less inflammatory action, which results in tenderness. It is not sought to convey the impression that the wall of the foot is elastic, for nature has so constructed it as to render it as stiff and unyielding as possible, but when it comes with force in contact with an inelastic surface like a macadamized road, more or less stretching is inevitable, so that a stay, as afforded by a well-formed shoe, is a great aid. At times of the year when the roads are icy, shoes perform the additional office of giving grip or preventing slipping.

It may be thought that information with regard to shoeing should be reserved for shoeing-smiths; but the writer has found that horse owners object to any change from the old traditional but irrational method usually practised, thinking that the smith is experimenting on their horses' feet, and shoers often urge this as an excuse for not pursuing the plan that admits of rational expansion; hence the necessity for a more general diffusion of knowledge on this subject.

The principles that should be observed in shoeing are simple and easily understood, and it is the effort on the part of many shoers to convert what is a simple process into a complicated one, from which the chief harm arises. A knowledge of the structure and function of the parts of which a horse's foot is composed is essential to the correct understanding of the principles of shoeing.

We will give a brief outline of the structures making up the foot. Those who desire a more accurate knowledge of its anatomy, will find the various parts pretty clearly shown, by sawing the portion of a limb from the fetlock downwards, in two, lengthwise. The three last bones of the limb or those entering into the formation of the coffin-joint, viz., the small pastern, navecular, and bone of the foot, form the foundation upon which the other structures are built. The bone of the foot resembles very much in form the outline of the hoof when planted on the ground. One of the tendons, commonly known as the back tendon, passes under the coffin-joint, and is attached to the lower and back part of the bone just alluded to. Lying under the coffin-joint and within the hoof is a considerable structure called the fatty frog. It is elastic, and aids in preventing jar, and supporting this joint, when the foot comes to the ground. The bones spoken of and fatty frog are invested by the quick, as perfectly as a sock surrounds the human foot. The quick is composed of a fibrous structure, in which are many blood-vessels and nerves. This sensitive membrane forms a close medium of connection between the structures it encloses and the hoof, and it also performs the very important office of secreting or producing the horny matter, that makes up the various portions of the hoof. If the hoof is separated from the underlying structures and soaked in water for a length of time, it divides into three parts, viz., the wall, sole and frog. The wall is that portion which is visible when the foot is planted on the ground, and which at the heels are bent inwards towards the centre of the sole, and forming which are called the bors, which arrangement gives firmness to the hoof. The lower margin of the wall is that which more especially comes in contact with the ground, and on which the shoe rests, and through which the nails are driven. On its upper margin is a well-marked groove, in which is situated a portion of the quick, which is much thickened when compared to the rest of it. This thick portion of the quick produces the wall, which is clearly demonstrated in observing an injury to the coronet grow out. The horny matter of the wall is composed of hair-like tubes held together by a sort of gluing material. The wall tissue is very tough, and inelastic, and will grow out to an indefinite length unless worn off by attrition with the ground, or removed with an instrument.

The *sole* is that portion of the hoof included within the lower margin of the wall, the bars and the point of the frog. It sustains weight and protects most of the lower surface of the foot. The quick immediately underlying it secretes it. Although composed of fibres glued together like the wall, still it differs considerably in its properties, for when it attains a certain thickness it crumbles or falls off in the form of flakes, thus it never grows beyond a certain thickness, and will regulate its own dimensions without the intervention of man. That triangular mass of horn in the middle and back part of the hoof known as the *frog*, has also a similar structure, but it is tougher than the sole, and possesses the quality of elasticity in an eminent degree, in which particular it differs from either wall or sole. It is also capable of looking after its own dimensions as it falls off in the form of shreds. In addition to protecting, and bearing weight, by virtue of its elasticity, it is intended by nature to come in contact with the ground, acting as a buffer in preventing concussion or jarring.

(To be continued)

The Farm.

The Way Some People Farm.

Birds which live in flocks are very much alike in their habits. Where one goes the other goes, what one does the other does, and they all seem intent on one pursuit, simply getting a living. In this we have a type of the way some neighborhoods get along. Living in sections as the people do, they get along in much the same oldfashioned way, non-ambitious, non-progressive, non-attempting. Indeed, the advance side of their lives is made up of negatives.

To put it in another way, "it reminds one of a "person lifting up a sledge hammer and letting it "fall down again," as we heard a gentleman remark not very long ago; or, to use the older comparison, there is very much of the treadmill about it. The old landmarks with this class of people are very sacred indeed. They never want to have them removed.

