high up on the mountains, and in the season of flowering give color to these regions with their large, bold, and symmetrically shaped blossoms, each like a magnified daisy, sweet to look upon, telling in a mass, and giving rise to hopes that the plants may be found of sufficient hardihood to weather the trials of an English winter and spring. About twenty-five species have been described, and not one can be called a weed, each and all possessing merit that places it in a good position among plants fit for the adornment of the garden. It is strange that the *Celmisias*, possessing characters that should render them valuable to the gardener, are practically a new revelation, new for the reason that one may hunt gardening dictionaries and works of authority upon such matters without obtaining information on this New Zealand family. It is placed, however, in the composite group in De Candolle's "Prodromus," published in the year 1836, where two species are described, and there is also reference to them in Hooker's "Flora of New Zealand," where a few kinds are figured. There is, however, a reason for the absence of the plants from English gardens, as they are very difficult to introduce from their native home, even by seeds, although at Kew efforts have been made to establish them there, but with small results. In the Royal Gardens two species are represented, one being the subject of the accompanying illustration, *C. spectabilis*, the other *C. Lindsayi*, while in 1890 nine plants of *Celmisia* were introduced alive, but never grew. A large specimen of *C. spectabilis* may be seen at Kew, but unfortunately it has not yet flowered, so that at present the hopes of this family making a permanent abode with us are not very strong. What is wanted is a plan by which they can be successfully imported from their mountain wilds in New Zealand; and as orchids, after repeated failures, were brought safely to our shores, so we may reasonably expect success with the *Celmisias*.

ple has, therefore, an individuality of its own, to a greater or less degree. The manner in which nature effects this variation has never yet been determined, though there is reason to believe the rhythmic growth has much to do with it. At each rest nutrition is diverted to other directions; in proportion to the duration of these rests other portions become developed. This is known as the law of acceleration or of retardation.

External circumstances, however, somewhat determine lines of growth. The warm sun brings forward the blossoms. The stamens, which prepare the fertilizing dust, develop rapidly under unusual warmth, while the pistil, which has the responsibility of bringing forth the fruit, takes its own time. In this way the stamens often mature the pollen in advance of the needs of the pistil. When the pistil is mature there is no pollen and hence no fertilization and no crop. The abundant seasons are when stamens and pistils mature contemporaneously. But even when the fruit is properly fertilized the tree has not stirred up nutrition enough the past season, and then the ground under the tree is stored with fallen miniature fruit.

Even the 2,000 kinds of apples now recognized make a trifling list compared to the apples of the past. No one knows where the apple was originally indigenous. It is common with garden authors to write that "by the skill of the pomologist the delicious apple has been developed from the wild crab." It is just as likely, from American experience, that the wild crab of the Old World is the degenerate escape from cultivated trees. We know that the ancient Greeks cultivated it, but, as the root of the word is the same in all, even the most barbaric tongues, there is little doubt of its being cultivated long before the dawn of modern civilization. Remains of what must have been very fine specimens of apples are found in the mud under spots where the lake dwellers of Switzerland had their cabins long be-

though the seed and core do not. Twins or even triplets are often seen in apples, as in so many other organisms, and just as in other organisms by independent germs coming into juxtaposition in an early stage of development, when the stronger body absorbs a considerable portion of the other.

Once in a while some tree in an orchard will take a notion to produce a different fruit from usual. Regularly producing round apples, the novelty may be a long apple, or it may differ in color or some other way. It is usual to refer this to the influence of some other pollen. But those who have made test experiments do not find any immediate effects on the fruit, though they do on the cotyledons or future seed leaves of the crossed fruit. On the other hand, we know that plants have a tendency to vary outside of any influence on the seed. The curled-leaved willow was raised from a branch which pushed out from a regular weeping willow, and in the same way many of the famous roses of the florists were not raised from seeds, but from branches, which, in some manner not yet explained, bore flowers wholly unlike those the plant had been in the habit of bearing. Human pride does not like to say it does not know, hence the intermixture of pollen is a popular explanation of this freak, but the wiser person risks "I do not know" as about the true state of the case.

