Diet and food considered in relation to strength and power of endurance, training and athletics / by Alexander Haig.

Diet and Food in Relation to Strength and Power of Endurance.—Haig.

FIFTH EDITION.

DIET AND FOOD

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Considered in relation to Strength and Power of Endurance, Training and Athletics

BY

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FIFTH EDITION

WITH SEVEN ILLUSTRATIONS

LONDON

J. & A. CHURCHILL

7 GREAT MARLBOROUGH STREET

1904

First Edition, September, 1898.
Second Edition, January, 1900.
Third Edition, January, 1901.
Fourth Edition, September, 1902.
Fifth Edition, August, 1904.

PREFACE TO FIFTH EDITION.

THE interval which has elapsed since the last edition of this book has served only to deepen my conviction of the importance, mental and physical, which attaches to the right understanding of dietary questions. It is scarcely an exaggeration to say that many matters which agitate the public mind are not worth a thought in comparison with this subject to which a thought is seldom given. Yet a little consideration should demonstrate that what a man thinks he becomes, and that a science which controls the building of brain-cell and therefore of mind-stuff lies at the root of all the problems of life. For mind is a function of the body, and the body is dependent on the material at its disposal for the purposes of stability and renewal, and though we may not agree with the philosopher who pronounced every sick man to be a scoundrel, it is obvious that each power must be dwarfed or distorted when the instrument of its manifestation is impaired. On the moral side it becomes increasingly apparent that many perversions and deformities formerly believed to be wilful and deliberate are to be recognised as falling into the domain of the

physician, and are as certainly diseases as the broken-down heart or crippled joint. In other words, they are things which may be prevented by human means and the necessary conditions, but are otherwise unavoidable. Doubtless palliatives have been and will be tried, but for a cure the world has looked far and wide, whilst, in my opinion, it has been a simpler matter than was supposed, and has lain all the time at our gates. Briefly, experience and experiment strengthen my belief that in adopting the stimulative forms of diet the race entered upon a path which could only lead, as it has done, to the mental and physical diseases which now baffle the scientific man and the moralist alike. Those who have understood this subtle degenerative influence and retraced their steps before it was too late, have found the result of their choice in an accession of health and an equipoise of mind and body which, increased and disseminated throughout the nation, would have more effect than any other measure for its well-being known to me at present. It is impossible to overstate the necessity for this reform, the neglect of which is already visible in many ominous signs, and bids fair later on to menace our very existence.

7, Brook Street, W.

August, 1904.

PREFACE.

In attempting to alter people's diet so as to free them from the poisonous xanthins and uric acid, I have met with so much ignorance, and its results in prejudice and superstition, that I have been led to write these pages in the hope of making clearer the position that diet holds in relation to matters of strength and nutrition.

And I believe I speak no more than the truth when I say that once a clear knowledge of the facts is possessed and a workmanlike and useful grasp of the subject attained, it will be found that in diet lies the key to nine-tenths of the social and political problems that vex our nation and time.

Diet, as at present used, is the product of a vast amount of ignorance; it is the cause of a hideous waste of time and money; it produces mental and moral obliquities, destroys health and shortens life, and generally quite fails to fulfil its proper purpose.

It is my object in the following pages to show

that it may be easily made to fulfil its proper purpose, and that with even a partial removal of the ignorance that surrounds it, the waste of time and money may be prevented, and the dangers to life and health averted.

But after pointing out the possibility I shall leave the facts to speak for themselves, since those will most completely understand them who put them to the test of experience.

7, Brook Street, W.

August, 1898.

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CHAPTER I.

Some Points in the Physiology of Albumen and Urea.

Health may be defined as a satisfactory condition of nutrition, strength, and power of endurance.

In considering how such a condition can be produced we shall have to treat of the albumens of food, their sources, characters, digestibility, and the amounts of force and urea derived from their metabolism in the body.

In far-off times, when man was a more natural and less artificial animal than at present, Nature managed the whole business for him, and he either died or attained an equipoise of health and nutrition without knowing how or why.

But when later on he began to control some of the conditions of nutrition without a thorough comprehension of all their bearings, he here, as in so many other points of contact with Nature,

upset her methods without the power of substituting more satisfactory ones and suffered in consequence from many unexpected and terrible results of his rashness.

As one of these many men are attempting to carry the diet of youth into middle life and age, and the diet that was suitable for an active outdoor life into a life of sedentary office work. If they fall into neither of these errors they are generally completely ignorant of the relative value and importance of foods, so that they either starve themselves on vegetables and herbs containing little or no albumen, or, on the other hand, over-feed themselves on concentrated albuminous foods.

To prevent such mistakes and to substitute a certain amount of scientific precision for the previous rule of thumb methods is the object of this little book, and we may say as a beginning that the first essential of nutrition is the supply to the blood of sufficient albumen to replace that transformed into urea in the production of force.

If food is withheld urea goes down and down, and with it falls the power of producing force in active exercise.

Fig. 1 shows in a curve the hourly excretion of urea in the sixteenth, fifteenth, fourteenth and earlier hours of a fast, no food having been taken since 8.30 p.m. on the previous day.

We see, then, that in the hour ending at 8 a.m. urea is a little above 13 grains, and it rises in the hour ending at 9 a.m. to a trifle above 14 grains ;

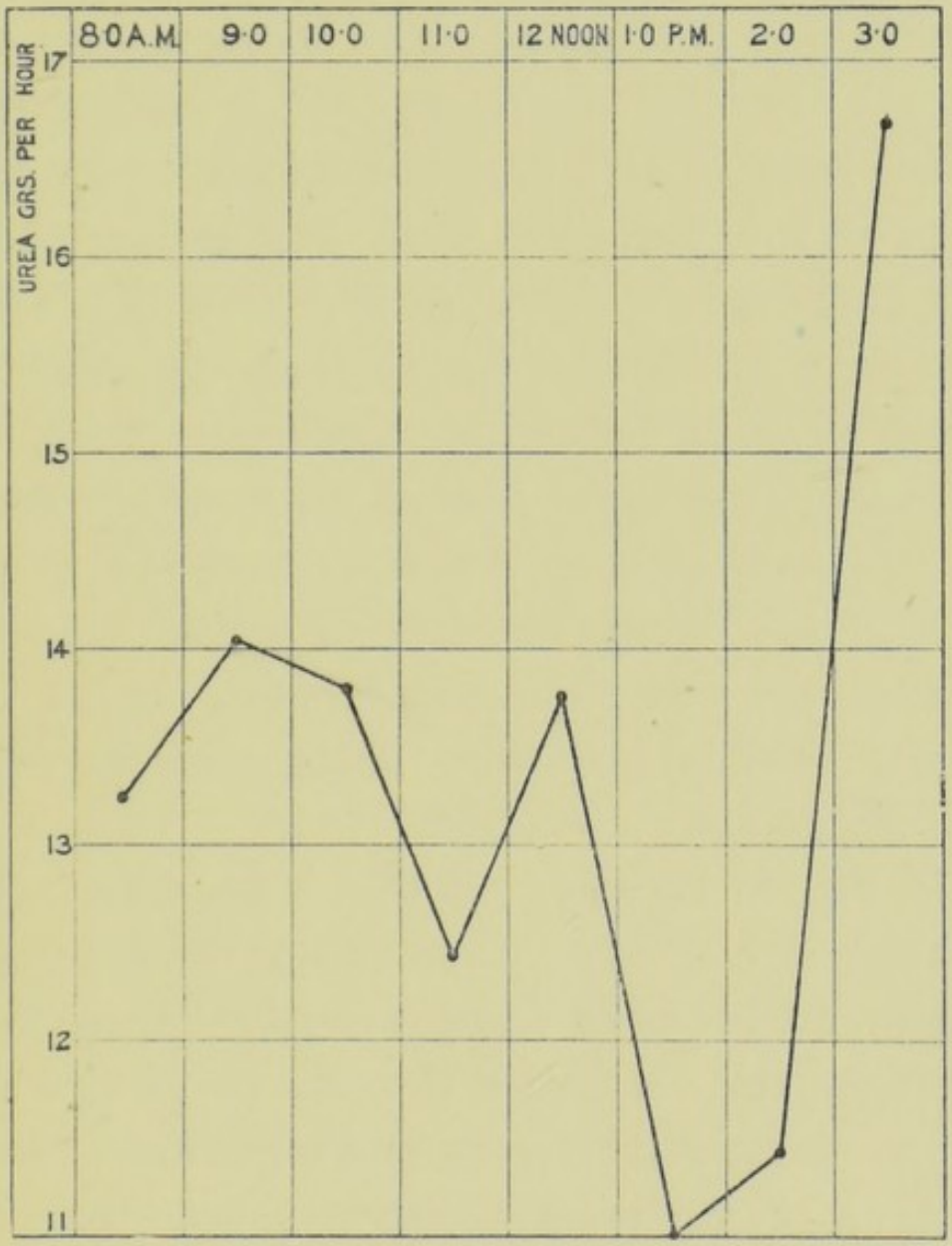

FIG. 1.—Effects of fasting and food on the excretion of urea.

this being probably the result of the exercise involved in the acts of washing and dressing.

At 10 it falls, and at 11 is only about 12·5 grains,

but at 12 it rises again nearly to 14 grains as the result of some exercise, only to fall more quickly and decidedly to 11 grains at 1 p.m. At 1.5 food is taken and at 2 there is a rise, but only a slight rise, to 11·5 grains; at 3, however, the full effect of the meal begins to be felt and it rises with a bound to 16·7 grains per hour. The total for the day being little over 400 grains, or 17 grains per hour.

