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Содержание

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WHEAT AND WHEAT BREAD

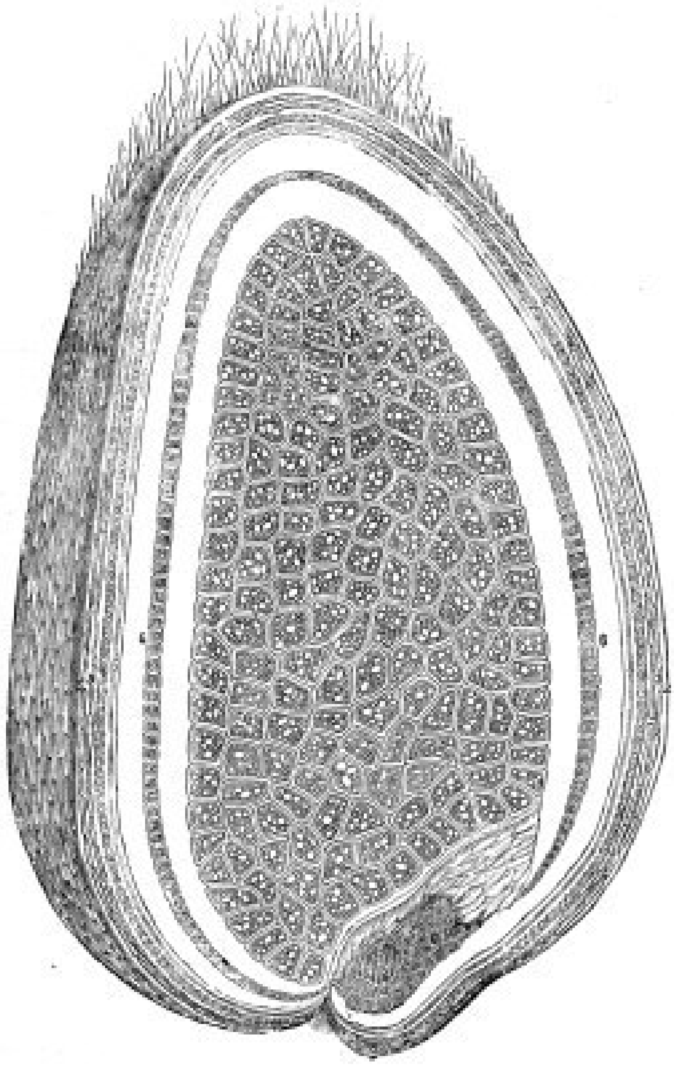
By H. MÈGE-MOURIÈS

In consequence of the interest that has been recently excited on the subject of bread reform, we have, says the London *Miller*, translated the interesting contribution of H. Mège-Mouriès to the Imperial and Central Society of Agriculture of France, and subsequently published in a separate form in 1860, on "Wheat and Wheat Bread," with the illustration prepared by the author for the contribution. The author says: "I repeat in this pamphlet the principal facts put forth in the notes issued by me, and in the reports furnished by Mr. Chevreul to the Academy of Science, from 1853 up to 1860."

The study of the structure of the wheat berry, its chemical composition, its alimentary value, its preservation, etc., is not alone of interest to science, agriculture, and industry, but it is worthy of attracting the attention of governments, for this study, in its connection to political economy, is bound up with the fate and the prosperity of nations. Wheat has been cultivated from time immemorial. At first it was roughly crushed and consumed in the form of a thick soup, or in cakes baked on an ordinary hearth. Many centuries before the Christian era the Egyptians were acquainted with the means of making fermented or leavened bread; afterwards this practice spread into Greece, and it is found in esteem at Rome two centuries B.C.; from Rome the new method was introduced among the Gauls, and it is found to-day to exist almost the same as it was practiced at that period, with the exception, of course, of the considerable improvements introduced in the baking and grinding.

Since the fortunate idea was formed of transforming the wheat into bread, this grain has always produced white bread, and dark or brown bread, from which the conclusion was drawn that it must necessarily make white bread and brown bread; on the other hand, the flours, mixed with bran, made a brownish, doughy, and badly risen bread, and it was therefore concluded that the bran, by its color, produced this inferior bread. From this error, accepted as a truth, the most contradictory opinions of the most opposite processes have arisen, which are repeated at the present day in the art of separating as completely as possible all the tissues of the wheat, and of extracting from the grain only 70 per cent of flour fit for making white bread. It is, however, difficult for the observer to admit that a small quantity of the thin yellow envelope can, by a simple mingling with the crumb of the loaf, color it brown, and it is still more difficult to admit that the actual presence of these envelopes can without decomposition render bread doughy, badly raised, sticky, and incapable of swelling in water. On the other hand, although some distinguished chemists deny or exalt the nutritive properties of bran, agriculturists, taking practical observation as proof, attribute to that portion of the grain a physiological action which has nothing in common with plastic alimentation, and prove that animals weakened by a too long usage of dry fodder, are restored to health by the use of bran, which only seems to act by its presence, since the greater portion of it, as already demonstrated by Mr. Poggiale, is passed through with the excrement.

With these opinions, apparently so opposed, it evidently results that there is an unknown factor at the bottom of the question; it is the nature of this factor I wish to find out, and it was after the discovery that I was able to explain the nature of brown bread, and its *role* in the alimentation of animals. We have then to examine the causes of the production of brown bread, to state why white bread kills animals fed exclusively on it, while bread mixed with bran makes them live. We have to explain the phenomena of panification, the operations of grinding, and to explain the means of preparing a bread more economical and more favorable to health. To explain this question clearly and briefly we must first be acquainted with the various substances forming the berry, their nature, their position, and their properties. This we shall do with the aid of the illustration given.



SECTION OF A GRAIN OF WHEAT MAGNIFIED.

EXPLANATION OF DIAGRAM.