Another freak is for an apple usually smooth to bear fruit with partially russeted skin. They have been seen with the upper half russet and the lower smooth, looking like huge acorns in their cups. Here we can get pretty near the direct cause, though we cannot yet understand how that cause is brought into operation. First, we must recall that an apple is only changed branches and leaves. Though changed, it will yet bear the characters of true branches. On the bark of young apple trees we may see, like needle punctures, small green spots, and we see the same on smooth apples.

These little dots are known as cork cells. On the bark they remain undeveloped for some ten years, when they proceed to work under the cuticle, and the old and useless bark is thrown off in thin scales. The rind of the apple is the analogue of the bark in the stems. The little dots or cork cells, much weaker in the rind than in the stem, start early with growth, and undermine the cuticle, thus giving the russet appearance. All this can be seen with a good lens. In the regular russet apples the tendency of the cork cells to form russet on the apple is very strong. This is all the difference between the true russet and those which are only occasionally so. Though we know this development of cork cells is the cause, science has not yet given us the slightest clew as to how these cork cells come to be set in motion—why they should not germinate so as to be destructive in less than ten years in the branch, and do it all in one year in the metamorphosed apple.

Why is one kind of apple red, another yellow, another green, even when ripe; or why a mixture of all these colors often in one? Again the truthful answer is, "We do not know." In flowers some have thought color was given in order to make them attractive to insects, the cross fertilization which sometimes occurs by such insect visits being supposed to be of some benefit to the race. Some pretty romancing stories have been written about this by the lively pens of even men distinguished in science. Such a reason for gay coloring could not apply to a fruit. It has been said by the same class of writers that an apple was made good to eat in order that the seed might be widely distributed. Most seeds have some special adaptation for distribution. A pine seed or a linden seed travels by wings spread to the wind; the sand burr adheres to the hair or wool of animals; the thistle or dandelion sails by its downy pappus to long distances, but the apple falls under the parent tree, and the seed can only grow after the apple has rotted away. And so, says the pretty theory, it was made grateful to man. He sends barrels of the fruit to long distances. Man eats the flesh and throws away the core, and on the spot where it falls an apple tree grows.

Surely, this is the fact, whether specially arranged to this end or not, but this will not account for the varying colors of the fruit. A Rhode Island Greening or a Newtown Pippin, green and unattractive, are scattered over the world as generously as the brightly colored Baldwin or Northern Spy.

We know a little of the manner in which color is brought about, and that is all. Oxidation of certain mineral elements, in connection with light, produces the various tints, but just why, in a striped yellow and red apple for instance, the mineral elements should not be uniform, and why there should be one kind in the line of the dark stripes and another in the line of lighter ones no one can tell.

We know also that the mysterious power we call life has something to say in the matter. An apple that may become highly colored when it is allowed to remain on the tree, will not color if plucked from its connection with its source of life on the tree.

There has been one gain in our knowledge of the cause of color in flowers or fruits in a general way. If we brave the cold on a keen winter's day, the roses come to the cheek or the blue to the lips or nose. It is the same battle with the elements that brings color to flowers. The brightest and most brilliant colors are where the struggle for life is the greatest—that is to say, in the Arctic, on mountain tops, or on dry, barren deserts. It has even been found that flowers like flax, which in blossom present a sheet of light blue in a mild climate, have a deep azure when growing in Sweden, where the struggle of the plant with the elements is more severe.

In the tropics where everything is favorable to vegetation, there is a far greater proportion of species with insignificant flowers than in northern regions. The chief blaze of color of which writers speak as characterizing tropical scenery is due chiefly to orchids and other air plants, which have a struggle to live at all by clinging to trees, walls, or rocks, where they have to subsist chiefly on what they can gather from the air. The beautiful colors that characterize the autumn forests of severer regions are never seen there, but a dull, monotonous green persists in the forest scenery all the year round.