We learn from this figure, that the effect of withholding food for sixteen hours is a steady fall of urea (only the latter part of which we see here), from 17 grains or more per hour down to 11, but that this fall is broken from time to time by the effect of exercise, which appears to call out albumen or nitrogen from some reserve store, about which more presently.

It is also to be observed that with this fall of urea there is a steady corresponding diminution of strength and power of endurance; that is, of force production, and that with the rise of urea, which at 3 p.m. follows the taking and digestion of food, there is an equally marked rise of general strength and power.

We thus learn that the excretion of urea is the measure of the force available, and that its falls and rises accurately register the conditions of the nutrition, strength, and endurance of the body.

We know also that this urea is generally obtained from nitrogen in the form of albumen contained in food, that there is a certain amount of stored albumen in some of the tissues, and that in prolonged starvation, nitrogen is further provided by destruction of the tissues themselves, this being accompanied by a definite daily decrease in body weight.

It will be seen that such loss of body weight is an exact measure of the albumens consumed, and of the urea and force produced from them.

Therefore, when there is no more albumen available for absorption, no more reserves and no food, urea and force alike are no longer produced, and life comes to an end.

From this we may conclude that urea excreted is an exact measure of force produced, and that albumen available is an exact measure of potential force (see also chap. iv.).

We shall see also (as I have already suggested in "Uric Acid,"[1] as the result of other researches) that those who believed that strength was obtainable from food containing no nitrogen, and that urea was therefore not an absolute measure of strength and power, had flaws in their premisses which seriously affected the value of their conclusion.

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[1] "Uric Acid as a Factor in the Causation of Disease." Sixth Edition. J. and A. Churchill. London: 1903. Pp. 373-379.

The point is mentioned here because the relation between albumen, urea and force is the keynote of this volume; but I shall have much evidence to bring forward on the subject in the following pages.

Further, by watching my own excretion of urea for many years (see details in "Uric Acid"), and on all kinds of diets, I have come to the conclusion that, given a sufficient amount of albuminous food, which can be digested and metabolised into sufficient urea, I can produce force proportional to that urea, without much regard to the quantities of other non-albuminous foods taken.

So that while sugar, starch and oil do, under certain conditions which I shall demonstrate presently, affect to a small extent the production of urea and force from albumen, their influence is always indirect, and generally of so little importance that in a purely practical work like the present it may be neglected.

We are now at once met by the question, how much urea and how much albumen are sufficient; and as most physiologists are agreed that good strength and nutrition in adult life can be maintained with an amount of albumen producing about $3\frac{1}{2}$ grains of urea per lb. of body weight per day, and as my own researches (see "Uric Acid," p. 834, *et seq.*) are in substantial agreement with them, I shall adopt this standard without further consideration here.

It will be found a rough but sufficiently accurate rule that the albumens required to produce any given quantity of urea can be found in grains by multiplying the grains of urea by 3.

If, therefore, we take the weight of any individual in pounds (should there be much adipose tissue either deduct it, or take the body weight before the adipose tissue was added) and multiply this by 3 if life is sedentary, and by 3·5 if life is active, we get the urea required, and this being again multiplied by 3 the albumens required to produce it.

Example.—A man weighs 160 lbs., but his active weight twenty years ago before he became stout was only 130 lbs., and he is now sedentary; therefore (130 × 3 × 3) = 1,170; and 1,170 grains of albumen per day are necessary for his proper nutrition and force production.

But if such a man leads, or wishes to lead, a decidedly active life, multiply 130 × 3·5 × 3, and 1,365 grains of albumen are required each day.

Old people produce much less urea, say about 2 grains per lb. per day: thus an old man might only require 130 × 2 × 3 = 780 grains of albumen, and would also, of course, produce less force in proportion; old people who are strong and active, however, still want 3 to 3·5 grains per lb. per day.

Children, on the other hand, need much more,

and may produce 6-8 and even 10 grains of urea per lb.; therefore a child of 35 lbs. may require 35 × 10 × 3 = 1,050 grains of albumen daily.

An interesting instance of this came under notice in the case of a boy, aged 10, admitted into the Royal Hospital for Children and Women, suffering from albuminuria and having a normal temperature.

He was put on a diet of milk only and, by accident, he was given 2¼ pints, this being an insufficient quantity of albumens.

On this he lost weight to the extent of 7 lbs. in eleven days, his weight on admission being 53 lbs.

Now the albumen in 2¼ pints milk = 590 grs.

And the albumen in 10 ozs. of his own tissues containing, say, 18 per cent. .. .. = 786 grs.

1,376 grs.

So that we get 1,376 grains of albumen as the quantity this boy required each day, and this divided by 3 gives 458 grains of urea, or 8·6 grains per lb. per day on his original weight of 53 lbs.

This is very interesting, as Nature made up the deficit and told us how much albumen and urea per lb. this boy required. I have often found children of this age excreting urea to about the quantity thus calculated, and younger ones still more per lb.

As soon as the mistake was discovered the milk was increased, the loss of weight ceased, and the amount lost was slowly regained.

Precisely the same results have often been produced in adults, who for one reason or another have starved themselves, and here again the urea excreted would be found to correspond to the albumens swallowed and the tissues absorbed.

I may remark that those who starve themselves may feel very bright and well at first, after the usual gastric symptoms of discomfort give way, for they are being nourished on a stimulating flesh diet from their own tissues, and are saving some of the force usually expended on digestion.

Later on, however, when their reserve of albumens has long been used up, and the tissue albumens get low, they discover that they have been living on capital which should never have been touched and which it is difficult to replace; for with all their forces, including that of digestion, at a low ebb, it will take a comparatively long time to assimilate sufficient albumens to keep the machine working as well as to replace lost capital. These considerations sufficiently account for the fact, of which I have seen many instances, that those who put themselves on an unaccustomed diet often dangerously diminish their allowance of albumens for some time before

they discover that there is anything wrong, and great difficulty is then found in getting back to physiological levels.

Thus while 10 grs. of albumen per lb. of body weight is required for an active life, 9 grs. per lb. is about the minimum that an adult can continue to take with safety.

Of course in the treatment of disease and for a day or two, much smaller quantities may have to be allowed; but whenever this is necessary there should always be a corresponding reduction in the output of force, or there will be a call on reserves and a loss of weight, which should be avoided if possible.

I mention this 9 grs. minimum specially because I find that people who do not take care get below it for a time, by accident or mere want of attention, and then becoming weak, get easily fatigued. The fatigue destroys appetite and power of digestion, and so they go on eating less and less, till some of them get to 7 or even 6 grs. per lb. per day, and are on a downward grade which will take them still lower if the danger is not recognised.

The best treatment of this condition is to increase milk or cheese to make up the 9 grs. per lb., and to give a tonic for a time to improve appetite and digestion till the fire burns up again.

It is because the fire goes down slowly, and

the change often escapes notice till more or less serious signs of debility begin to appear, that it is so necessary to bestow some care at first to ensure the proper quantities of albumen being taken by those who are changing diets.

If at any time there is a doubt on the matter the urine of 24 hours should be collected and the urea estimated to make certain.

Given sufficient albumens, it is a matter of very little consequence where they come from, whether from the animal or vegetable kingdom, though, of course, where poisons are swallowed with the albumens these will influence results, as we shall see further on. The first point is, however, a sufficient quantity of albumen, and this in a condition suitable for digestion and absorption.

With these simple facts kept in mind there is no difficulty at all in getting sufficient albumen, and therefore ample strength and nutrition, from many kinds of food beside those which form the staple diet of England to-day.

Those who have been ignorant of these facts, and have attempted to walk without the light of knowledge, have fallen into many and great errors, but chiefly in one of two directions.

Either they have been ignorant of the quantities required, and have over-estimated the nutrition values of garden vegetables and fruits,

attempting to live on these alone which it is almost impossible to do, or they have under-