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1.--Superficial Coating of the Epidermis, severed at the Crease of the Kernel.
2.--Section of Epidermis, Averages of the Weight of the Whole Grain, ½ %.
3.--Epicarp,                do.           do.           do.      1   %.
4.--Endocarp,               do.           do.           do.      1 ½ %.
5.--Testa or Episperm,      do.           do.           do.      2   %.
6.--Embryo Membrane (with imaginary spaces in white on both sides to make it distinct).
7.\            /  Glutonous Cells     \
8. > Endosperm  <   containing          >  do.          do.     90   %.
9./            \  Farinaccous Matter  /
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ANATOMICAL STRUCTURE AND CHEMICAL COMPOSITION OF WHEAT

The figure represents the longitudinal cut of a grain of wheat; it was made by taking, with the aid of the microscope and of photography, the drawing of a large quantity of fragments, which, joined together at last, produced the figure of the entire cut. These multiplied results were necessary to appreciate the insertion of the teguments and their nature in every part of the berry; in this long and difficult work I have been aided by the co-operation of Mr. Bertsch, who, as is known, has discovered a means of fixing rapidly by photography any image from the microscope. I must state, in the first place, that even in 1837 Mr. Payen studied and published the structure and the composition of a fragment of a grain of wheat; that this learned chemist, whose authority in such matters is known, perfectly described the envelopes or coverings, and indicated the presence of various immediate principles (especially of azote, fatty and mineral substances which fill up the range of contiguous cells between them and the periphery of the perisperm, to the exclusion of the gluten and the starchy granules), as well as to the mode of insertion of the granules of starch in the gluten contained in the cells, with narrow divisions from the perisperm, and in such a manner that up to the point of working indicated by the figure 1 this study was complete. However, I have been obliged to recommence it, to study the special facts bearing on the alimentary question, and I must say that all the results obtained by Mr. Bertsch, Mr. Trécul, and myself agree with those given by Mr. Payen.

ENVELOPES OF THE BERRY

No. 1 represents a superficial side of the crease.

No. 2 indicates the epidermis or cuticle. This covering is extremely light, and offers nothing remarkable; 100 lb. of wheat contain ½ lb. of it.

No. 3 indicates the epicarp. This envelope is distinguished by a double row of long and pointed vessels; it is, like the first one, very light and without action; 100 lb. of wheat contain 1 lb. of it.

No. 4 represents the endocarp, or last tegument of the berry; the sarcocarp, which should be found between the numbers 2 and 3, no longer exists, having been absorbed. The endocarp is remarkable by its row of round and regular cells, which appear in the cut like a continuous string of beads; 100 lb. of wheat contain 1½ lb. of it.

These three envelopes are colorless, light, and spongy; their elementary composition is that of straw; they are easily removed besides with the aid of damp and friction. This property has given rise to an operation called decortication, the results of which we shall examine later on from an industrial point of view. The whole of the envelopes of the berry of wheat amount to 3 lb. in 100 lb. of wheat.

ENVELOPES AND TISSUES OF THE BERRY PROPER

No. 5 indicates the testa or episperm. This external tegument of the berry is closer than the preceding ones; it contains in the very small cells two coloring matters, the one of a palish yellow, the other of an orange yellow, and according as the one or the other matter predominates, the wheat is of a more or less intense yellow color; hence come all the varieties of wheat known in commerce as white, reddish, or red wheats. Under this tegument is found a very thin, colorless membrane, which, with the testa or episperm, forms two per cent. of the weight of the wheat.

No. 6 indicates the embryous membrane, which is only an expansion of the germ or embryo No. 10. This membrane is seen purposely removed from its contiguous parts, so as to render more visible its form and insertions. Under this tissue is found with the Nos. 7, 8, and 9, the endosperm or perisperm, containing the gluten and the starch; soluble and insoluble albuminoids, that is to say, the flour.

The endosperm and the embryous membrane are the most interesting parts of the berry; the first is one of the depots of the plastic aliments, the second contains agents capable of dissolving these aliments during the germination, of determining their absorption in the digestive organs of animals, and of producing in the dough a decomposition strong enough to make dark bread. We shall proceed to examine separately these two parts of the berry.

ENDOSPERM OR FLOURY PORTION, NOS. 7, 8, 9

This portion is composed of large glutinous cells, in which the granules of starch are found. The composition of these different layers offers a particular interest; the center, No. 9, is the softest part; it contains the least gluten and the most starch; it is the part which first pulverizes under the stone, and gives, after the first bolting, the fine flour. As this flour is poorest in gluten, it makes a dough with little consistency, and incapable of making an open bread, well raised. The first layer, No. 8, which surrounds the center, produces small white middlings, harder and richer in gluten than the center; it bakes very well, and weighs 20 lb. in 100, and it is these 20 parts in 100 which, when mixed with the 50 parts in the center, form the finest quality flour, used for making white bread.

The layer No. 7, which surrounds the preceding one, is still harder and richer in gluten; unfortunately in the reduction it becomes mixed with some hundredth parts of the bran, which render it unsuitable for making bread of the finest quality; it produces in the regrinding lower grade and dark flours, together weighing 7 per cent. The external layer, naturally adhering to the membrane, No. 6, becomes mixed in the grinding with bran, to the extent of about 20 per cent., which renders it unsuitable even for making brown bread; it serves to form the regrindings and the offals destined for the nourishment of animals; this layer is, however, the hardest, and contains the largest quantity of gluten, and it is by consequence the most nutritive. We now see the endosperm increasing from the center, formed of floury layers, which augment in richness in gluten, in proportion as they are removed from the center. Now, as the flours make more bread in proportion to the quantity of gluten they contain, and the gluten gives more bread in proportion to its being more developed, or having more consistence, it follows that the flour belonging to the parts of the berry nearest the envelopes or coverings should produce the greatest portion of bread, and this is what takes place in effect. The product of the different layers of the endosperm is given below, and it will be seen that the quantity of bread increases in a proportion relatively greater than that of the gluten, which proves once more that the gluten of the center or last formation has less consistence than that of the other layers of older formation.

The following are the results obtained from the same wheat:

		Gluten.		Bread.
100 parts of flour in	center contain..	8	and produce	128
" "	first layer " ..	9,2	"	136
" "	second " " ..	11	"	140
" "	external " " ..	13	"	145

On the whole, it is seen, according to the composition of the floury part of the grain, that the berry contains on an average 90 parts in 100 of flour fit for making bread of the first quality, and that the inevitable mixing in of a small quantity of bran reduces these 90 to 70 parts with the ordinary processes; but the loss is not alone there, for the foregoing table shows that the best portion of the grain is rejected from the food of man that brown or dark bread is made of flour of very good quality, and that the first quality bread is made from the portion of the endosperm containing the gluten in the smallest quantity and in the least developed form.

This is a consideration not to be passed over lightly; assuredly the gluten of the center contains as much azote as the gluten of the circumference, but it must not be admitted in a general way that the alimentary power of a body is in connection with the amount of azote it contains, and without entering into considerations which would carry us too wide of the subject, we shall simply state that if the flesh of young animals, as, for instance, the calf, has a debilitating action, while the developed flesh of full-grown animals–of a heifer, for example–has really nourishing properties, although the flesh of each animal contains the same quantity of azote, we must conclude that the proportion of elements is not everything, and that the azotic or nitrogenous elements are more nourishing in proportion as they are more developed. This is why the gluten of the layers nearest the bran is of quite a special interest from the point of view of alimentation and in the preparation of bread.

