild state

Structure and Office of Roots.

The embryo of every seed developes in two opposite directions, one portion possessing an inherent tendency to seek the light, the other endowed with a contrary property, to shun the light and penetrate the soil The one is adapted in its form, its members, and mode of growth, for spreading in the air and exhaling and absorbing vapor or gas, while the other is specially fitted for extending itself in the more solid and resisting medium of the earth, and absorbing nourishment in a liquid state. The manner in which these conditions are provided for in the two portions of plants furnishes one amongst the many beautiful illustrations and evidences of contrivance and design with which the works of nature abound. Let us confine our examination at present to the roots, and consider how they grow. It was shown in a former article, on the germination of the seed, that the ascending portion of the plant, or stem, was divided more or less regularly into segments, each of which, at its extremity, produced at least one leaf and bud; and each of these divisions increases in length by growth throughout its whole extent; so that the adjacent leaves on the stem, which at the first were close together, become separated by a considerable space This kind of elongation never takes place in the root; if leaves or buds were formed on its surface, they would remain always exactly in the same situation, and the distance between such appendages would never increase In other words, the root elongates by additions to its point, and not by the extension of any part once formed In diameter, the root increases, like the stem by the interposition of new cells or fibres amongst the old, but in length it grows exclusively by the addition of new tissue at the extremity. Roots are entirely destitute of such appendages as the leaves of the stem; we cannot, therefore verify the statement by observing whether or not such natural offshoots become further removed from each other, as in the stem, but if we, artificially, mark a growing root, we shall find that the marks remain always exactly at the same distance from each other as at first; no subsequent growth of the root carries them wider apart Now, this peculiarity in the growth of the root exactly fits it for the conditions in which it is placed and the purposes it has to fulfil. The newly formed cells at the end of each rootlet, with their extremely thin and delicate membranous walls, are admirably adapted for absorbing the moisture which surrounds them, and which forms a large portion of the food of the plant. This absorbing surface is greatly increased by prolongations from the young cells, having the appearance of minute hairs, which in some instances can only be discerned by the aid of the microscope, but in others are obvious to the naked eye, as in the first rootlets of the seedling maple, an illustration of which was given in fig. 5, accompanying the article before alluded to, in the last number of this journal. Nothing else could so well perform the office of absorption as this delicate, newly formed tissue. Nature, therefore, provides that it shall be freshly laid on to the extremity of each tiny rootlet, as it insinuates its way further and further, in search, as it were, of fresh nutriment in the surrounding soil. In another equally important respect this peculiar mode of growth is adapted for the conditions in which the root is placed. Unlike the stem, which can extend without impediment in the air, this portion of the plant has to make its way through a comparatively dense and solid medium, and if the divisions of the root extended throughout their whole length like the joints of the stem, it is easy to see that, when thus forced against the resistance opposed to them by the earth, they would become so twisted and compressed as to be entirely unfitted for the free transmission of fluid through them. But as it is, a portion of the root once formed, is never pushed forward by any subsequent effort of growth, and the channels provided for the passage of fluid remaining undisturbed, continue to perform the office of conduits as long as the absorption of moisture goes on. How beautifully, too, this mode of growth, at the extremity only, enables the roots to insinuate their soft and yielding fibrils into the tiny crevices and interstices of the soil, bending and passing over such obstructions as oppose an effectual barrier to the penetration of their points, while once having found their way into any aperture or fissure, the lateral expansion of the growing roots, a movement which, as in all vegetation, takes place with slow but irresistible force, is sufficient to widen the passage, and make room for its subsequent increase in diameter. As the main root branches out in every direction, each rootlet branches out in the manner we have described. The increase of roots below the surface of the earth goes on just in proportion to the spread of the branches above ground.

That the absorption of moisture, that is, of nutriment, takes place only from the freshly formed ends of the rootlets, has been proved in the following manner by Senebier:—He took a radish, and placed it in such a position, that the extremity only of the root was plunged in the water; it remained fresh for several days. He then bent back the root so that its extremity was carved up to the leaves; he plunged the bent part in water, and the plant soon withered; but it recovered its former freshness upon relaxing the curvature and again plunging the extremity of the root into the water.