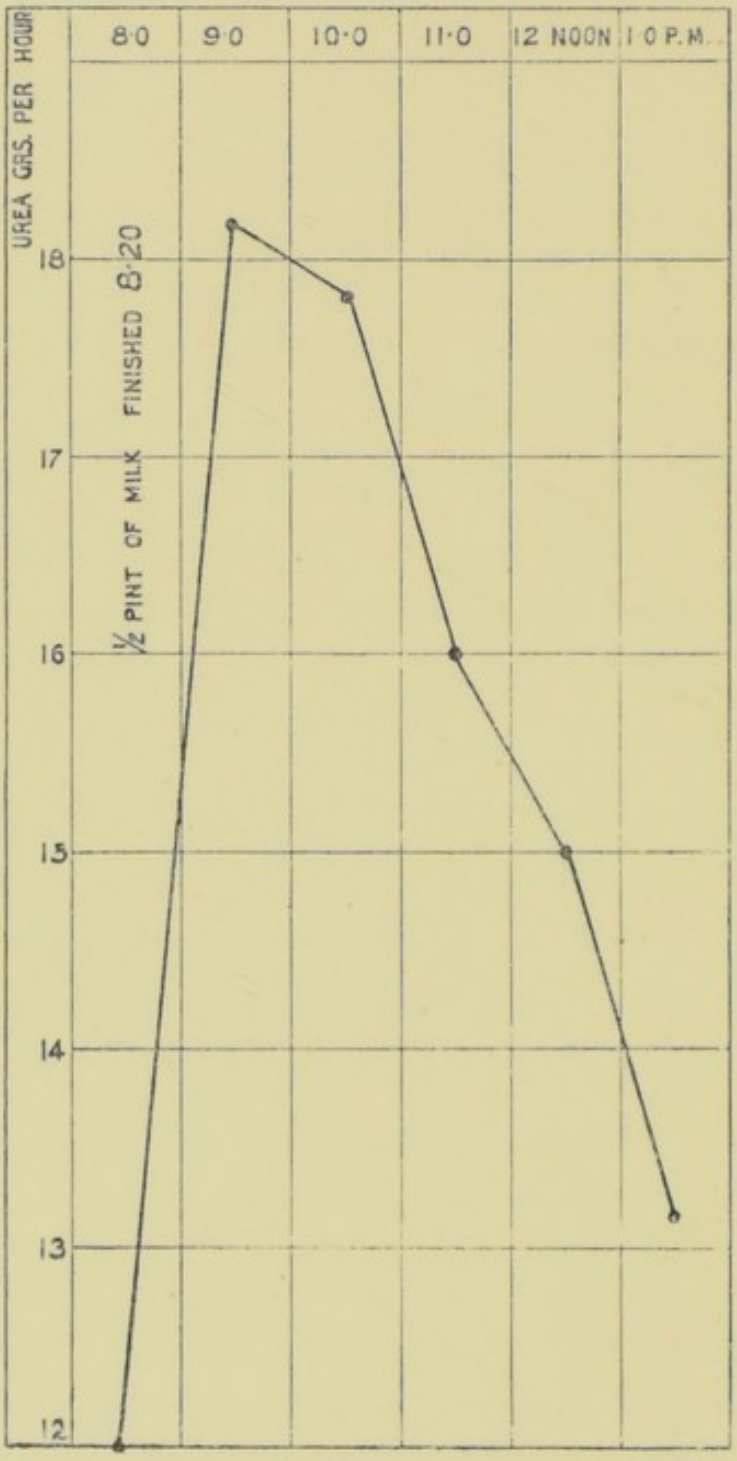

FIG. 2.—Effects of milk on the excretion of urea.

estimated the nutrition values of such things as milk and cheese, and have eaten them in as large quantities as the fruits and vegetables.

For it is possible, by introducing more food than can readily be digested, to overpower digestion so that nothing is digested and absorbed and starvation results; a fact which is brought to the front in the most interesting manner in the writings of Dr. Dewey.[1]

We learn, then, from fig. 1, that as supplies run short, urea and power of force production fall lower and lower, but that a supply of food (when digested, and generally in the course of thirty to ninety minutes), introduces into the blood a fresh supply of albumens available for the production of force and urea, when the urea curve ascends and the power of producing force is correspondingly increased.

This is a simple experiment which any one can repeat on themselves.

Fig. 2 shows the effect of a similar fast to that of fig. 1, broken in the thirteenth hour after 8 p.m. by taking ½ pint of milk.

Here in the hour ending 8 a.m. urea is at 12 grains per hour, and it rises at 9.0 above 18 grains and gradually falls from that until 1 p.m., when it is about 13 grains per hour. If we take it that

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[1] "The True Science of Living," by E. H. Dewey, M.D., Norwich, Conn. The Henry Bill Publishing Company, and J. and J. Bumpus, Ltd., Oxford Street, London, England. 1895.

urea, had no food been taken, would have steadily fallen from 12 grains per hour to 9·5 grains per hour at 1 p.m. and draw an imaginary line accordingly, the urea enclosed between these two lines will equal that produced in five hours from the albumens of milk taken; this is about 28 grains, or almost exactly $\frac{2}{3}$ of the calculated urea value of $\frac{1}{2}$ pint of milk, and probably the rest would have been obtained, but that longer time was necessary for its extraction. It is the same with cheese and other foods; their urea value to some extent comes out in five hours following ingestion, and thus roughly the nutrition value and digestibility of many foods may be directly tested on any individual concerning whom the information may be required.

Thus fig. 3 shows the effect of taking at 8.15 a.m. 1 oz. of cheese. Here it may be seen that in contrast with the milk results it is only in the second hour after the cheese that a rise of urea is produced.

So, considering that urea would have fallen much as in the other figures if no cheese had been taken, we get urea enclosed between the two lines equal to 17·7, say 18 grains, and this multiplied by 3 is equal to 54 grains of albumen.

This cheese is, however, theoretically equivalent to 140 grains of albumen, so that in five hours of

digestion we have got less than half its urea and albumen value, which looks as if cheese were both harder and slower of digestion than milk, and is probably after all less completely digested, leaving greater undigested residues.

The cheese taken was Gruyère, and was somewhat hard from keeping, which probably accounts for part of its slow digestion and indigestibility. I give the result to show how the possible nutrition value of foods may be gauged by this process.

Many people say they cannot digest milk or cheese, but a few tests similar to these would soon show whether there was any truth in the statement.

A similar test may be applied to such foods as nuts and gluten, to be mentioned further on. These dry or hard albumens are, in my experience, more slowly digested than cheese, just as one would expect and for the same reason, since we see cheese is more slowly digested than milk.

People vary considerably in their powers of digesting these things, and while some produce urea from them equal to at least $\frac{3}{4}$ of their calculated value, others produce less even than half their value, and others, again, appear not to digest them at all, there being no rise of urea whatever.

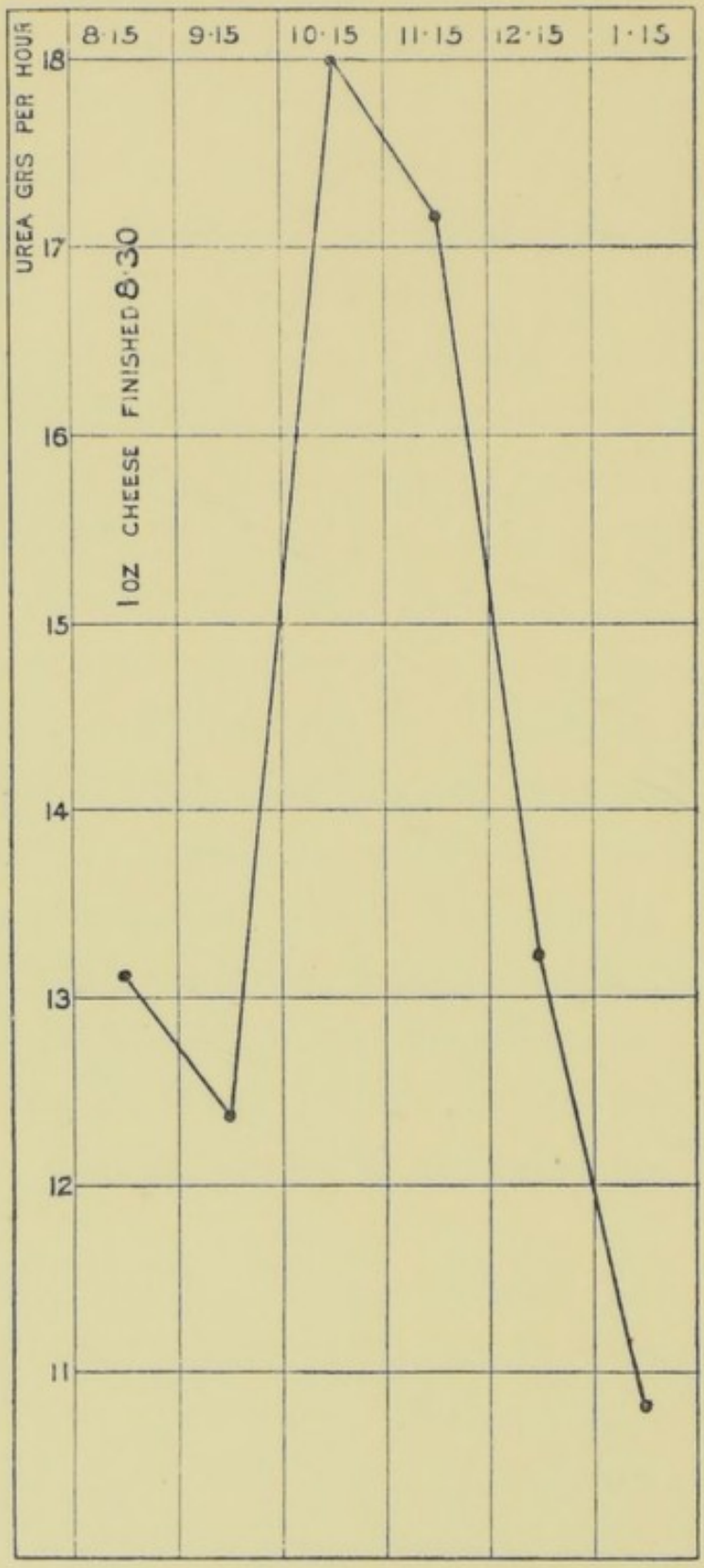

FIG. 3.—Effects of cheese on the excretion of urea.

Circumstances which increase appetite and digestive power seem to increase the urea obtained from these dried forms of albumen, and thus some people can digest these foods when leading an active life, and cannot when sedentary.