The causes are not far to seek. They do not read much, they reflect less, and travel less still, working at the same time so hard that there is not much inclination for reflection. When one reads what is going on in the great world around him, it is like taking a film from his eyes, but the results of ocular demonstration are more striking still. Hence the great utility of shows, which carry the elements of possibility right up to the gaze of the visitor.

The remedy consists solely of *education* in one or other of its forms. In part, it may be done by the spread of agricultural literature, by the spirited sustenance of exhibitions, and in part by the planting of farmers' institutes in such localities. If more on agriculture were taught in our schools, the gain would be greater and far more rapid.

The future, however, is full of hope. The elements of progress are permeating the very atmosphere and coming down in showers in some localities more grateful than the rains of June. There is of late a great shaking amid the dry bones and they have assumed already more than the skeleton form. The good ship of progress is more than launched. She has got a good way out to sea. The Canada that we all love so much is running in the neck to neck race with the agricultural peoples of every clime, and we no of us shall rest satisfied unless she comes out head?

Yet we have a great work to do within our own borders, where still so many are only half awake, or slumbering profoundly. Every lover of progress should for their sakes take upon him the office of porter, and wake them up lest they miss the train.

Mission work is always a noble work when the motive prompting it is pure, and all who love humanity must rejoice in its success, more especially in its recent years. Yet we should not forget that there are various kinds of this. We have a great home mission work to do amongst the class of farmers to which we refer above, and every lover of progress should in this sense become a missionary.

Agricultural College, Guelph; Bulletin IX.

DRAINAGE WATER.

BY C. C. JAMES, M.A., PROFESSOR OF CHEMISTRY.

In estimating the worth of a fertilizer, commercial values are set only upon the nitrogen, phosphoric acid and potash; sometimes the lime is considered. The three first mentioned are of the most importance, since nearly all soils contain sufficient of the other plant foods to sustain ordinary crops. To grow crops it is necessary, therefore, to supply nitrogen, otherwise the land will become exhausted. The ordinary crops annually remove from the soil the following quantities of nitrogen per acre:

				Total.
Wheat (30 bush.)	Grain 33 lbs	Straw.... 12 lbs		45 lbs
Barley.....(40 ")	Grain 35 "	Straw.... 12 "		47 "
Oats ... (45 ")	Grain 38 "	Straw.... 14 "		52 "
Hay ...(1½ tons)	.....	45 "		45 "
Red Clover (2 ")	.....	70 "		70 "
Turnips ...(17 ")	Roots 63 lbs	Tops . .. 45 "		108 "
Mangolds..(22 ")	Roots 85 "	Tops ..... 46.5"		131.5"
Potatoes... (6 ")	Roots 42 "	Tops, etc 18 "		60 "

The rain carries into the soil from the atmosphere every year from five to ten pounds; other sources of supply besides that of direct applications of a nitrogenous fertilizer are, as yet, somewhat uncertain.

The nitrogen, however, before it is in form available for the plant must be converted into a *nitrate*, a compound resulting from the union of nitric acid with some such substance as lime. This formation of nitrates in the soil is called *nitrification*, and every farmer should be thoroughly familiar with the condition under which it proceeds.

The process is one of fermentation in the soil. The work is done by a very minute organism or vegetable cell (called *bacterium*), similar to the yeast cell and other vegetable organized bodies producing the various fermentations. It is found in all fertile soils, and for its development and work demands a supply of air and water. Tillage, therefore, assists in the process. The presence of too much water excludes the air and hinders the work, even undoing it. Drainage therefore increases the range of nitrification and deepens the fertility. A proper degree of heat is also most important. Nitrification ceases below and near the freezing point. As the temperature rises to 98° Fah. (37°C) actively increases. From that point it again diminishes to about 131°(55°C) when it ceases. Under these conditions nitrification proceeds most actively during the summer, and continues even into the autumn. The nitric acid thus formed unites with lime principally, forming nitrate of lime, or *calcium nitrate*.

In the spring there are few, if any, nitrates to be washed out of the soil; in the summer there is but little, if any, drainage to wash out the nitrates; in the autumn, therefore, when nitrates have accumulated and drainage is also abundant, we may expect the greatest loss.

In the experimental department of our farm we have a set of drainage measures, or lysimeters; also a large rain gauge. The area of each drain gauge is $\frac{1}{1000}$ of an acre, and that of the rain gauge $\frac{1}{1000}$ of an acre. The former are 36 inches deep, and contain the soil preserved in its natural condition and position. The soil in three of them is eight inches sandy loam, ten inches reddish clay, fourteen inches of gravelly loam, and four inches of pure building sand.

One has been covered with permanent pasture, manured in 1884 with farmyard manure, 14 tons to the acre. A two year's rotation, bare fallow and fall wheat, has been kept up on two of the others, con-