This absorption of moisture only by the extremity of the rootlets "explains," says Dr. Lindley, "why forest trees, with their dense umbrageous heads, do not perish of drought in hot summers or dry situations, when the earth often becomes mere dust for a considerable distance from their trunks, in consequence of their foliage turning off the rain. The fact is, obviously, that the roots near the stem are inactive, and have little or nothing to do as preservatives of life, except by acting as conduits, while the functions of absorption are going on through the spongelets, which, being at the extremities of the roots, are placed beyond the influence of the shadow, and extend wherever moisture is to be found. The same peculiarity prevents a plant from exhausting the earth in which it grows; for, as the roots are always spreading further and further from the main stem, they are continually entering new soil, the properties of which are unexhausted."

From the foregoing considerations, the practical importance of preserving the delicate terminal fibres of the roots in transplanting trees, shrubs, or herbs, will at once be obvious, and has been so often enforced in agricultural writings that it is needless to dwell on the subject here.

It follows, also, that as the increase of the root and the general activity of the vital functions take place just at the time and in the same proportion that the stem above is growing and spreading that while evaporation is going on most rapidly from the leafy expansion of the aerial system of the plant, a compensating process of absorption is going on from the spongy rootlets beneath the ground—it is clear that to disturb and tear asunder these delicate organs during the period of activity, must be injurious to the plant, must retard its growth, if it do not kill it outright. Hence, it is a most unwise practice to choose this season for transplanting. Before this activity of growth and absorption has commenced, or after it has subsided, are the proper times for performing this operation. The early spring, therefore, before the plant has burst into leaf, or, better still, where the climate will allow, in the fall of the year, when all parts of vegetation are at rest, are the best and only seasons for removing growing plants; the early summer is in all cases the least favorable season for successfully accomplishing the change. The correspondence between the increase of the roots and branches should also be considered in the operation of pruning.

Besides the purpose of absorbing nourishment from the soil, roots have another office, that of fixing the plant in its place, and how admirably they fulfil this object is shown by the tenacity with which they retain their hold, so that the violence of storms will oftener break the trunks of even the largest trees than tear them up from the ground by their roots.

There is considerable variety in the form and general appearance of the root in different plants, and it is not uncommon to include certain modifications of the stem under this name. But it should be remembered that all true roots spring from the base of the embyro or of a leaf-bud. These last will emit roots in almost all cases when placed in favorable situations, as, for example, when the portion of the stem from which they spring is placed in contact with the ground or covered with earth. Runners habitually take root in this way, and sets are artificially obtained on the same principle. While some true stems run under ground, there are also true roots that are emitted in the air, where they either attain a considerable length before they reach their natural bed in the soil, or where in some instances they remain and perform all their functions by absorbing moisture from the air. Of this latter kind are the aerial roots of some orchids; and of the former, the roots at the base of corn-stalks, and a still more remarkable example in the aerial roots of the celebrated Banyan tree of India.

The real distinction between root and stem may thus be briefly summed up:—The origin of all true roots has just been noticed, and forms a notable distinction. Stems are, moreover, divided with greater or less regularity into segments marked by the growth of leaves and leaf buds. Roots are entirely destitute of scales or leaves, or any scars left by their presence; and as a rule, have no leaf buds, and ramify without any symmetry or regularity. Accordingly, we must regard as stems the underground portion of such plants as couch-grass, which is jointed, and furnised with buds that, alas! are only too prone to start up into vigorous life. The tuber of the potato, also, the eyes of which are merely leaf-buds, must be classed amongst the varieties of stem; and all true bulbs are stems, or often little else than large leaf-buds; while such reservoirs of plant food as we meet with in the raddish, beet, turnip, and such like, are true roots. They belong to a class of plants called biennials, and the nutriment stored up in the root during the first year of their growth serves to nourish the plant and mature the seeds during the second year, after which the whole plant perishes.

These subjects are of great interest, and to be illustrated would occupy far more space than can be allotted to them in a periodical journal of this kind. A brief sketch is all that can be given, and our object will be gained if, while some useful knowledge is imparted, new interest is awakened, and a desire excited for the fuller information which systematic works alone can furnish.