On the same ground, those who are strong and well fed digest better than people who are weak and under fed, for it is obvious that in the well nourished the digestive juices are more potent and the digestive processes more completely carried out.

Hence the great importance I attach to making changes of diet slowly, that the fires of life may not run down. (See chap. iv.)

The old foods, therefore, must not be given up till it is quite certain that a sufficient quantity of the new can be substituted, for if nutrition is lowered digestion is impaired, and people get on a downward incline, which may end in trouble.

The time at which the new foods are taken and their admixture with other foods make also important differences in the results obtained, and I mention these things here to bring out the value of the above test, for the quantity of urea produced from any food in a given time is an absolute guide to the nutrition value of that food for the individual on whom we are working. By this test milk stands quite at the head of the list, and is followed by

cheese, and the above and other forms of hard or desiccated albumens come some way behind both.

Those who are in doubt should put the matter to the test and judge by results.

In those who cannot digest these hardened albumens, they may act as irritants and upset digestion of other foods as well, possibly causing more or less severe dyspepsia with loss of weight and strength; so that something like actual starvation may result even on a diet of which the calculated albumens are sufficient. It is in these cases not only useless to swallow hard or desiccated albumens but may be actually dangerous to do so.

On the other hand, small quantities of such indigestible substances as a few Brazil nuts, three times a day before meals, will sometimes cure chronic constipation. They probably bring about this result by leaving undigested residues which stimulate the intestines and promote peristalsis; figs, dates and prunes may be mentioned as having more or less similar effects.

In all cases it is necessary to hit the happy mean between constipation on the one hand and chronic dyspepsia with starvation on the other; and those who have altered their diet without much knowledge of physiology have not always kept these points sufficiently in mind.

By persons who have previously suffered from

intestinal irritation, such as gout of the intestines, appendicitis, &c., such indigestible substances must be specially avoided, or relapse of their troubles may easily be produced.

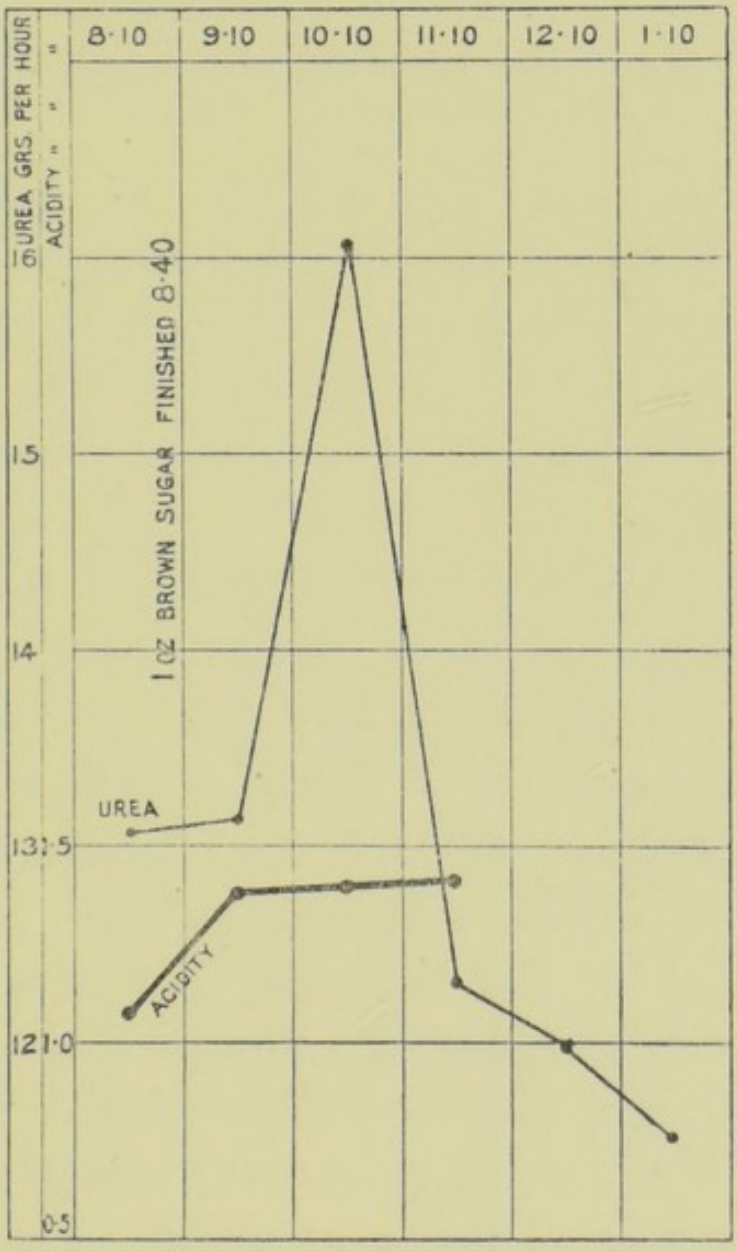

FIG. 4.—Effects of sugar on the excretion of urea and of acid.

Fig. 4 shows the effect of swallowing 1 oz. of brown sugar, which was finished at 8.40 a.m.

Here is seen a very marked rise of urea, from

13 grains in the hour ending 9.10, to 16 grains in that ending 10.10, followed by a fall to 11·5 grains in the hour ending 1.10 p.m.

Now this rise of urea cannot be directly due to the sugar for it contains no nitrogen; the result is probably due to the rise of acidity which precedes it.

Below the urea curve is shown the excretion of acid in the urine in grains per hour, and from this we see there was a marked rise in the excretion of acid in the hour ending 9.10, and that it kept at the same level in the two following hours.

Readers of "Uric Acid" already know that every rise of acidity is accompanied or followed by a rise of urea, and we gather from works on physiological chemistry that the rise of acidity which sugar produces is due to the effects of lactic and butyric fermentation in the alimentary canal.

This, no doubt, accounts for the bad name which sugar has had for many years as a producer of gout and rheumatism; though it may now be seen that sugar produced these troubles indirectly by its effects on acidity and the solubility of uric acid, and that, if uric acid supplies are kept low while the supply of fresh vegetables is good, sugar need do no harm. In a word, the trouble with sugar has arisen from associating it with animal flesh, while, taken with plenty of vegetables such

as potatoes, it is relatively harmless. The rise of acidity shown in our figure would do no harm to a

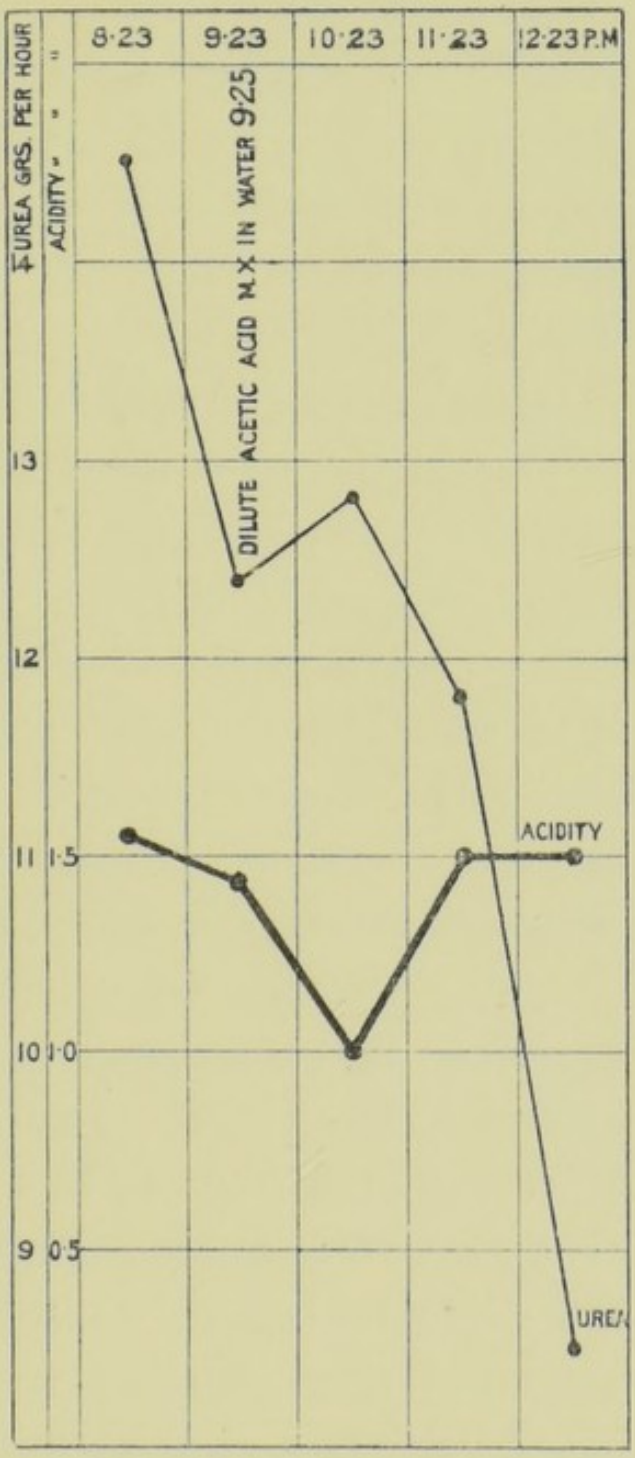

FIG. 5.—Effects of an acid on the excretion of urea and of acid.

frugivore, but in a flesh-eater might precipitate an arthritis.