THE EMBRYO AND THE COATING OF THE EMBRYO

To be intelligible, I must commence by some very brief remarks on the tissues of vegetables. There are two sorts distinguished among plants; some seem of no importance in the phenomena of nutrition; others, on the contrary, tend to the assimilation of the organic or inorganic components which should nourish and develop all the parts of the plant. The latter have a striking analogy with ferments; their composition is almost similar, and their action is increased or diminished by the same causes.

These tissues, formed in a state of repose in vegetables as in grain, have special properties; thus the berry possesses a pericarp whose tissues should remain foreign to the phenomena of germination, and these tissues show no particularity worthy of remark, but the coating of the embryo, which should play an active part, possesses, on the contrary, properties that may be compared to those of ferments. With regard to these ferments, I must further remark that I have not been able, nor am I yet able, to express in formula my opinion of the nature of these bodies, but little known as yet; I have only made use of the language mostly employed, without wishing to touch on questions raised by the effects of the presence, and by the more complex effects of living bodies, which exercise analogous actions.

With these reservations I shall proceed to examine the tissues in the berry which help toward the germination.

THE EMBRYO (10, see woodcut) is composed of the root of the plant, with which we have nothing to do here. This root of the plant which is to grow is embedded in a mass of cells full of fatty bodies. These bodies present this remarkable particularity, that they contain among their elements sulphur and phosphorus. When you dehydrate by alcohol 100 grammes of the embryo of wheat, obtained by the same means as the membrane (a process indicated later on), this embryo, treated with ether, produces 20 grammes of oils composed elementarily of hydrogen, oxygen, carbon, azote, sulphur, and phosphorus. This analysis, made according to the means indicated by M. Fremy, shows that the fatty bodies of the embryo are composed like those of the germ of an egg, like those of the brain and of the nervous system of animals. It is necessary for us to stop an instant at this fact: in the first place, because it proves that vegetables are designed to form the phosphoric as well as the nitrogenous and ternary aliments, and finally, because it indicates how important it is to mix the embryo and its dependents with the bread in the most complete manner possible, seeing that a large portion of these phosphoric bodies always become decomposed during the baking.

COATING OF THE EMBRYO.–This membrane (6), which is only an expansion of the embryo, surrounds the endosperm; it is composed of beautiful irregular cubic cells, diminishing according as they come nearer to the embryo. These cells are composed, first, of the insoluble cellular tissue; second, of phosphate of chalk and fatty phosphoric bodies; third, of soluble cerealine. In order to study the composition and the nature of this tissue, it must be completely isolated, and this result is obtained in the following manner.

The wheat should be damped with water containing 10 parts in 100 of alcoholized caustic soda; at the expiration of one hour the envelopes of the pericarp, and of the testa Nos. 2, 3, 4, 5, should be separated by friction in a coarse cloth, having been reduced by the action of the alkali to a pulpy state; each berry should then be opened separately to remove the portion of the envelope held in the fold of the crease, and then all the berries divided in two are put into three parts of water charged with one-hundredth of caustic potash. This liquid dissolves the gluten, divides the starch, and at the expiration of twenty-four hours the parts of the berries are kneaded between the fingers, collected in pure water, and washed until the water issues clear; these membranes with their embryos, which are often detached by this operation, are cast into water acidulated with one-hundredth of hydrochloric acid, and at the end of several hours they should be completely washed. The product obtained consists of beautiful white membranes, insoluble in alkalies and diluted acids, which show under the microscope beautiful cells joined in a tissue following the embryo, with which it has indeed a striking analogy in its properties and composition. This membrane, exhausted by the alcohol and ether, gives, by an elementary analysis, hydrogen, oxygen, carbon, and azote. Unfortunately, under the action of the tests this membrane has been killed, and it no longer possesses the special properties of active tissues. Among these properties three may be especially mentioned:

1st. Its resistance to water charged with a mineral salt, such as sea salt for instance

2d. Its action through its presence.

3d. Its action as a ferment.

The action of saltwater is explained as follows: When the berry is plunged into pure water it will be observed that the water penetrates in the course of a few hours to the very center of the endosperm, but if water charged or saturated with sea salt be used, it will be seen that the liquid immediately passes through the teguments Nos. 2, 3, 4, and 5, and stops abruptly before the embryo membrane No. 6, which will remain quite dry and brittle for several days, the berry remaining all the time in the water. Should the water penetrate further after several days, it can be ascertained that the entrance was gained through the part No 10 free of this tissue, and this notwithstanding the cells are full of fatty bodies. This membrane alone produces this action, for if the coatings Nos. 2, 3, 4, and 5 be removed, the resistance to the liquid remains the same, while if the whole, or a portion of it, be divided, either by friction between two millstones or by simple incisions, the liquid penetrates the berry within a few hours. This property is analogous to that of the radicules of roots, which take up the bodies most suitable for the nourishment of the plant. It proves, besides, that this membrane, like all those endowed with life, does not obey more the ordinary laws of permeability than those of chemical affinity, and this property can be turned to advantage in the preservation of grain in decortication and grinding.

To determine the action of this tissue through its presence, take 100 grammes of wheat, wash it and remove the first coating by decortication; then immerse it for several hours in lukewarm water, and dry afterwards in an ordinary temperature. It should then be reduced in a small coffee mill, the flour and middlings separated by sifting and the bran repassed through a machine that will crush it without breaking it; then dress it again, and repeat the operation six times at least. The bran now obtained is composed of the embryous membrane, a little flour adhering to it, and some traces of the teguments Nos. 2, 3, 4, and 5. This coarse tissue-weighs about 14 grammes, and to determine its action through its presence, place it in 200 grammes of water at a temperature of 86°; afterwards press it. The liquid that escapes contains chiefly the flour and cerealine. Filter this liquid, and put it in a test glass marked No. 1, which will serve to determine the action of the cerealine.

The bran should now be washed until the water issues pure, and until it shows no bluish color when iodized water and sulphuric acid are added; when the washing is finished the bran swollen by the water is placed under a press, and the liquid extracted is placed, after being filtered, in a test tube. This test tube serves to show that all cerealine has been removed from the blades of the tissue. Finally, these small blades of bran, washed and pressed, are cast, with 50 grammes of lukewarm water, into a test tube, marked No. 3; 100 grammes of diluted starch to one-tenth of dry starch are then added in each test tube, and they are put into a water bath at a temperature of 104° Fahrenheit, being stirred lightly every fifteen minutes. At the expiration of an hour, or at the most an hour and a half, No. 1 glass no longer contains any starch, as it has been converted into dextrine and glucose by the cerealine, and the iodized water only produces a purple color. No. 2 glass, with the same addition, produces a bluish color, and preserves the starch intact, which proves that the bran was well freed from the cerealine contained. No. 3 glass, like No. 1, shows a purple coloring, and the liquid only contains, in place of the starch, dextrine and glucose, *i. e*, the tissue has had the same action as the cerealine deprived of the tissue, and the cerealine as the tissue freed from cerealine. The same membrane rewashed can again transform the diluted starch several times. This action is due to the presence of the embryous membrane, for after four consecutive operations it still preserves its original weight.

