LETTERS TO THE EDITOR.

***Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Unconscious Bias in Walking.

THE question is again raised as to the cause of the deviations from a right line in walking with the eyes closed, or in the dark, in the letter to the editor with the caption "Is Man Left-Legged" (*Science*, xiv. p. 412). Several theories have been advanced to account for the frequently observed phenomena referred to, which may be briefly stated as follows: —

1. The legs are not of equal strength, and the strongest outwalks the other, making a curve to the opposite side.

2. The relative dexterity with which the legs are used; some persons being right-legged, and others left-legged, regardless of strength or length. It is probable, however, that there will be the greatest dexterity with the strongest limb; and, if so, this is only another form of the first theory.

3. The legs are not of equal length, and a person will take the longest step *with* the longest leg.

4. The legs are not of equal length, and a person will take the longest step *from* the longest leg.

In the last two theories, it will be observed, opposite conclusions are reached from the same assumed facts.

Several years ago I made a careful series of experiments with forty-nine young men to test the correctness of these theories. Their legs were accurately measured to determine the length, and a dynamometer was used to ascertain the relative strength. The curves representing their bias in walking when blindfolded were accurately traced and plotted on a diagram, so that they could be readily compared and studied.

The results of these experiments (published in *Nature*, July 30, 1885) were as follows: Of five cases in which there was no bias, in two the right leg was longest (in one of these the right leg was strongest, and in one the strength of the legs was not tested), — one presented the greatest difference in length of legs, and the other more than the average of those with right leg longest, — and in three the legs were of equal length (in one of these the right leg was strongest, and in two the left leg was strongest (*a*)). Four were right-handed: one used right and left with equal dexterity (*a*). In pointing at a distant object with both eyes open, in three the right eye was dominant, in one the left eye was dominant, and in one both eyes were apparently used to determine the range. Of fourteen cases in which the bias was to the right, in five the right leg was longest (in two the right leg was strongest, in two the left leg was strongest, and in one the strength of the legs was not tested), in four the left leg was longest (in three the right leg was strongest (*a*), and in one the left leg was strongest), and in five the legs were of equal length (in two the right leg was strongest (*a*), and in three the left leg was strongest). All were right-handed. In pointing at a distant object with both eyes open, in twelve the right eye was dominant, and in two the left eye was dominant, the latter in the groups marked (*a*). Of thirty cases in which the bias was to the left, in eight the right leg was longest (in five the right leg was strongest (*a*) (*b*), in two the left leg was strongest, and in one the legs were of equal strength), in ten the left leg was longest (in five the right leg was strongest (*b*), in four the left leg was strongest (*b*), and in one the legs were of equal strength), and in twelve the legs were of equal length (in five the right leg was strongest, in five the left leg was strongest (*b*), and in two the strength of the legs was not tested). One was left-handed (*a*), twenty-five were right-handed, four used right and left with nearly equal dexterity (*b*). In pointing with the finger at a distant object with both eyes open, in twenty-two the right eye was dominant, in six the left eye was dominant, and in two both eyes were apparently used to determine the range.

From the facts here presented, it is evident that the relative length or strength of the legs cannot be assigned as the cause of the observed bias in walking. The phenomena in question can, however, be readily explained by the application of well-established physiological principles.

When walking in a straight line, the muscles of locomotion are made to act in orderly correlation through impressions received by the senses and conveyed to the nervous centres, and thence transmitted to the muscles by the motor nerves.

When a person is blindfolded, or in the dark, or in a mist, the senses cannot serve as guides to direction, and the muscles of the two sides of the body may not act with the same energy, from differences in nutrition, or from lack of co-ordinating impulses from the nervous centres; that is to say, an exact equilibrium in the muscular activity of the two sides of the body can only be secured through the co-ordinating influence of the senses acting through the nervous system. When this directive agency is not available, a divergence from a direct course will, in most cases, follow from a lack of bilateral symmetry in the functional activity of the muscles.