This rise in acidity was probably due to the sugar, for normally the rise in the acidity of the urine does not begin till 10 a.m., and when it begins generally continues to ascend slowly till 2 or 3 p.m. (see "Uric Acid," fig. 3), but this rise, beginning at 9.10 a.m., does not increase in the two following hours.

Fig. 5 shows a similar curve, in which at 9.23 ɱx. of dilute acetic acid were taken, and this is followed by a break in the downward trend of the urea curve, which, however, again falls rapidly to 8·5 grains in the hour ending 12.23.

Below the urea curve is the acidity curve, and this does not at once move upward after the acid is taken: but in the hour ending 11.23 there is a decided rise, not due to the normal rise at that hour, because it does not continue in the hour ending 12.23.

I take it, therefore, that the rise at 11.23 was due to the acetic acid and that the acidity (looking to the rapid drop of urea from 14 to 8·5 grains in about four hours) would have fallen further at 10.23 but for the acid taken; that this affected the blood before its full effect became visible in the urine, and that the rise of urea represents the effect of the acid on the circulation of the blood. But it may be asked how it was that with a small rise of acid of ½ grain in fig. 4 there was a rise of 3 grains

in urea, while with a rise of about 1 grain of acid in fig. 5 there was a rise of probably less than 2 grains of urea ?

As already shown in "Uric Acid," pp. 378 and 612, the rise of urea that follows the taking of an acid, or a rise of acidity otherwise caused, is not proportional to that acidity, but rather to the condition of the blood and tissues when the acid is taken, and the rise of acidity affects them.

I have also shown in "Uric Acid," prev. refs., that a rise of acidity causes a rise of urea because it clears the blood of uric acid which, probably in colloidal form, is obstructing the peripheral capillary circulation and preventing the ready access of the blood albumens to the tissues and the removal of waste products from them; so that the rise of urea which results is proportional, not so much to the greatness of the rise of acidity, as to the condition of the tissues at the time it takes place.

That is to say, the longer the tissue circulation has been exposed to the obstructing influence of colloid uric acid the greater may be the accumulation of waste products in those tissues and the greater the rise of urea when the circulation through them is once more freed. In illustration of this point I have remarked that the rise of urea which follows the clearing of the blood of uric acid in physiological conditions is only, as seen in

these figures, a matter of a few grains, but when the blood is cleared of uric acid in Bright's disease (where the obstruction to the circulation is both greater and more lasting), urea may rise as much as 100 grains in a day.

Hence I conclude that the difference in the extent of the rise of urea in figs. 4 and 5 may be due to some difference in the quantity of waste products available in the tissues, and, in conformity with this, it is to be observed that urea was falling slowly as the result of the fast in fig 4, while at the same hours in fig. 5 it was falling very quickly indeed. My notes on fig. 5 show that it relates to the day following a large excretion of urea after exercise, so that it is possible the muscles were on this day rather poor both in stores of albumens and of waste products, and therefore the rise of acidity produced relatively little effect.

I have gone at length into this question of the effects of uric acid on circulation, nutrition and excretion of urea, because we are here in sight of the second great factor in nutrition, strength and power of endurance.

Our first factor is an adequate supply of albumens in a digestible form for introducing into the blood stream the albumens necessary to produce in the tissues urea to the extent of 3·5 grains per lb. of body weight per day, and the corresponding amount of force.

Our second factor is the possibility of a satisfactory circulation through the tissues, bringing these albumens to the tissues and removing the corresponding waste products.

And this, as we see, is dependent on the absence of any excess of uric acid from the blood stream.

It therefore follows that, as some sources of albumens (such as animal flesh of all kinds) contain either uric acid or substances equivalent to it (such as the xanthins), these must be ruled out, for the blood cannot be kept properly free from this substance while it is being introduced with every mouthful swallowed, and, if the blood is not kept fairly free from it, the circulation will not be that best suited to the production of strength and endurance: a fact of which we shall see some practical proofs further on.

But to return to figs. 4 and 5; I give them to show that the effect of 1 oz. of sugar (containing no albumens) on the excretion of urea is very slight compared with the effect of 1 oz. of cheese, and that this small effect is probably indirect and due to the sugar altering the alkalinity of the blood and so affecting the circulation in the tissues and the removal of their waste products.

We have thus far learned, then, that the production of force requires:—

(1) A sufficient supply of albumens in a digestible form.

(2) A satisfactory interstitial circulation of the blood to carry these albumens to the tissues and to remove waste products, while to make this possible the blood must contain little or no uric acid or similar substances, such as xanthins.

Before I leave the subject, illustrated by the above figures of urea excretion, I will point out that : a small quantity of milk, cheese, or any food of similar albumen value causes a feeling that hunger is sated as urea rises, and a sensation of returning hunger as urea falls. Whereas if a food poor in albumen is taken, such as fruit, though in much larger bulk than the milk or cheese, there may be a feeling of fulness, but hunger is not sated and there is little or no rise of urea. So that hunger is to a large extent a measure of the want of albumens in the body, and is to be met only by albuminous food, while as 1 oz. of cheese is worth in albumens more than ten times its weight of fruit, it is clear that hunger is not a matter of mere bulk.

Similarly, if sufficient albuminous food is taken but something upsets digestion, there is little or no rise of urea, and no increase of strength and power, but rather a feeling of languor and debility with a desire to keep quiet.

Good digestion is accompanied, so long as urea is rising, by sensations of strength and a desire to be up and doing, and from these observations it is quite possible to tell whether digestion is good, bad, indifferent, or *nil*.

It is not uncommon to meet with people who, soon after eating a hearty meal start for some exercise, but within half an hour are in a condition bordering on collapse; if questioned, they will tell you that they have an intense feeling of emptiness referred to the epigastrium, as if the good meal recently eaten had given them the slip.

What has happened here? Merely this, that the exercise was too much for gastric digestion, and caused its suspension, so that though the stomach is full, there is no absorption of albumens into the circulation, no rising urea, and no force available; therefore, in spite of a full stomach, there is a feeling of more or less emptiness, which shows that the blood is poorly supplied with nutritive albumens, and we find, if we estimate it, that urea is falling, or at least, not rising.

A little rest puts matters right; the stomach circulation is restored, digestion begins again, albumen is absorbed, force produced, urea formed, and the man walks perhaps quite well for many miles, making almost as good use of his meal as if nothing had occurred.

On the other hand, it is possible that the

temporary suspension of digestion may permit fermentative, putrefactive, and other processes to take place in the food mass, which continue and disorganise digestion for hours, days or weeks afterwards.

A corresponding suspension of digestion, absorption and urea formation may be brought about with exactly similar results by other disturbing influences besides exercise, such as the circulation changes produced by the rush of a quantity of uric acid into the blood; this producing, as I have elsewhere explained ("Uric Acid," prev. ref., p. 283), obstructive congestion of the whole digestive circulation, and in consequence imperfection or suspension of gastric digestion, with the other results above mentioned.

This is the causation of the gastric upset and vomiting, of the severe uric acid storm (or bilious attack, so called), and of the more or less sudden feelings of emptiness in cases of glycosuria and diabetes, associated with such and similarly caused circulation troubles and their effects on digestion and the circulation and metabolism in the liver.

As readers of "Uric Acid" already know, every rise of uric acid in the blood and urine is accompanied by a fall in urea, which is no doubt partly due to defective circulation and metabolism in the muscles and other important tissues (the reverse effect to that shown in fig. 5), and partly

also to defective circulation and digestion in the stomach and consequent diminished absorption of albumen into the blood.

If, however, even at the end of the sixteenth, seventeenth, or eighteenth hours no food is taken, urea, in spite of this, often begins to rise a little, and there comes a feeling of increased strength and power, while the emptiness passes off or is greatly lessened.

This means, I believe, that the body has begun to feed on its own tissues, and there is a rise of urea and of energy from this source; but prolong the fast for twenty-four to thirty-six hours and there will be a distinct loss of weight, as in the boy above mentioned who was put on a diet deficient in albumens; for this represents the albumen necessary to raise urea and produce the force required for the bodily functions in the absence of supplies from without.

This loss will be continued for weeks and weeks, and sufficient albumen appropriated each day to keep the chief functions of the body from coming to a standstill, while a corresponding amount of urea will be excreted.

We may sum up the main points in the physiology of the subject by saying that the first requisite for strength and power of endurance is a satisfactory and sufficient supply of albumens,

that the body depends for these chiefly on the foods taken, but there is also a small store of these substances in certain tissues which becomes available if prolonged exertion is called for in the absence of food, and beyond this point in continued starvation certain definite quantities of the tissues themselves are daily absorbed to produce the necessary force and urea.

My results are thus in complete accord with the teachings of those physiologists who say that albumen is the *sine quâ non* of a diet that sustains life; and my researches, some of which I have published in "Uric Acid" (prev. ref., p. 831), show that the excretion of urea bears a definite relation to force produced, and that a diet in which urea is at or below 2·5 grains per pound of body weight per day will not suffice to produce much force in spite of a liberal allowance of sugar, starch and fat.

Force is thus in all directions proportional to urea, whether gauged from hour to hour or day to day.

The second requisite is a free circulation through the tissues to introduce the albumens and to remove their waste products; this circulation being only possible in the comparative absence of uric acid from the blood stream. The absence of uric acid explains the rise of urea in fig. 5, and also the still more marked rise in Bright's disease, if the blood can then be cleared of it.