As regards the remains of the other segments, they have no influence on this phenomenon, for the coating Nos. 2, 3, 4, and 5, separated by the water and friction, have no action whatever on the diluted starch. Besides its action through its presence, which is immediate, the embryous membrane may also act as a ferment, active only after a development, varying in duration according to the conditions of temperature and the presence or absence of ferments in acting.

I make a distinction here as is seen, between the action through being present, and the action of real ferments, but it is not my intention to approve or disapprove of the different opinions expressed on this subject. I make use of these expressions only to explain more clearly the phenomena I have to speak of, for it is our duty to bear in mind that the real ferments only act after a longer or shorter period of development, while, on the other hand, the effects through presence are immediate.

I now return to the embryous membrane. Various causes increase or decrease the action of this tissue, but it may be said in general that all the agents that kill the embryous membrane will also kill the cerealine. This was the reason why I at first attributed the production of dark bread exclusively to the latter ferment, but it was easy to observe that during the baking, decompositions resulted at over 158° Fah., while the cerealine was still coagulated, and that bread containing bran, submitted to 212° of heat, became liquefied in water at 104°. It was now easy to determine that dark flours, from which the cerealine had been removed by repeated washings, still produced dark bread. It was at this time, in remembering my experiences with organic bodies, I determined the properties of the insoluble tissue, deprived of the soluble cerealine, with analogous properties, but distinguished not alone by its solid organization and state of insolubility, but also by its resistance to heat, which acts as on yeast. There exists, in reality, I repeat, a resemblance between the embryous membrane and the yeast; they have the same immediate composition; they are destroyed by the same poisons, deadened by the same temperatures, annihilated by the same agents, propagated in an analogous manner, and it might be said that the organic tissues endowed with life are only an agglomeration of fixed cells of ferments. At all events, when the blades of the embryous membrane, prepared as already stated, are exposed to a water bath at 212°, this tissue, in contact with the diluted starch, produces the same decomposition; the contact, however, should continue two or three hours in place of one. If, instead of placing these membranes in the water bath, they are enveloped in two pounds of dough, and this dough put in the oven, after the baking the washed membranes produce the same results, which especially proves that this membrane can support a temperature of 212° Fah. without disorganization. We shall refer to this property in speaking of the phenomena of panification.

CEREALINE.–The cells composing the embryous membrane contain, as already stated, the cerealine, but after the germination they contain cerealine and diastase, that is to say, a portion of the cerealine changed into diastase, with which it has the greatest analogy. It is known how difficult it is to isolate and study albuminous substances. The following is the method of obtaining and studying cerealine. Take the raw embryous membrane, prepared as stated, steep it for an hour in spirits of wine diluted with twice its volume of water, and renew this liquid several times until the dextrine, glucose, coloring matters, etc., have been completely removed. The membranes should now be pressed and cast into a quantity of water sufficient to make a fluid paste of them, squeeze out the mixture, filter the liquid obtained, and this liquid will contain the cerealine sufficiently pure to be studied in its effects. Its principal properties are: The liquid evaporated at a low temperature produces an amorphous, rough mass nearly colorless, and almost entirely soluble in distilled water; this solution coagulates between 158° and 167° Fah., and the coagulum is insoluble in acids and weak alkalies; the solution is precipitated by all diluted acids, by phosphoric acid at all the degrees of hydration, and even by a current of carbonic acid. All these precipitates redissolve with an excess of acid, sulphuric acid excepted. Concentrated sulphuric acid forms an insoluble downy white precipitate, and the concentrated vegetable acids, with the exception of tannic acid, do not determine any precipitate. Cerealine coagulated by an acid redissolves in an excess of the same acid, but it has become dead and has no more action on the starch. The alkalies do not form any precipitate, but they kill the cerealine as if it had been precipitated The neutral rennet does not make any precipitate in a solution of cerealine–5 centigrammes of dry cerealine transform in twenty-five minutes 10 grammes of starch, reduced to a paste by 100 grammes of water at 113° Fah. It will be seen that cerealine has a grand analogy with albumen and legumine, but it is distinguished from them by the action of the rennet, of the heat of acids, alcohol, and above all by its property of transforming the starch into glucose and dextrine.

It may be said that some albuminous substances have this property, but it must be borne in mind that these bodies, like gluten, for example, only possess it after the commencement of the decomposition. The albuminous matter approaching nearest to cerealine is the diastase, for it is only a transformation of the cerealine during the germination, the proof of which may be had in analyzing the embryous membrane, which shows more diastase and less cerealine in proportion to the advancement of the germination: it differs, however, from the diastase by the action of heat, alcohol, etc. It is seen that in every case the cerealine and the embryous membrane act together, and in an analogous manner; we shall shortly examine their effects on the digestion and in the phenomena of panification.

PHOSPHATE OF CALCIUM.–Mr. Payen was the first to make the observation that the greatest amount of phosphate of chalk is found in the teguments adjoining the farinaceous or floury mass. This observation is important from two points of view; in the first place, it shows us that this mineral aliment, necessary to the life of animals, is rejected from ordinary bread; and in the next place, it brings a new proof that phosphate of chalk is found, and ought to be found, in everyplace where there are membranes susceptible of exercising vital functions among animals as well as vegetables.

Phosphate of chalk is not in reality (as I wished to prove in another work) a plastic matter suitable for forming bones, for the bones of infants are three times more solid than those of old men, which contain three times as much of it. The quantity of phosphate of chalk necessary to the constitution of animals is in proportion to the temperature of those animals, and often in the inverse ratio of the weight of their bones, for vegetables, although they have no bones, require phosphate of chalk. This is because this salt is the natural stimulant of living membranes, and the bony tissue is only a depot of phosphate of chalk, analogous to the adipose tissue, the fat of which is absorbed when the alimentation coming from the exterior becomes insufficient. Now, as we know all the parts constituting the berry of wheat, it will be easy to explain the phenomena of panification, and to conclude from the present moment that it is not indifferent to reject from the bread this embryous membrane where the agents of digestion are found, viz., the phosphoric bodies and the phosphate of chalk.

THE ORIGIN OF NEW PROCESS MILLING

The following article was written by Albert Hoppin, editor of the *Northwestern Miller*, at the request of Special Agent Chas. W. Johnson, and forms a part of his report to the census bureau on the manufacturing industries of Minneapolis.