MANLY MILES.

Lansing, Mich., Dec. 26.

The Influence of Baking-Powder Residues on Digestion.

THERE has always been more or less discussion over the question of what a pure baking-powder should consist, and which of the constituents of many kinds of baking-powders are most deleterious to the human system.

The manufacturers of different brands of powders obtain indorsements from eminent chemists that theirs is the only powder on the market which does not exert a harmful effect when taken every day in our food.

What one manufacturer calls an adulteration another claims is beneficial to the health, when taken in small quantities. This is especially true in the case of the animated discussion in the newspapers at the present time between the manufacturers of the various phosphate baking-powders and those who produce a powder made of bicarbonate of soda and cream-of-tartar.

The manufacturers of the latter brands advertise that theirs does not contain any calcium phosphate, and look upon this compound as an adulterant; while the firms interested in the sale of the former brands laud the use of phosphates in food, at the same time claiming that the bicarbonate of soda and cream-of-tartar form, after baking, a residue of Rochelle salts, the constant introduction of which daily into the stomach would prove very deleterious to the action of the gastric juice.

While these claims are made by the different manufacturers merely for the purpose of selling their own goods, and consequently the harmfulness of their rivals' products greatly overdrawn, yet in a measure the claims of both are true.

That all baking-powders have, to a greater or less degree, a retarding action on digestion by reason of the difficultly soluble salts left as residues after the process of baking, no one doubts; but now the question arises, "Which of the constituents used in the manufacture of baking-powders have the least injurious effects?"

In order to learn what were the most common adulterants of baking-powders, the writer made a tour of many grocery-stores in the city of New Haven, and was enabled to purchase thirteen different brands. In all cases it was found that the cheaper brands, and those offering inducements to the poorer classes by reason of their gifts of household articles, etc., with the purchase of their powders, were adulterated to by far the greatest extent.

The adulterations in some of these cases were not of a harmful character in themselves; e.g., starch was used in a very liberal quantity on account of its being so much cheaper than bicarbonate of soda and cream-of-tartar.

The only ill effect produced by the use of starch is, that, the strength of the powder being lessened so much by the absence of the proper amount of bicarbonate of soda, the housekeeper is forced to use a great quantity of the powder in order to cause the liberation of carbonic-acid gas necessary for the lightness of the bread or pastry. Thus the stomach gets a greater dose of impurities, which generally occur in a powder adulterated with starch, than it would from a powder not containing the latter ingredient.

Of the thirteen brands of powder examined, eight contained large quantities of alum; and two more, traces. Six contained calcium phosphate; two of which, however, were labelled "phosphate powders," but in the other cases it was used as an adulteration.

One of the phosphate powders contained a great quantity of alum, although it claimed to be free from it. All contained more or less starch, but the better brands use only a very small quantity of it, for the purpose, they claim, of keeping the powder from being decomposed by the moisture. *Terra alba*, or "white earth," was found as a common adulterant of the cheaper powders; and, while it is claimed that it is so insoluble that it passes through the body unchanged, yet, accepting that, the same thing may be said of it as has been said of the use of a large quantity of starch; viz., that a larger amount of the powder must be used to produce the required porosity in the bread, thus increasing the amount of residue.

It was the object of this investigation not only to find out the influence the residues of impure baking-powders have on digestion, but also to find out to what extent, if any, the residues of the purest made powders retard the digestive action of the gastric juice.

Regarding the use of alum as an adulterant, Dr. Mallét of the University of Virginia has just made a careful investigation, and finds that its use is very harmful, as it does not retain its form as a sulphate, but, on being subjected to the process of baking, assumes the highly insoluble form of aluminium hydroxide.

By quantitative work with this latter compound, and also by means of taking a large dose of it after a hearty meal and noting the result, he has found that digestion is impaired, and proves that this result is due to the fact that the aluminium unites with the acid of the gastric juice, thus depreciating the effectiveness of the latter secretion; also that part of the organic matter of the food is precipitated in an insoluble form by the presence of the aluminium compounds.