CHAPTER II.

Physiology and Pathology of Fatigue.

From what has already been said we gather that fatigue (that is, the inability to produce force), may be due to two causes: (1) a general dearth of albumens in the blood, and (2) a condition in the blood which leads to its defective circulation through the tissues, so that though the blood may contain sufficient albumens the tissues cannot readily obtain them, the tissues themselves becoming also, as the result of their activity, laden with waste products, which are not sufficiently quickly removed.

It will be well to go somewhat deeper into this causation of fatigue, so as to obtain the power of distinguishing in practical experience between the fatigue due to the first and that which is due to the second condition.

Now the fatigue which proceeds from dearth of albumens in the blood is always absent so long as sufficient food is taken and digested; in the condition of dyspepsia mentioned in the previous chapter it was not digested. Therefore, if a man in any

trial of endurance drops out while supplied with sufficient albumens and apparently digesting them, we may be sure that his fatigue is not due to (1), but by exclusion is probably due to (2).

And practically, apart from digestive accidents, the fatigue which is due to dearth of albumens does not occur till some four or five hours after a meal, nor till urea has begun to fall very considerably below the level of 17 grains per hour, as shown, for instance, in figs. 2 and 3.

So that, if a man who has a sufficient supply of albumens, and a good digestion, yet falls out in the early stage of a contest, long before those albumens can be exhausted, we must conclude that his fatigue is due to uric acid in the blood, and may proceed further to identify this condition by considering its concomitant signs and symptoms.

As will appear from my consideration of the subject in " Uric Acid " (prev. ref., p. 380), there is, in addition to the sensation of powerlessness in the limbs, a feeling of chilliness, with coldness of skin and extremities, and a fall of surface temperature, but temperature in the rectum will be raised and separated more than usually from the surface temperature (sign of excess of uric acid in the blood); and for the same reason, the general blood pressure will be raised, the diameter of the radial artery increased, and the sounds of the heart altered.

Under this condition, if a white spot is made by pressure with the finger-tip on the back of the hand, the colour will take from three to four seconds or more to return; while where there is no excess of uric acid in the blood, it may only take from one and a half to two seconds.[1]

These are all effects of one and the same cause, defective capillary circulation (which can be seen on the back of the hand), affecting especially the temperature of surfaces and extremities, but affecting also the circulation of the whole body, raising the blood pressure and influencing the action of the heart.

On the other hand, the man who has fatigue caused by deficiency of albumens will not suffer from coldness nearly so much ; will have but little difference between surface and deep temperatures, and little if any slowing of the capillary reflux on the back of the hand; nor will he have a general rise of blood pressure with increased diameter of the arteries, nor much alteration of the sounds of the heart.

This man is all right in himself, supplies have merely run short; give him fresh albumens, and a little time (such as we see from fig. 1 is required) to digest them, and he will promptly be himself

[1] See *British Medical Journal*, October, 1899.

again; or even a rest without any fresh albumens will enable him to draw on his reserves and tissue albumens, and he will be able to go on once more.

Far different is the case of the other man, for even if he is supplied with albumens it will do little good, he has already sufficient in his blood, but they cannot get to the tissues, and, owing to the general defective circulation, his digestion of new albumens will be as slow as all his other physiological processes.

To supply him with fresh food may add to his troubles by starting dyspepsia, if not putrefaction, in the digestive organs, and presently he may vomit all the fresh supplies almost untouched by digestion.

To get this man into a condition to proceed may be a matter of hours, possibly days; and the first necessity is to clear the uric acid out of the blood. If this can be done, there will immediately be a rise of urea and a return of power without any fresh nourishment: thus further illustrating the points already mentioned in reference to figs. 4 and 5.

The best way to clear the blood of uric acid is, as we see from these figures, to give acids, acid wines, acid fruits; in fact acid in any form most likely to be absorbed from the stomach: or calomel, or other metals that form insoluble compounds with

uric acid will be effectual, as I have pointed out in previous writings. But as the whole object of this book is to show that, with proper care in selecting our sources of albumen, this fatigue and the obstructed circulation produced by uric acid collæmia need not occur, I shall not here go further into the treatment of the condition by means of acids and drugs.

While speaking of this, however, I will again point out that though the albuminous foods are those that really control the situation, other foods have effects which may easily appear to be of more importance than they really are.

Thus, though in fig. 4 the effect of 1 oz. of sugar is very small compared with that of 1 oz. of cheese, any one who had taken the sugar would say that he felt distinctly stronger and better for it ; and this would certainly be the case while acidity and urea were rising, partly because some albumen is indirectly rendered available for force production, and partly because the amount of uric acid in the blood is diminished and the circulation thus improved.

But it would also be the case if the rise of acidity was produced by an acid containing no food elements whatever (see fig. 5) ; so that while I do not say that carbohydrates, oils and fats, have no effect on nutrition, and am not discussing their

influence on the production of force in other forms (such as heat), I do say that their effect on the production of force and activity, and the excretion of urea, is so slight and indirect, that it may for the present be neglected, with the object of making more useful and readily available our knowledge of the metabolism of the albumens.

Since I propose to point out that those who are free from excess of uric acid in the blood are also free from the severe and intractable form of fatigue just described, I must at the same time mention that the difference between sufferers and those who do not suffer is one of degree only, for all have some uric acid in the blood, and are influenced in the same way by acids and other drugs which clear it out of the circulation.

In cases having no excess of uric acid in the body and blood, an acid, or acid-forming food introduced into the stomach will at once be absorbed and clear out any uric acid there may be in the circulation, whereas in people who are full of uric acid, digestion and absorption are as much upset by the large quantity of uric acid in the blood as are the muscular circulation, skin circulation and general metabolism, and the condition is difficult or impossible to cure, since food and drugs introduced into the stomach may easily remain unabsorbed. Uric acid collæmia is a curable con-

dition in the one case, but is certainly for a time more or less incurable in the other.

I have pointed out in "Uric Acid," that if urea excretion is watched during exercise it is possible to ascertain whether fatigue is coming early, and whether such fatigue is due to excess of uric acid. For exertion generally causes, as we have seen, a rise of urea; but if there is much uric acid in the blood, exertion will lead to a fall of urea in place of a rise, and more or less severe fatigue is soon experienced.

This fatigue can be prevented, as I shall show, by means of a uric-acid-free diet providing the necessary albumens, or it can also, as already demonstrated in "Uric Acid," be evaded by previously clearing out all available uric acid; *e.g.*, either by a course of salicylate to be left off on the day of exercise, or else by giving acids, mercury, &c., to temporarily clear the blood at the time of exercise. In fact, it matters not how the blood is cleared so long as it is kept free during the exertion.

There is another point; namely, that exercise brings excess of uric acid into the blood by causing the elimination of acids in perspiration. The acidity of the urine is thus diminished and the alkalinity of the blood increased, and it becomes a better solvent of uric acid, so that it straightway

dissolves as much of that substance as is available in the tissues.

In a word, exercise acts like a dose of alkali, and reverses the effects which are produced by acids, hence, in those who have plenty of available uric acid, heat and fatigue are contemporaneous, and almost synonymous; but in those who are free from excess of uric acid, heat and perspiration have little or no power of producing collæmia, and fatigue is to a corresponding extent delayed.

Indeed, the records we are now receiving show that the less animal flesh people take the better do they come out in trials of endurance. As regards force production, those having equivalent quantities of albumen, animal or vegetable, will equal each other; but in endurance those will excel whose albumens are procured from such animal and vegetable sources as are practically free from uric acid, and who do not indulge in the stimulant poisons of tea, coffee, and other alkaloid-containing substances.

So far as I know the "vegetarians" of this country are decidedly superior in endurance to those feeding on animal tissues, who might otherwise be expected to equal them; but these "vegetarians" would be better still if they not only ruled out animal flesh, but also eggs, the pulses (peas, beans, lentils and pea-nuts), asparagus and

mushrooms, as well as tea, coffee, and cocoa, all of which contain a large amount of uric acid, or substances physiologically equivalent to it.

It follows that meat is a stimulant because of the acid salts it contains, for uric acid itself is one, as may be demonstrated by swallowing a few grains of it, and this is the chief stimulant in beef-tea, soups, meat extracts, and other deadly decoctions of flesh. Meat, however, also contains a supply of easily digested albumens, and the effect of swallowing animal flesh is, that digestion is stimulated and circulation improved by the acids and acid salts, so that the albumens are quickly digested and rendered available. As a result the meat-eater is sooner in a position to evolve large quantities of force than the man who gets his albumen—perhaps exactly the same in amount—from a less stimulating source.

But there is another side to the question, for in so far as this effect of flesh is due to stimulation, it will come to an abrupt end: just as we see in fig. 5 that the rise of urea after an acid is followed by a fall which is rapid and decided. And the albumens of flesh being thus rapidly available, it follows that, (other things, such as quantity, being equal), these albumens are also more quickly worked off and dissipated than those having a less stimulating origin in cheese or vegetables; though a somewhat

similar effect can be produced by eating acid fruits and vegetables with cheese, milk, &c.

It therefore follows that a meal of meat, as compared with a meal of milk, cheese and bread, equally rich in albumens, is like the force in an explosive oil, as compared with the same amount in a slow-burning oil.

And the man who has dined on flesh, though possibly more lively and energetic at first, will find himself at the end of stimulation and available albumens, and faced by rapidly falling urea and increasing fatigue, some time before an opponent, whose precisely similar allowance of albumen was drawn from other sources.