"The development of the milling industry in this city has been so intimately connected with the growth and prosperity of the city itself, that the steps by which the art of milling has reached its present high state of perfection are worthy of note, especially as Minneapolis may rightly claim the honor of having brought the improvements, which have within the last decade so thoroughly revolutionized the art of making flour, first into public notice, and of having contributed the largest share of capital and inventive skill to their full development. So much is this the case that the cluster of mills around the Falls of St. Anthony is to-day looked upon as the head-center of the milling industry not only of this country, but of the world. An exception to this broad statement may possibly be made in favor of the city of Buda Pest, in Austro-Hungary, from the leading mills in which the millers in this country have obtained many valuable ideas. To the credit of American millers and millwrights it must, however, be said that they have in all cases improved upon the information they have thus obtained.

"To rightly understand the change that has taken place in milling methods during the last ten years, it is necessary to compare the old way with the new, and to observe wherein they differ. From the days of Oliver Evans, the first American mechanic to make any improvement in milling machinery, until 1870, there was, if we may except some grain cleaning or smut machines, no very strongly marked advance in milling machinery or in the methods of manufacturing flour. It is true that the reel covered with finely-woven silk bolting cloth had taken the place of the muslin or woolen covered hand sieve, and that the old granite millstones have given place to the French burr; but these did not affect the essential parts of the *modus operandi*, although the quality of the product was, no doubt, materially improved. The processes employed in all the mills in the United States ten years ago were identical, or very nearly so, with those in use in the Brandywine Mills in Evans's day. They were very simple, and may be divided into two distinct operations.

"First. Grinding (literally) the wheat.

"Second. Bolting or separating the flour or interior portion of the berry from the outer husk, or bran. It may seem to some a rash assertion, but this primitive way of making flour is still in vogue in over one-half of the mills of the United States. This does not, however, affect the truth of the statement that the greater part of the flour now made in this country is made on an entirely different and vastly-improved system, which has come to be known to the trade as the new process.

"In looking for a reason for the sudden activity and spirit of progress which had its culmination in the new process, the character of the wheat raised in the different sections of the Union must be taken into consideration. Wheat may be divided into two classes, spring and winter, the latter generally being more starchy and easily pulverized, and at the same time having a very tough bran or husk, which does not readily crumble or cut to pieces in the process of grinding. It was with this wheat that the mills of the country had chiefly to do, and the defects of the old system of milling were not then so apparent. With the settlement of Minnesota, and the development of its capacities as a wheat-growing State, a new factor in the milling problem was introduced, which for a time bid fair to ruin every miller who undertook to solve it. The wheat raised in this State was, from the climatic conditions, a spring wheat, hard in structure and having a thin, tender, and friable bran. In milling this wheat, if an attempt was made to grind it as fine as was then customary to grind winter wheat, the bran was ground almost as fine as the flour, and passed as readily through the meshes of the bolting reels or sieves, rendering the flour dark, specky, and altogether unfit to enter the Eastern markets in competition with flour from the winter wheat sections. On the other hand, if the grinding was not so fine as to break up the bran, the interior of the berry being harder to pulverize, was not rendered sufficiently fine, and there remained after the flour was bolted out a large percentage of shorts or middlings, which, while containing the strongest and best flour in the berry, were so full of dirt and impurities as to render them unfit for any further grinding except for the very lowest grade of flour, technically known as 'red dog.' The flour produced from the first grinding was also more or less specky and discolored, and, in everything but strength, inferior to that made from winter wheat, while the 'yield' was so small, or, in other words, the amount of wheat which it took to make a barrel of flour was so large, that milling in Minnesota and other spring wheat sections was anything but profitable.

"The problem which ten years since confronted the millers of this city was how to obtain from the wheat which they had to grind a white, clear flour, and to so increase the yield as to leave some margin for profit. The first step in the solution of this problem was the invention by E. N. La Croix of the machine which has since been called the purifier, which removed the dirt and light impurities from the refuse middlings in the same manner that dust and chaff are removed from wheat by a fanning mill. The middlings thus purified were then reground, and the result was a much whiter and cleaner flour than it had been possible to obtain under the old process of low close grinding. This flour was called 'patent' or 'fancy,' and at once took a high position in the market. The first machine built by La Croix was immediately improved by George T. Smith, and has since then been the subject of numberless variations, changes, and improvements; and over the principles embodied in its construction there has been fought one of the longest and most bitter battles recorded in the annals of patent litigation in this country. The purifier is to-day the most important machine in use in the manufacture of flour in this country, and may with propriety be called the corner-stone of new process milling. The earliest experiments in its use in this country were made in what was then known as the 'big mill' in this city, owned by Washburn, Stephens & Co., and now known as the Washburn Mill B.

"The next step in the development of the new process, also originating in Minneapolis, was the abandonment of the old system of cracking the millstone, and substituting in its stead the use of smooth surfaces on the millstones, thus in a large measure doing away with the abrasion of the bran, and raising the quality of the flour produced at the first grinding. So far as we know, Mr. E. R. Stephens, a Minneapolis miller, then employed in the mill owned by Messrs. Pillsbury, Crocker & Fish, and now a member of the prominent milling firm of Freeman & Stephens, River Falls, Wisconsin, was the first to venture on this innovation. He also first practiced the widening of the furrows in the millstones and increasing their number, thus adding largely to the amount of middlings made at the first grinding, and raising the percentage of patent flour. He was warmly supported by Amasa K. Ostrander, since deceased, the founder and for a number of years the editor of the *North-Western Miller*, a trade newspaper. The new ideas were for a time vigorously combated by the millers, but their worth was so plain that they were soon adopted, not only in Minneapolis, but by progressive millers throughout the country. The truth was the 'new process' in its entirety, which may be summarized in four steps–first, grinding or, more properly, granulating the berry; second, bolting or separating the 'chop' or meal into first flour, middlings, and bran; third, purifying the middlings, fourth, regrinding and rebolting the middlings to produce the higher grade, or 'patent' flour. This higher grade flour drove the best winter wheat flours out of the Eastern markets, and placed milling in Minnesota upon a firm basis. The development of the 'new process' cannot be claimed by any one man. Hundreds of millers all over the country have contributed to its advance, but the millers of Minneapolis have always taken the lead.

"Within the past two or three years what may be distinctively called the 'new process' has, in the mills of Minneapolis and some few other leading mills in the country, been giving place to a new system, or rather, a refinement of the processes above described. This latest system is known to the trade as the 'gradual reduction' or high-grinding system, as the 'new process' is the medium high-grinding system, and the old way is the low or close grinding system. In using the gradual reduction in making flour the millstones are abandoned, except for finishing some of the inferior grades of flour, and the work is done by means of grooved and plain rollers, made of chilled iron or porcelain. In some cases disks of chilled iron, suitably furrowed, are used, and in others concave mills, consisting of a cylinder running against a concave plate. In Minneapolis the chilled iron rolls take the precedence of all other means.