This has been found just as true of apples as of leaves and flowers, and was one of the great lessons taught by our great Centennial Exhibition. The apples of Canada beat the world for brilliant coloring. The collections became duller and duller as they came

NEW ZEALAND ASTER—CELMISIA SPECTABILIS. (FLOWERS WHITE.)

The species with which we are most concerned here is *C. spectabilis*, and the award of a first-class certificate was well merited. A large basket of small plants were exhibited, and at once compelled attention, as being utterly unlike the usual run of things shown at the meetings. The plants were about six inches high, the leaves distinctly lanceolate, narrow, and covered on the under surface with a down-like felt, the upper surface silvery, and in excellent contrast to the flowers. Each is erect, carried on a short, sturdy peduncle, and about two inches across, the ray florets numerous, pure white, the disk yellow, and making up a full, handsome, symmetrical bloom. It is very free flowering, and the whole plant of a distinct, tufted character. The great point is whether it will stand the rigors of an English winter, and if it does then we shall have acquired a valuable acquisition for the outdoor garden. If it does not, however, exhibit this commendable trait, it may well take its place among plants suitable for growing in pots in the cool house. Those who wish for a *Celmisia* at once distinct and beautiful should not forget *C. spectabilis*, and the accompanying illustration shows its bold, handsome character better than mere description of its manifold charms. It is mentioned by Mr. Dutton in his interesting letter from New Zealand in the *Gardeners' Magazine*, July 18, page 433, as one of the treasures of the Christchurch Botanic Gardens; the flowers are described as being "as large as those of *Chrysanthemum lacustre*," but those illustrated were scarcely so large. Climatic differences easily account for this.—*The Gardeners' Magazine*.

APPLES.

By THOMAS MEEHAN.

THERE are described by various writers as having been at some time growing in America—all of which have had names given to them—some two thousand varieties of apples. As a matter of fact, no apple comes from seed exactly like its parent. Every seedling ap-

ple has, therefore, an individuality of its own, to a greater or less degree. That it traveled with the white man from his early Asiatic home is much more likely than that nature, unaided by man, spread it all over the woods and wilds of Northern Europe.

Another good argument for its Asiatic origin lies in the fact that there is a closely related species of apple, *Pyrus coronaria*, truly indigenous to the Atlantic portion of the United States. During the past few years a remarkable correspondence has been discovered between the flora of this portion of our Union and that of Northern Asia. Many trees, shrubs, and flowers are absolutely identical and many a scientific man would be willing to stake his reputation on the chance that, with this pretty native apple before him, there must be or have been more close Asiatic relations. Still, as an absolute fact, when asked where is the apple from, the honest answer is we do not know!

Among apples, as among living things, there are freaks—forms appearing in individual trees at the very extremes of normal conditions. A member of the State Board of Agriculture, in one of the Northern counties, has an apple tree that has never had a petal. No one would ever know that it was in blossom, yet it bears fruit abundantly. This shows that the pretty rosy parts of the flower, the petals, are non-essential to fruitfulness.

Some contend that the brilliant colors of the petals of flowers are given to attract insects, and arrange for cross fertilization. Others contend that the petals act as protectors of the undeveloped parts, while others believe that, to some extent, they have the function of leaves, and prepare food for the younger parts. Whatever it be, we see by this freak it is possible to have apples without them. Then there are seedless apples—apples with no core. There may be germs in the ovariums, and the germs may be properly fertilized by the pollen, but the power to absorb nutrition is weak and the ovaries die in infancy from sheer starvation. Having been once fertilized, the fleshy part we know emphatically as the apple grows on and matures,

from southern locations, till, reaching the collections from North Carolina, scarcely a bright one could be found in the very large collections that came from there. The same varieties would be larger, more juicy, and, in many respects, better than the northern ones, but these latter, though smaller, carried away always the popular vote for brilliancy and beauty. Undoubtedly, the more severe the struggle for life, the greater is the prevalence of brilliant color.