Stimulation is not strength, but force rendered a little more quickly available; and it is invariably followed by an exactly corresponding amount of depression when the force is used up and must be replaced.

Again the meat-eater whose blood is temporarily cleared as the result of acid stimulation, has not, therefore, got rid of that uric acid; it is waiting in his body and will return in increased quantity into the circulation as soon as the rise of acidity and stimulation comes to an end. Hence this man may, some time before his next meal, have an excess of uric acid in the blood and suffer from fatigue as a result, while his milk, cheese, and

bread eating opponent, with less uric acid to return into the blood, will escape.

I think the action of meat, as a stimulant and producer of quickly worked off force, has a good deal to say to the fact that, as we have eaten more and more meat, we have come to have a larger number of meals in the day; and while the bread, cheese and vegetable feeder can do well on two, or at most three, meals daily, the flesh feeders often take four, or even five.

It is perhaps also the reason why an exaggerated and erroneous estimate has been formed of the power of meat to produce force that its stimulating effect has been mistaken for power, and the following depression has either been overlooked, (which is possible for a time), or later has been counteracted by alcohol, tobacco and other more harmful stimulants. The man who gets his albumens from a less stimulating source, having no early stimulation, has no subsequent depression, and so probably never feels the want of alcohol at all.

Hence it follows that those who took alcohol on a flesh diet generally very soon give it up when flesh foods are relinquished, and smoke very little also, being independent of stimulant. Yet if what most meat-eaters say were true, namely, that meat is much more nourishing and supporting than milk,

bread, cheese, fruit and vegetables, it ought to be exactly the other way, and those who live on the latter foods should be the ones to require alcohol, and be unable to dispense with it.

Another very common effect of meat eating, whether alcohol is or is not taken, will be a certain amount of dulness, heaviness, and disinclination for mental or bodily exertion in the morning hours, often associated with more or less irritability and mental depression. (See also similar facts mentioned further on from the records of others.)

In fact, the meat eater is never quite himself or at his best till the evening, when rising acidity clears his blood for a time from excess of uric acid; and this is, I think, at least one of the factors that has caused our morning and evening hours to grow progressively later as we have drifted into living more in towns, eating more luxuriously, and taking more poisons.

It is misery to rise in the morning hours if you feel dull, depressed and unrefreshed; it is a pleasure to prolong the evening conviviality when you feel bright and cheerful. Few or none realise that a multitude of such minor grievances, with much waste of good daylight and heavy bills for artificial light, are direct results of wrong habits of eating and drinking.

We see, then, that there are two forms of fatigue,

one due to absence of albumens from the blood, because albuminous foods are deficient; and one due to absence of albumens from the muscular tissues, because, though there is plenty of albumen in the blood, the blood is unable to get freely to the tissues. Both forms of fatigue are really due to defective supply of albumens to the tissues but the latter has the additional complication that, the circulation being defective, waste products are not removed from the tissues but remain to further hinder their function and nutrition.

Thus, in the walking race to be mentioned further on, in which the vegetarians are said to have walked the meat eaters off their legs, food was partaken of by both alike, but the meat eaters had impure blood so that they could neither digest the albumens nor get them to their tissues when digested, and so failed, not from defective supply but from obstructed circulation. Further, the vegetable feeders arrived fresh and in good condition and the winner asserted that he could have gone faster if necessary; whereas the only meat eater who came in at all required brandy to revive him.

We have also seen that by means of diet it is possible to prevent completely the latter form of fatigue, leaving the individual who thus controls his intake liable only to that form of fatigue which

is due to deficient albumen, from poor or irregular food supplies.

More recently, May, 1902, in a walking match (Dresden to Berlin, 125 miles), six vegetarians again came in first, and the then champion walker of Germany was among those who gave up the contest. The winner, Karl Mann, who trained for the most part by the rules in this book, made two world's records in the race, and arrived some three hours before anyone else.

I have pointed out in "Uric Acid" that other things such as nutrition and the supply of albumens being equal, I can absolutely control the incidence of fatigue by controlling uric acid; that I can prevent fatigue for many hours in spite of great heat and exertion either by sweeping out beforehand most of the available uric acid by means of a solvent such as a salicylate or by clearing the blood directly with drugs such as acids, opium or mercury, thus acting on uric acid by interfering with its solubility which is a repetition of the way in which meat acts as a stimulant. I have indicated that these methods have been used probably for thousands of years by those who had no exact knowledge of their mode of action, *e.g.*, opium for fatigue of men and horses in India, and lemons, &c., by athletes on this side of the world, and I have come across

several individuals who had similarly made use of mercury or more recently of salicylates, for the effect on their mental or bodily powers. I have also remarked that exactly the same result can be produced by clearing the blood of uric acid by means of diet and have said that whereas in my own case while on ordinary flesh diet I might often be *hors de combat* in half an hour or an hour from exposure to heat and exertion, on a uric acid free diet I can confidently reckon on being able to produce large amounts of force for at least three or four hours, in spite of any heat met with in this country. And I have stated that abstainers from flesh all over the world have had similar experiences and not infrequently get the better of flesh-eating opponents from this cause.

I have demonstrated that fatigue which is produced by a rush of uric acid into the blood is accompanied by an immediate fall of urea, while exercise without such uric acid in the blood and without fatigue is accompanied by an immediate rise of urea, and no doubt it would thus be easy to tell from the urea excretion of two athletic competitors which would fail first.

In myself also the rise and fall of urea as shown in the previous figures, is accurately represented in the sensations of strength or weakness, so that over and over again it has occurred to me

in making these and similar curves to write down my feelings at the time, and to find afterwards, when the urine had been collected and estimated and the urea worked out, that they had accurately represented the changes taking place in the excretion of urea. And anyone who will note his own sensations during such a change in the excretion of urea as is shown in fig. 1 from 1 p.m. to 3 p.m., will have no difficulty in understanding this.

I have now no doubt that the severe collapse and asthenia following attacks of gastric dyspepsia or gastritis from any cause, are due to a stoppage of the digestion and absorption of albumens producing a corresponding fall in the production of force and urea, and that the fall in urea would be found in all such cases if the urine were collected and examined.

In the same way an injury to any part of the body which causes serious interference with gastric digestion will produce similar asthenia and fall of urea, and it is a sequence of our first principles that in flesh eaters such fall of urea is the signal for a rush of uric acid into the blood, and that this still further hampers and impedes digestion, circulation and nutrition in all directions, giving rise to the serious and fatal complications of shock.

It is a further sequence that abstainers from flesh and tea have, as compared with flesh eaters

and tea drinkers, a certain relative immunity from shock after injury and its more severe results; and this is, I think, as shown by cases quoted in "Uric Acid" (pp. 405 and 870), a matter of common observation.

It seems, then, that there is overwhelming evidence to prove that fatigue or its absence is simply a matter of the adequate supply of albumen to the muscles, and this in turn is controlled by two factors: (1) a satisfactory and sufficient supply of albumens in the blood, and (2) a free circulation of blood through the tissues to furnish the albumen as required, and remove waste products.

We see, also, that diet places both these factors under our control and that the excretion of urea is a reliable guide to the results it produces.

CHAPTER III.

Foods Available: their Properties and Relative Importance.

The foods available are so numerous, that we must first of all divide them into classes and consider them in a general way.

These classes have one thing in common, that they contain no uric acid, or very little indeed compared with animal flesh, eggs, or vegetable substances rich in alkaloids, such as pulses, asparagus and mushrooms, tea, coffee and cocoa, which are, for the reasons given in previous chapters, excluded.

The uric acid free foods fall, then, into the following classes or groups:—

(1) Milk and milk products, as cheese.
(2) Bread stuffs, cereal foods and glutens.
(3) Nuts and nut foods.
(4) Garden vegetables, as potatoes.
(5) Garden fruits, as apples.
(6) Dried and foreign fruits.

Milk is one of the best of these foods because

it is easy and quick of digestion and affords, as we have seen in fig. 2, a supply of albumens and therefore of force and urea, in a comparatively short space of time.

Many people believe that they cannot take milk, and there are undoubtedly a good many things in ordinary diet with which it does not harmonise, *e.g.*, flesh, beer, wine and tobacco; but the mistake is in the use of these and the disuse of a more wholesome food.

A difficulty in digesting milk generally resolves itself into taking it with improper foods, in improper quantities, or at improper times; when people have already swallowed a good and sufficient meal of other things and add a tumbler or more of milk, they are very likely to have some digestive trouble.

People who take three or four good meals a day and add a tumbler of milk between times to keep up their strength, are much more likely to tire out the gastric digestion and acquire dyspepsia and debility. All this, however, cannot be charged to the milk but to the foolish way in which it is taken.

When milk is treated as a most important food deserves to be, that is taken at one or two of the three daily meals and broken up and distributed, among the rest of the foods, such as bread, cereals,

vegetables and fruits, it is, in the great majority of cases, easily digested and furnishes its proper quantum of albumens, force and urea.

Very much the same applies to cheese and the bad character it frequently bears, which is much more often due to the way in which it is eaten at the end of a meal already too heavy, or to excess of quantity or deficiency of mastication.

Cheese contains more albumen than any other of the common foods, and should be taken early in the meal and well distributed through bread stuffs or vegetables : it must be well broken up and masticated, and if it is hard and the teeth bad it should be grated before use.