Accepting, then, this well-proved and universal belief that alum is deleterious to the human system, a series of experiments were begun to find out what other salts used in the preparation of baking-powders exert a harmful effect on the digestive process.

For these experiments, an artificial gastric juice was prepared by dissolving .05 of a gram of scale pepsin in a solution of .4 of one per cent hydrochloric acid.

In the first series, egg-albumen was taken as the material to be digested, after freeing it from globulin by precipitating the latter with a few drops of hydrochloric acid.

The first experiment was undertaken to determine what effect the purest made baking-powder has on digestion; the one which stood the best tests in the previous analysis being chosen, as it contained only the bicarbonate of soda and pure cream-of-tartar.

Three digestions were carried on at the same time and under the same conditions. The first was the control or normal digestion, in which 10 cubic centimetres of albumen, 40 of distilled water, and 50 of the artificial gastric juice, were used. In the second 1 gram of the baking-powder was heated with the 40 cubic centimetres of water for a short time at a temperature of 100° C., to give it the same conditions it would have in baking bread; then the starchy residue was filtered off, and the same amounts of gastric juice and albumen added as were used in the control. The third was treated in the same manner as the second, except that 2 grams of the baking-powder were used.

The three digestions were then carried on in a 40° C. water-bath, thus giving the digestion normal temperature.

After stirring well at different periods, the digestions were stopped, after five hours had elapsed, by raising their temperature above 70° C., and killing the ferment. All were neutralized with a dilute solution of sodium carbonate, filtered through a weighed filter, washed well with hot water, and, after drying in an oven, the precipitate was weighed.

If none of the albumen had been digested in any case, the precipitate should weigh 1 gram, for 10 cubic centimetres of egg-albumen yield (with slight variations) 1 gram. The following figures, however, representing the weight of the precipitates, show how far digestion had proceeded in each case: No. 1, or control, .3065; No. 2, 1 gram of powder, .6495; No. 3, 2 grams of powder, .7570: in other words, the amounts digested in grams would be, No. 1, .6935, or 100 per cent; No. 2, .3505, or 50½ per cent; No. 3, .2324, or 33⅓ per cent.

Regarding the normal amount digested as 100 per cent, the amounts digested in the other cases are thus deduced.

While the inhibitory action of this residue seems to be very great on studying these figures, it must be remembered that only a small amount of albumen was used in comparison with the amount of baking-powder; but these results only go to show that even the "purest" baking-powder retards digestion in a measure.

To avoid the trouble with the starchy sediment that occurs with the baking-powder, a second series of experiments was undertaken with different amounts of the pure Rochelle salts, which is the residue formed by the action of cream-of-tartar on bicarbonate of soda in baking. The same amount and strength of gastric juice were used in this series as in the first, and also the same amount of albumen. The following table shows the result obtained after digestion had proceeded seventeen hours:—

	Grams of Salt used.	Weight of Precipitate.	Grams digested.	Per Cent digested.
No. 1	0.0	.2263	.7737	100.0
No. 2	0.1	.2398	.7602	98.2
No 3	0.5	.3314	.6686	86.4
No. 4	1.5	.7347	.2653	34.2
No. 5	2.0	.7575	.2425	31.3

Three other series were carried through to verify the result obtained in this experiment, and the amount digested in any case was found to be fairly constant with the amount of salt used.

A series of digestions was then carried on with the use of ammonium alum to show what effect this salt has on digestion in its unchanged form of a sulphate, and it is interesting to note that its inhibitory action is not very much greater than the Rochelle salts.

The following table shows the result obtained after digestion had been carried on five hours:—

	Grams of Salt used.	Weight of Precipitate.	Grams digested.	Per Cent digested.
No. 1	0.0	.4021	.5979	100.0
No. 2	0.1	.5496	.4504	75.3
No. 3	0.8	.7079	.2921	48.8
No. 4	1.0	.7128	.2872	48.0

The next residue experimented with was the one which is left in the cooked food when a baking-powder adulterated with calcium phosphate and alum, or an ordinary phosphatic powder containing alum, is used; i.e., aluminium phosphate.