"The system of gradual reduction is much more complicated than either of those which preceded it; but the results obtained are a marked advance over the 'new process.' The percentage of high-grade flour is increased, several grades of different degrees of excellence being produced, and the yield is also greater from a given quantity of wheat. The system consists in reducing the wheat to flour, not at one operation, as in the old system, nor in two grindings, as in the 'new process,' but in several successive reductions, four, five, or six, as the case may be. The wheat is first passed through a pair of corrugated chilled iron rollers, which merely split it open along the crease of the berry, liberating the dirt which lies in the crease so that it can be removed by bolting. A very small percentage of low-grade flour is also made in this reduction. After passing through what is technically called a 'scalping reel' to remove the dirt and flour, the broken wheat is passed through a second set of corrugated rollers, by which it is further broken up, and then passes through a second separating reel, which removes the flour and middlings. This operation is repeated successively until the flour portion of the berry is entirely removed from the bran, the necessary separation being made after each reduction. The middlings from the several reductions are passed through the purifiers, and, after being purified, are reduced to flour by successive reductions on smooth iron or porcelain rollers. In some cases, as stated above, iron disks and concave mills are substituted for the roller mill, but the operation is substantially the same. One of the principal objects sought to be attained by this high-grinding system is to avoid all abrasion of the bran, another is to take out the dirt in the crease of the berry at the beginning of the process, and still another to thoroughly free the bran from flour, so as to obtain as large a yield as possible. Incidental to the improved methods of milling, as now practiced in this country, is a marked improvement in the cleaning of the grain and preparing it for flouring. The earliest grain-cleaning machine was the 'smutter,' the office of which was to break the smut balls, and scour the outside of the bran to remove any adhering dust, the scouring machine being too harsh in its action, breaking the kernels of wheat, and so scratching and weakening the bran that it broke up readily in the grinding. The scouring process was therefore lessened, and was followed by brush machines, which brushed the dirt, loosened up and left by the scourer, from the berry. Other machines for removing the fuzzy and germ ends of the berry have also been introduced, and everything possible is done to free the grain from extraneous impurities before the process of reduction is commenced. In all the minor details of the mill there has been the same marked change, until the modern merchant mill of to-day no more resembles that of twenty-five years ago than does the modern cotton mill the old-fashioned distaff. The change has extended into the winter wheat sections, and no mill in the United States can hope to hold its place in the markets unless it is provided with the many improvements in machinery and processes which have resulted from the experiments begun in this city only ten years since, and which have made the name of Minneapolis and the products of her many mills famous throughout the world. The relative merits of the flour made by the new process and the old have been warmly discussed, but the general verdict of the great body of consumers is that the patent or new process flour is better in every way for bread making purposes, being clearer, whiter, more evenly granulated, and possessing more strength. Careful chemical analysis has confirmed this. As between winter and spring wheat flours made by the new process and gradual reduction systems, it maybe remarked that the former contain more starch and are whiter in color, while the latter, having more gluten, excel in strength. In milling all varieties of wheat, whether winter or spring, the new processes are in every way superior to the old, and, in aiding their inception and development, the millers of Minneapolis have conferred a lasting benefit on the country.

"Minneapolis, Minn., December 1, 1880."

THE MILLING STRUCTURES AND MACHINERY

Mr. Johnson added the following, showing the present status of the milling industry in Minneapolis:

"The description of the process of the manufacture of flour so well given above, conveys no idea of the extent and magnitude of the milling structures, machinery, and buildings employed in the business. Many of the leading millers and millwrights have personally visited and studied the best mills in England, France, Hungary, and Germany, and are as familiar with their theory, methods, and construction as of their own, and no expense or labor has been spared in introducing the most approved features of the improvements in the foreign mills. Experimenting is constantly going on, and the path behind the successful millers is strewn with the wrecks of failures. A very large proportion of the machinery is imported, though the American machinists are fast outstripping their European rivals in the quality and efficiency of the machinery needed for the new mills constantly going up.

"There are twenty-eight of these mills now constructed and at work, operating an equivalent of 412 runs of stone, consuming over sixteen million bushels of wheat, and manufacturing over three million barrels of flour annually. Their capacities range from 250 to 1,500 barrels of flour per day. Great as these capacities are, there is now one in process of construction, the Pillsbury A Mill, which at the beginning of the harvest of 1881 will have a capacity of 4,000 barrels daily. The Washburn A Mill, whose capacity is now 1,500 barrels, is being enlarged to make 8,500 barrels a day, and the Crown Roller Mill, owned by Christian Bros. & Co., is also being enlarged to produce 3,000 barrels a day. The largest mill in Europe has a daily capacity of but 2,800 barrels, and no European mill is fitted with the exquisite perfection of machinery and apparatus to be found in the mills of this city.

"The buildings are mainly built of blue limestone, found so abundant in the quarries of this city, range and line work, and rest on the solid ledge. The earlier built mills are severely plain, but the newer ones are greatly improved by the taste of the architect, and are imposing and beautiful in appearance."

DIRECT FOREIGN TRADE

The flour of Minneapolis, holding so high a rank in the markets of the world, is always in active demand, especially the best grades, and brings from $1.00 to $1.60 per barrel more than flour of the best qualities of southern, eastern, or foreign wheat. During the year nearly a million barrels were shipped direct to European and other foreign ports, on through bills of lading, and drawn for by banks here having special foreign exchange arrangements, at sight, on the day of shipment. This trade is constantly increasing, and the amount of flour handled by eastern commission men is decreasing in proportion.

Referring to the foregoing, the following letter from Mr. Geo. T. Smith to the editor of the *London Miller* is of interest:

SIR: I find published in the *North-western Miller* of December 24, 1880, extracts from an article on the origin of new process milling, prepared by Albert Hoppin, Esq., editor of the above-named journal, for the use of one of the statistical divisions of the United States census, which is so at variance, in at least one important particular, with the facts set forth in the paper read by me before the British and Irish millers, at their meeting in May last, that I think I ought to take notice of its statements, more especially as the *North-Western Miller* has quite a circulation on this side of the water.

As stated in the paper read by me above-mentioned, I was engaged in February, 1871, by Mr. Christian, who was then operating the "big," or Washburn Mill at Minneapolis, to take charge of the stones in that mill. At this time Mr. Christian was very much interested in the improvement of the quality of his flour, which in common with the flour of Minneapolis mills, without exception, was very poor indeed. For some time previous to this I had insisted to him most strenuously that the beginning of any improvement must be found in smooth, true, and well balanced stones, and it was because he was at last convinced that my ideas were at least worthy of a practical test I was placed in charge of his mill. Nearly two months were consumed in truing and smoothing the stone, as all millers in the mill had struck at once when they became acquainted with the character of the changes I proposed to make.