Just why some should be sweet and some sour is again another puzzle. The malic acid which gives it the sour taste seems to be in about the same proportion in the unripe as in the ripe apples; the difference in sweetness seems to arise from the change of starchy matter into sugar as the ripening process proceeds. But, though the chemist can tell us the exact elements that go to make sugar, he cannot make sugar for us. No power but that of the living plant can do it, and we are absolutely in the dark as to how the plant gets it done. Possibly the climate has some influence on the acting vital power, for the Rhode Island Greening, a sour apple in the Atlantic States, is a sweet apple on the Pacific—and the same apple will often have a part of the same fruit sweet on one side and sour on the other. These cases are generally attributed to some one in the past having split a branch through a bud, then fitting the sweet apple half to the half of the sour apple bud, and grafting the spliced graft. This is regarded as an ingenious after thought. Those who have directly gone and repeated the experiment have had no such result.

reduced scale, of the Apadana or Throne Hall, constructed in the fifth century before Christ, under the reign of Artaxerxes Mnemon, the son of Darius II., the brother and conqueror of the younger Cyrus, who was killed at Cunoxa, despite the aid of a Greek contingent among which were Xenophon's ten thousand.

The Apadana formed a part of what Mr. Dieulafoy calls the acropolis or royal city of Susa. This city consisted, at the north, of a semicircular citadel; at the northwest, of a redoubt or collection of defenses called the dungeon; at the west, of the palace properly so called, and of the harem dwellings of the king, of his wives and of the court; and, finally, at the south, of the Throne Hall or Apadana.

These various constructions stood upon an artificial plateau of bricks and earth and overlooked the immense plain of Susiana, the aspect of which is given us by the panorama painted by Mr. Jambon in order to set off the reproduction of the Apadana. This entire collection of palaces and defenses was inclosed within three thick walls of unburned bricks rising one above the other from the exterior to the interior, flanked by battlemented towers and by machicolations situated very near each other and preceded by two moats. The three walls and their moats had a width of 295 feet and circumscribed an area of about thirty-three acres. One point to be remarked on an examination of a plan of the defensive system of the acropolis of Susa is that it already realized the divisions of the military architecture of our middle ages, with its towers, detours, flankings, etc., that rendered difficult both access to the

entire length of the seven naves, and the effect of those thirty-six columns, whether the view be a front or a three-quarter one.

On this side, the fluted columns, six in number, 69 feet in height and 6 feet in diameter at the base, are of very fine grained gray marble, brought from the mountains situated at about forty leagues from Susa. They start from a square base and terminate in a double superposed capital, the lower part of which consists of figures of the Egyptian lotus, with a crown of Ionic volutes, and the upper of a group of kneeling bulls, with gilded horns, eyes and feet. The columns of the porticoes start from a round base more ornamented than that of the columns of the front, but their capitals consist only of bulls' heads. This decoration of the capitals is a reminiscence of the arts of the Egyptians and Greeks, with whom the Persians of the time of the Achemenides were in constant relation; but the decorative *motifs* of them were modified according to the national instinct and symbolism. Upon the front capitals rest the rafters of the roof. Beneath, there extends a frieze of faience, with polychrome lions as at the top of the towers. This entire *ensemble* of seventy-two columns supported the ceiling of cedar rafters, weighing 2,600 tons, which had been dragged by men from Lebanon to Susa—a distance of 1,080 miles. This cedar ceiling was covered with a layer of earth, and this was protected by large terra cotta tiles with joint covers of the same material. The other columns of the front and the openings of the porticoes were closed by tapestry veils moved by

RESTORATION OF THE PALACE OF ARTAXERXES.