The results obtained in this series, when compared with those of the Rochelle salts, or even with the alum, show a greater inhibitory power than either, and go to show that the occurrence of alum and calcium phosphate in the same powder forms a residue which greatly retards digestion.

The results after digestion had been carried on fifteen hours were as follows:—

	Grams of Salt used.	Weight of Precipitate.	Grams digested.	Per Cent digested.
No. 1	0.0	.1651	.8349	100.0
No. 2	0.1	.2889	.7111	85.1
No. 3	1.0	.6323	3477	41.6

In order to obtain a correct comparison between the inhibitory effects of a baking-powder made from bicarbonate of soda and

cream-of-tartar, and one made by substituting calcium acid phosphate for the cream-of-tartar, two different amounts of Rochelle salts and calcium acid phosphate were used, and each subjected to the same conditions.

The difference in the retarding action of these residues is easily seen from the following table (digestion carried on five hours) : —

	Grams of Salt used.	Weight of Precipitate.	Grams digested.	Per Cent digested.
No. 1	0.0	.3441	.6559	100.0
No. 2	0.5 (Rochelle)	.5678	.4322	65.9
No. 3	1.0 (Rochelle)	.7700	.2300	35.0
No. 4	0.5 ($Ca H_4 (PO_4)_2$)	.8220	.1780	27.1
No. 5	1.0 ($Ca H_4 (PO_4)_2$)	.8852	.1148	17.5

The superiority of cream-of-tartar over calcium acid phosphate as the acid principle of a baking-powder is shown very well in this last experiment; and, although it is claimed that the latter form of powder furnishes the necessary phosphates for building up the bone-tissue of the body, yet this benefit is rather overbalanced by the harm done by the retardation of the digestive process.

In some cases where it was desirable to compare the effects of two baking-powders directly, or in cases where insoluble salts were used, time digestions were resorted to, in order to avoid loss in neutralizing and filtering.

For these experiments 20 grams of coagulated albumen, and 200 cubic centimetres of artificial gastric juice, were employed.

The digestions were carried on in a 40° C. water-bath, stirred well, and observations made regarding the time of disappearance of the coagulated albumen in each digestion.

In the first series, three amounts of a phosphate baking-powder were used, and, as in previous experiments, a control free from powder.

	Grams of Powder.	Time (hours) to digest.
No. 1	0.0	22
No. 2	0.5	30
No. 3	1.0	42
No. 4.	1.5	50

Having obtained the datum in a previous experiment that a phospate powder adulterated with alum had great retarding action on digestion, a comparison was made between a pure phosphate powder and one known to contain alum; and, although the digestion was not carried on until all of the coagulated albumen had disappeared, yet it was carried far enough to enable the observer to make a good comparison. No. 1 contained no salt; No. 2, .5 of a gram of pure phosphate powder; No. 3, 1 gram; No. 4, 1.5 grams; No. 5, .5 of a gram of impure phosphate powder; No. 6, 1 gram; No. 7, 1.5 grams.

The albumen in No. 1 was first to disappear, followed closely by No. 2, then a little later by No. 5; and so on, in every case the one containing the pure phosphate powder digesting before the one containing a similar amount of impure powder.

Ammonium carbonate has been put down by some as inhibiting digestion, but others claim that on baking it volatilizes and goes off as ammonia gas, leaving a harmless residue; but, in fact, only a small portion of the whole is driven off in this way, for the ammonia forms a compound of ammonium tartrate immediately on heating, and this latter salt is not easily decomposed by heat.