I remained with Mr. Christian until the latter part of 1871, in all about eight months. During this time the flour from the Washburn Mill attained a celebrity that made it known and sought after all over the United States. It commanded attention as an event of the very greatest importance, from the fact that it was justly felt that if a mill grinding spring wheat exclusively was capable of producing a flour infinitely superior in every way to the best that could be made from the finest varieties of winter wheats, the new North Western territory, with its peculiar adaptation to the growing of spring grain, and its boundless capacity for production, must at once become one of the most important sections of the country.

Mr. Christian's appreciation of the improvements I had made in his mill was attested by doubly-locked and guarded entrances, and by the stringent regulations which were adopted to prevent any of his employes carrying information with regard to the process to his competitors.

All this time other Minneapolis mills were doing such work and only such as they had done previously. Ought not the writer of an article on the origin of new process milling–which article is intended to become historical, and to have its authenticity indorsed by the government–to have known whether Mr. Christian, in the Washburn Mill, did or did not make a grade of flour which has hardly been excelled since for months before any other Minneapolis mill approached his product in any degree? And should he not be well enough acquainted with the milling of that period–1871-2–to know that such results as were obtained in the Washburn Mill could only be secured by the use of *smooth* and *true* stones? Mr. Stephens–whom I shall mention again presently–did *not* work in the Washburn Mill while I was in charge of it.

In the fall of 1871 I entered into a contract with Mr. C. A. Pillsbury, owner of the Taylor Mill and senior partner in the firm by whom the Minneapolis Mill was operated, to put both those mills into condition to make the same grade of flour as Mr. Christian was making. The consideration in the contract was 5,000 dols. At the above mills I met to some extent the same obstruction in regard to millers striking as had greeted me at Mr. Christian's mill earlier in the year; but among those who did not strike at the Minneapolis Mill I saw, for the first time, Mr. Stephens–then still in his apprenticeship–whom Mr. Hoppin declares to have been, "so far as I know," the first miller to use smooth stones. If Mr. Hoppin is right in his assertion, perhaps he will explain why, during the eight months I was at the Washburn Mill, Mr. Stephens did not make a corresponding improvement in the product of the Minneapolis Mill. That he did not do this is amply proved by the fact of Mr. Pillsbury giving me 5,000 dols. to introduce improvements into his mills, when, supposing Mr. Hoppin's statement to be correct, he might have had the same alterations carried out under Mr. Stephens' direction at a mere nominal cost. As a matter of fact, the stones in both the Taylor and Minneapolis Mills were as rough as any in the Washburn Mill when I took charge of them.

Thus it appears (1) that the flour made by the mill in which Stephens was employed was not improved in quality, while that of the Washburn Mill, where he was not employed, became the finest that had ever been made in the United States at that time. That (2) the owner of the mill in which Mr. Stephens was employed, as he was not making good flour, engaged me at a large cost to introduce into his mills the alterations by which only, both Mr. Hoppin and myself agree, could any material improvement in the milling of that period be effected, .viz., smooth, true, and well-balanced stones.–GEO. T. SMITH.

For breachy animals do not use barbed fences. To see the lacerations that these fences have produced upon the innocent animals should be sufficient testimony against them. Many use pokes and blinders on cattle and goats, but as a rule such things fail. The better way is to separate breachy animals from the lot, as others will imitate their habits sooner or later, and then, if not curable, *sell them*.

THE GUENON MILK-MIRROR

The name of the simple Bordeaux peasant is, and should be, permanently associated with his discovery that the milking qualities of cows were, to a considerable extent, indicated by certain external marks easily observed. We had long known that capacious udders and large milk veins, combined with good digestive capacity and a general preponderance of the alimentary over the locomotive system, were indications that rarely misled in regard to the ability of a cow to give much milk; but to judge of the amount of milk a cow would yield, and the length of time she would hold out in her flow, two or three years before she could be called a cow–this was Guenon's great accomplishment, and the one for which he was awarded a gold medal by the Agricultural Society of his native district. This was the first of many honors with which he was rewarded, and it is much to say that no committee of agriculturists who have ever investigated the merits of the system have ever spoken disparagingly of it. Those who most closely study it, especially following Guenon's original system, which has never been essentially improved upon, are most positive in regard to its truth, enthusiastic in regard to its value.

The fine, soft hair upon the hinder part of a cow's udder for the most part turns upward. This upward-growing hair extends in most cases all over that part of the udder visible between the hind legs, but is occasionally marked by spots or mere lines, usually slender ovals, in which the hair grows down. This tendency of the hair to grow upward is not confined to the udder proper; but extends out upon the thighs and upward to the tail. The edges of this space over which the hair turns up are usually distinctly marked, and, as a rule, the larger the area of this space, which is called the "mirror" or "escutcheon," the more milk the cow will give, and the longer she will continue in milk.

ESCUTCHEON OF THE JERSEY BULL-CALF, GRAND MIRROR, 4,904.

That portion of the escutcheon which covers the udder and extends out on the inside of each thigh, has been designated as the udder or mammary mirror; that which runs upward towards the setting on of the tail, the rising or placental mirror. The mammary mirror is of the greater value, yet the rising mirror is not to be disregarded. It is regarded of especial moment that the mirror, taken as a whole, be symmetrical, and especially that the mammary mirror be so; yet it often occurs that it is far otherwise, its outline being often very fantastical–exhibiting deep *bays*, so to speak, and islands of downward growing hair. There are also certain "ovals," never very large, yet distinct, which do not detract from the estimated value of an escutcheon; notably those occurring on the lobes of the udder just above the hind teats. These are supposed to be points of value, though for what reason it would be hard to tell, yet they do occur upon some of the very best milch cows, and those whose mirrors correspond most closely to their performances.

Mr. Guenon's discovery enables breeders to determine which of their calves are most promising, and in purchasing young stock it affords indications which rarely fail as to their comparative milk yield. These indications occasionally prove utterly fallacious, and Mr. Guenon gives rules for determining this class, which he calls "bastards," without waiting for them to fail in their milk. The signs are, however, rarely so distinct that one would be willing to sell a twenty-quart cow, whose yield confirmed the prediction of her mirror at first calving, because of the possibility of the going dry in two months, or so, as indicated by her bastardy marks.

It is an interesting fact that the mirrors of bulls (which are much like those of cows, but less extensive in every direction) are reflected in their daughters. This gives rise to the dangerous custom of breeding for mirrors, rather than for milk. What the results may be after a few years it is easy to see. The mirror, being valued for its own sake–that is, because it sells the heifers–will be likely to lose its practical significance and value as a *milk* mirror.