This chapter would not be complete without some reference to the apple of Paradise. All writers on the apple are expected to bring it in—but they start with it as a prelude, while we make it the peroration. It is one of the mysteries how this magnificent fruit got out of the Garden of Eden, following our first parents into a sinful world. If one might be permitted to formulate a theory, it was no doubt through the foresight of Eve. Adam probably threw away the core—the thoughtfulness of his wife undoubtedly led her to gather it up for the sake of the seed, wrap it up in a fig leaf, and take it with her when banished beyond the gates. However, we have the apple and are thankful.—*Phila. Ledger*.

THE APADANA OF ARTAXERXES MNEMON.

At the time of the opening of the museum of Persian antiquities at the Louvre, we told how the Dieulafoy mission had succeeded in reaching Dizfoul, a city situated not far from the site of Susa, one of the capitals of the ancient Persian empire. We also told how the mission, surmounting all difficulties, and despite the dangerous contact with superstitious and pillaging peoples who admitted the authority of the Shah of Persia only with great reluctance, had dug into the tumulus formed by the accumulation of the debris of palaces that had successively fallen down one over another, and how it had had the happy fortune to bring to France some pavements of Persian art of the times of Darius and Artaxerxes. This museum of Susiana has just been rendered complete by a restoration, on a

place and the march of the assailant in case of surprise.

The Apadana, which our draughtsman has rendered in the landscape of the time, that is, standing in the midst of gardens planted with sycamores and palms, growing in the artificial soil of the acropolis, was appropriated to the official life of the king. Here he received ambassadors and gave his audiences, and, at certain times of the year, showed himself to the people. It had, as is shown by an inscription, replaced the Apadana of Darius I. (who was conquered at Marathon), which was burned and destroyed under the reign of Xerxes, who was vanquished at Salamis. The edifice formed a vast quadrilateral set with regard to the four cardinal points, and built upon a substructure 59 feet in height, measuring 354 feet in length by about 300 in width.

It consisted of four corner towers with high and thick walls of brick, presenting no opening except at the base, and crowned with a tile frieze from which stood out, in low relief, polychrome heraldic lions. Between the towers, to the east and west, extended two porticoes in two rows of six columns, separated from the Throne Hall by a wall containing free entrances, over which ran the great frieze of the archers called "the immortal," and of which the museum possesses beautiful examples. At the north the portico was similar, but was limited by a stronger relief of towers.

The south side, the one shown in our engraving, is, properly speaking, the true facade of the Apadana. The hall opens directly and the eye can take in the

systems of poles and cordages. The floor was paved with marble and covered with carpet; the area of the Throne Hall was 38,700 square feet, and that of the entire Apadana was more than 107,000 square feet.

The throne, which was of gold and ivory, stood at the northern extremity of the hall, hidden by hangings that were drawn apart for an instant, so that the people could get but a glimpse, in his mysterious and royal pomp, of the king of kings, or the great king, as the inscriptions preserved in the museum call him.

Such was this Throne Hall of the Achemenidian sovereigns, restored by the study of various substructures, such as those of the debris brought to light by Mr. Dieulafoy, and by a comparison of what still exists with the texts of Greek authors. In order to produce works of such grandeur, and to remove masses of such bulk, and carry them from such a distance, the Persian architects had at their disposal nothing but manual labor; but where, for one stress, we use a hundred weight of coal, they, for a like stress, perhaps used up the life of one man.—*L'Illustration*.

ARTIFICIAL FUEL.—By J. Lundstrom, Stockholm.—The blocks of fuel are prepared by mixing the small coal produced in breaking anthracite with an adhesive paste made of finer coal, coal dust, peat, sawdust, etc., and a solution of silicate of soda; the mixture is then moistened with a solution of common salt containing 5 to 50 per cent of calcium chloride in order to hasten solidification, pressed or moulded into suitable forms, and dried if necessary.