To discover the relative inhibitory action of this residue on digestion, a series was made, using comparative amounts of aluminium phosphate, Rochelle salts, and ammonium tartrate. No. 1 contained no salt; No. 2, .5 of a gram of aluminium phosphate; No. 3, 1 gram; No. 4, .5 of a gram of Rochelle salts; No. 5, 1 gram; No. 6, .5 of a gram of ammonium tartrate; No. 7, 1 gram.

No. 1 was digested in about 45 hours, followed closely by No. 6, and the remaining ones digested in the following order: Nos. 4, 7, 5, 2, 3.

As far as could be seen from this series, there is very little difference in the inhibitory powers of the Rochelle salts and the ammonium tartrate; and the latter cannot be considered, therefore, to be more harmful than the residue of a pure baking-powder.

As a summary of the facts brought out by this investigation, we find (1) that the residues of all baking-powders, no matter how pure may be their constituents, have a harmful effect on digestion, due, in all probability, primarily to the fact that the salts are acted upon by the hydrochloric acid of the gastric juice with the formation of more soluble compounds, and, secondarily, that these salts may form organic compounds with albuminous bodies in the same manner as many of the metals do; (2) that calcium phosphate, on account of its great inhibitory action on digestion, must be regarded as a poor agent for the manufacture of a baking-powder, while ammonium tartrate may be looked upon with more favor; (3) that the presence of alum in a powder made with calcium phosphate greatly increases its retarding action; (4) that the least harmful baking-powder is one containing only the bicarbonate of soda and cream-of-tartar, and that the presence of any other chemical substance, however harmless it may be in itself, tends only to increase the complexity of the residue and impair the activity of the gastric juice.

R. TAYLOR WHEELER.

Jersey City, N.J., Dec. 24.

Resemblance of People.

WHILE in Chicago during the Republican convention of the summer of 1888, it occurred to me to make an estimate of the number of people that must be taken, in order that there may be in general two persons who look enough alike for the resemblance to be noticed at first glance, taking account only of the features, and not of characteristics of voice, motion, etc., which of course help us very much to distinguish persons.

Posting myself upon a street-corner so as to face the moving crowds of people, and throwing myself into as passive a condition as possible, I gazed intently upon the passing faces. Out of 700 persons tried, 29 brought to mind some acquaintaince. I estimated the number of available acquaintances at 5,000 at least, for among the number suggested some could scarcely be called acquaintances. This would indicate, that, among 120,000 people, one will likely be found to resemble any one person enough to be noticed at a glance; or among $\sqrt{120{,}000}$, i.e., about 400 persons, two will probably be found to resemble enough to be noticed at a glance. Of course, the result depends upon one's memory of faces and the ease with which faces are distinguished, and undoubtedly upon many other things.

W. S. FRANKLIN.

Lawrence, Kan., Dec. 23.

A Remarkable Bowlder of Nephrite or Jade.

THE writer lately obtained in southern Oregon a bowlder of jade, which is the largest erratic mass of the mineral yet found on this continent. It was found among the auriferous gravel of a stream near a small mining hamlet by a gold prospector. Its color is of a mottled deep leek green, interspersed with veins of light green and yellow. It is turtle-back in form, and weighs 47¼ pounds avoirdupois. To the eye it is semi-translucent, splintery, and fibrous in its structure; but that it is remarkably compact and homogeneous in character, is attested by a blow, when it produces a clear metallic ring like bell-metal. The specific gravity of three small chips taken from different parts of the bowlder is 2.949, 3.01, 3.04, the difference being probably due to the variance of magnetite in the pieces. The extremes correspond nearly with those given by Dr. Fischer (*Nephrit und Jadeit*, p. 54, Stuttgart, 1880) and by Clarke (*Proceedings of the United States National Museum*, p. 116, 1888). This occurrence of nephrite bowlders among the river-gravel of our Western coast streams, in connection with Mr. G. M. Dawson's (*Science*, xi. p. 186), tends to confirm the belief that it was found by the native races of that coast in sufficient quantities from which to manufacture their various implements of jade.

JAMES TERRY.

New York, Dec. 30.