We have a striking photograph of a young Jersey bull, the property of Mr. John L. Hopkins, of Atlanta, Ga., and called "Grand Mirror." This we have caused to be engraved and the mirror is clearly shown. A larger mirror is rarely seen upon a bull. We hope in a future number to exhibit some cows' mirrors of different forms and degrees of excellence.–*Rural New Yorker*.

TWO GOOD LAWN TREES

The negundo, or ash-leaved maple, as it is called in the Eastern States, better known at the West as a box elder, is a tree that is not known as extensively as it deserves. It is a hard maple, that grows as rapidly as the soft maple; is hardy, possesses a beautiful foliage of black green leaves, and is symmetrical in shape. Through eastern Iowa I found it growing wild, and a favorite tree with the early settlers, who wanted something that gave shade and protection to their homes quickly on their prairie farms. Brought east, its growth is rapid, and it loses none of the characteristics it possessed in its western home. Those who have planted it are well pleased with it. It is a tree that transplants easily, and I know of no reason why it should not be more popular.

For ornamental lawn planting, I give pre-eminence to the cut-leaf weeping birch. Possessing all the good qualities of the white birch, it combines with them a beauty and delicate grace yielded by no other tree. It is an upright grower, with slender, drooping branches, adorned with leaves of deep rich green, each leaf being delicately cut, as with a knife, into semi-skeletons. It holds its foliage and color till quite late in the fall. The bark, with age, becomes white, resembling the white birch, and the beauty of the tree increases with its age. It is a free grower, and requires no trimming. Nature has given it a symmetry which art cannot improve.

H.T.J.

CUTTING SODS FOR LAWNS

I am a very good sod layer, and used to lay very large lawns–half to three-quarters of an acre. I cut the sods as follows: Take a board eight to nine inches wide, four, five, or six feet long, and cut downward all around the board, then turn the board over and cut again alongside the edge of the board, and so on as many sods as needed. Then cut the turf with a sharp spade, all the same lengths. Begin on one end, and roll together. Eight inches by five feet is about as much as a man can handle conveniently. It is very easy to load them on a wagon, cart, or barrow, and they can be quickly laid. After laying a good piece, sprinkle a little with a watering pot, if the sods are dry; then use the back of the spade to smooth them a little. If a very fine effect is wanted, throw a shovelful or two of good earth over each square yard, and smooth it with the back of a steel rake.

F.H.

[COUNTRY GENTLEMAN.]

HORTICULTURAL NOTES

The Western New York Society met at Rochester, January 26.

New Apples, Pears, Grapes, etc.--Wm. C Barry, secretary of the committee on native fruits, read a full report. Among the older varieties of the apple, he strongly recommended Button Beauty, which had proved so excellent in Massachusetts, and which had been equally successful at the Mount Hope Nurseries at Rochester; the fine growth of the tree and its great productiveness being strongly in its favor. The Wagener and Northern Spy are among the finer sorts. The Melon is one of the best among the older sorts; the fruit being quite tender will not bear long shipment, but it possesses great value for home use, and being a poor grower, it had been thrown aside by nurserymen and orchardists. It should be top-grafted on more vigorous sorts. The Jonathan is another fine sort of slender growth, which should be top-grafted.

Among new pears, Hoosic and Frederic Clapp were highly commended for their excellence. Some of the older peaches of fine quality had of late been neglected, and among them Druid Hill and Brevoort.

Among the many new peaches highly recommended for their early ripening, there was great resemblance to each other, and some had proved earlier than Alexander.

Of the new grapes, Lady Washington was the most promising. The Secretary was a failure. The Jefferson was a fine sort, of high promise.

Among the new white grapes, Niagara, Prentiss, and Duchess stood pre-eminent, and were worthy of the attention of cultivators. The Vergennes, from Vermont, a light amber colored sort, was also highly commended. The Elvira, so highly valued in Missouri, does not succeed well here. Several facts were stated in relation to the Delaware grape, showing its reliability and excellence.

Several new varieties of the raspberry were named, but few of them were found equal to the best old sorts. If Brinckle's Orange were taken as a standard for quality, it would show that none had proved its equal in fine quality. The Caroline was like it in color, but inferior in flavor. The New Rochelle was of second quality. Turner was a good berry, but too soft for distant carriage.

Of the many new strawberries named, each seemed to have some special drawback. The Bidwell, however, was a new sort of particular excellence, and Charles Downing thinks it the most promising of the new berries.

Discussion on Grapes.--C. W. Beadle, of Ontario, in allusion to Moore's Early grape, finds it much earlier than the Concord, and equal to it in quality, ripening even before the Hartford. S. D. Willard, of Geneva, thought it inferior to the Concord, and not nearly so good as the Worden. The last named was both earlier and better than the Concord, and sold for seven cents per pound when the Concord brought only four cents. C. A. Green, of Monroe County, said the Lady Washington proved to be a very fine grape, slightly later than Concord. P. L. Perry, of Canandaigua, said that the Vergennes ripens with Hartford, and possesses remarkable keeping qualities, and is of excellent quality and free from pulp. He presented specimens which had been kept in good condition. He added, in relation to the Worden grape, that some years ago it brought 18 cents per pound in New York when the Concord sold three days later for only 8 cents. [In such comparisons, however, it should be borne in mind that new varieties usually receive more attention and better culture, giving them an additional advantage.]

The Niagara grape received special attention from members. A. C. Younglove, of Yates County, thought it superior to any other white grape for its many good qualities. It was a vigorous and healthy grower, and the clusters were full and handsome. W. J. Fowler, of Monroe County, saw the vine in October, with the leaves still hanging well, a great bearer and the grape of fine quality. C. L. Hoag, of Lockport, said he began to pick the Niagara on the 26th of August, but its quality improved by hanging on the vine. J. Harris, of Niagara County, was well acquainted with the Niagara, and indorsed all the commendation which had been uttered in its favor. T. C. Maxwell said there was one fault–we could not get it, as it was not in market. W. C. Barry, of Rochester, spoke highly of the Niagara, and its slight foxiness would be no objection to those who like that peculiarity. C. L. Hoag thought this was the same quality that Col. Wilder described as "a little aromatic." A. C. Younglove found the Niagara to ripen with the Delaware. Inquiry being made relative to the Pockington grape, H. E. Hooker said it ripened as early as the Concord. C. A. Green was surprised that it had not attracted more attention, as he regarded it as a very promising grape. J. Charlton, of Rochester, said that the fruit had been cut for market on the 29th of August, and on the 6th of September it was fully ripe; but he has known it to hang as late as November. J. S. Stone had found that when it hung as late as November it became sweet and very rich in flavor.

Конец ознакомительного фрагмента.