Those living on a mixed diet rarely require to take more than 1 or 2 ozs. of cheese in a day ; that is, 1 oz. at two meals, and I have never met any one who could not take this quantity easily and digest it well, when going the right way to work.

Bread stuffs and cereal foods are the most important items in the diet list ; containing much less albumen than cheese they are eaten in much larger quantity, and generally form the backbone of the mixed diets, often contributing one-half or more of the day's allowance of albumens.

A larger volume than this would scarcely suffice to enumerate their kinds, qualities and preparations, and I must content myself with saying

that they appear to me (especially in the form of bread or biscuit), to furnish a steady and equable supply of albumens over a number of hours, and thus to increase the powers of endurance of those who use them, being in this respect at the opposite pole of nutrition from milk or meat.

A bread stuff diet may sometimes be eaten almost all day long without strict attention to meal times, in a way and to an extent that milk and cheese could not be taken without causing serious dyspepsia.

Another great advantage of a diet consisting largely of bread and bread stuffs is that it is dry as distinguished from a milk diet, which of course implies much fluid. And in the treatment of many uric acid diseases this is so great an advantage that, while it is hardly possible to treat some of them on milk, they are at once shorn of many of their terrors by being put on a relatively dry diet of bread stuffs.

Uric acid diseases fall chiefly into two groups: (*a*) The arthritic group, containing gout, rheumatism, and similar affections of many fibrous tissues throughout the body; (*b*) the circulation group containing headache, epilepsy, mental depression, anæmia, Bright's disease, &c. Now the members of this latter and far larger group are nearly all associated with high blood pressure and its

secondary troubles, and it is nearly impossible to attain success with these while two or three pints of milk are swallowed every day; whereas on a dry diet of bread stuffs many of their more severe symptoms are not difficult to control.

The most important point in the complete and satisfactory digestion of bread stuffs is to ensure their thorough mixing with the saliva and this is greatly facilitated by taking them in a dry state.

Thus toasted bread, biscuits and rusks into which the saliva can penetrate easily, are much more readily and certainly digested than such things as new bread, bread and milk, porridges or milky puddings, upon which the saliva acts slowly and with difficulty after more or less dilution with other fluids.

The three chief forms of bread foods are breads, biscuits, and puddings; and when they are taken in this last form they should always be firm and solid so that they can be cut with a knife and eaten almost like bread, requiring and getting plenty of mastication and teeth work.

Even teeth are not an absolute necessity, for if dry bread stuffs are well sucked they become completely mixed with saliva and softened by the aid of the tongue and gums, so that those whose teeth have been ruined by the fibres of meat and fish, for which Nature probably never intended them (see

figs. 6 and 7), can adapt themselves to a bread stuff diet.

As I have said, bread stuffs are slowly digested and give a steady supply of urea and force over a number of hours. Thus, 400 grs. of albumen taken as milk may be nearly all worked off in about two or three hours from the time it is swallowed, while a precisely similar amount of albumen taken as bread would probably continue to supply force for at least an hour longer. The amount of force available in, say, the first two hours might not be as great on bread as on milk, but it would be more steady and continuous (I gave a figure to show this in a paper, "Living on Bread," read before the American Medical Association, and published in their Journal in 1901).

This is probably what people mean when they say that a meal of bread lasts better than a meal of meat, for meat, like milk, is quickly digested and worked off, and probably the slow metabolism of bread accounts, at least in part, for the superior powers of endurance shown by grain-eating animals, and I might add of grain-eating men (see records further on).

If you must work very hard for an hour only, take milk, but if you have to do steady work for three or four hours take bread; for force is, as I have shown, in all conditions proportional to urea

(for urea is the ash of the albumen metabolised), and urea and force rise quickly in the case of milk, more slowly in the case of bread.

Bread stuffs form a very convenient diet for those who are moving about the world, for they can be obtained almost anywhere and where not obtainable are more easily carried than any other food.

The cereals have been the sustenance of mankind in the past and are still the foods of the great majority: it is only in a few countries where flesh eating has been carried to great excess that they have fallen into comparative neglect.

I quite agree, however, with Dr. Kellogg and those of his school, who teach the importance of complete and thorough cooking of cereal foods,[1] for the use of such foods is often an additional help in severe dyspepsia, but I find that many people can take ordinary bread, biscuits, and cereal foods if they are careful to take them dry (a point also insisted on by Dr. Kellogg), and that the complete penetration of the saliva thus insured will, in many people, make all the difference between flatulent dyspepsia and satisfactory digestion of cereals. I shall have to mention this subject again

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[1] Super-cooked cereal foods as advised by Dr. Kellogg can be obtained from the International Health Association, Ltd., 70, Legge Street, Birmingham.

in connection with the common causes of dyspepsia (see chap. iv.).

It appears probable, for reasons which I have given at some length in "Uric Acid," pp. 835 and 836, that the outer husk of all grain foods contains some xanthin.

I therefore, as a rule, advise that only the breads and cereal foods which are free from the brown outer husk should be used, and this excludes all forms of wholemeal and brown bread, also the coarse oatmeal in which a considerable amount of husk is often visible.

As a matter of fact little or nothing is lost by this exclusion, for it has been proved in the researches undertaken by the Agricultural Department of the United States (Annual Report, June 30, 1901, p. 469), that wholemeal bread is very often incompletely digested, and the nourishment obtained from it is therefore not more than that obtained from white bread (see previous remarks on indigestible substances, pp. 18 and 19).

The figures in the U.S. Tables (Bulletin, No. 28, pp. 60 and 61) are as follows:—

(1) White bread (cheap grade)	..	10·97 per cent. albumen.
(2) Whole wheat bread	.. ..	9·7 ,, ,,
(3) White bread	.. .. ..	8·0 ,, ,,

So that, in every way, the best bread is that made from cheap or "seconds" flour, which con-

tains most of the albumen, without the objectionable outer husk.

Those have the best bread who make it at home, and generally speaking the less a food has been manufactured, manipulated and tampered with, the better for the consumer. Plain, simple foods, as direct as possible from the fields, orchards and woods, should always be our aim.

Rice, the staple food of many Eastern countries, is another important cereal, and in this country we have probably neither treated it properly nor appreciated it as it deserves.

The nations that depend upon it are careful to get good rice, to cook it thoroughly, and to have it as dry as possible when served. With this object they steam rather than boil it, or if water is added to the rice it is all boiled away, as any water poured off after cooking carries nourishment with it.

I have been told that much of the rice sent to this country is not that which is considered the best by the natives of countries where it is grown, and one can quite understand that it is useless to send the best to countries where it is not appreciated.

Gluten is the albumen of bread or flour, and can be added to bread, biscuits, puddings, or other cereals to increase, if need be, their albumen

values; it may also be used by itself in various forms, where the starch of cereals is not wanted.[1]

Nuts and nut foods are valuable because fairly rich in albumens; but have the disadvantage of requiring good sound teeth well used, or they are apt to be indigestible. They often contain a considerable quantity of oil, and many biscuits and foods prepared from them do not keep well owing to changes in this oil.

Nevertheless, nuts are by no means to be neglected; they form a large item in the diet of many nations, and with some they more or less completely take the place of bread.

This is specially the case with chestnuts, which when well cooked are easily digested by almost everyone, and other nuts may be passed through a nut-mill and reduced to a meal if the teeth are defective.

Chestnut-flour can be obtained from the grocer and may be mixed with other flour or meal for scones, &c.; while pounded almonds are used in the same way, or made into cakes by themselves or with sugar, as in the almond paste of cakes. But all who use these things for the first time should

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[1] Gluten bread, biscuits, and other preparations of gluten can be obtained from Blatchley, 167, Oxford Street, W.; Callard, 65, Regent Street, W.; or Van Abbott, 104, Wigmore Street, W.

bear in mind the points mentioned on pp. 18, 19, and be cautious as to quantity and careful as to complete mastication, rejecting all hard and insoluble particles.

Those who, for one reason or another, do not like milk or cheese, should remember that from one pound of bread, or bread stuffs of equal value (as in puddings), and a few ounces of nuts, or almonds, can be had nearly three-quarters of the albumens required for a day, so that in this way they may get on with very little milk or cheese, or even dispense with them.

Speaking generally, garden vegetables contain very little albumen and are of use to supply bulk, and to dilute and break up the more albuminous foods, such as milk and cheese, rather than for their albumens.

Potatoes, in addition to somewhat less than 2 per cent. of albumens, contribute a considerable quantity of alkali, which is often useful to keep down the acidity of the urine and prevent retention of uric acid by other foods, some of which, such as the cereals, have been mentioned above as contributing some excess of acids.

For this reason eating a moderate quantity of potatoes twice a day may suffice to make a urine which tends to throw out a little red sand from time to time owing to relatively high acidity,

cease to do so, and those who suffer in this way from eating acid fruits should counteract their effects by taking a corresponding quantity of potatoes.

Garden fruits — here, again, I must pass over whole classes with a word. Most of our fruits contain only a fraction of 1 per cent. of albumens, and are generally equivalent to water with some sugar and salts. These salts, as a rule, may be considered as alkalies, for though they are often present in the form of acid tartrate of potash, which reddens litmus and acts as an acid when first swallowed, their effect on the blood and urine of a whole day is that of an alkali, diminishing the acidity of the urine and probably increasing the alkalinity of the blood (see "Uric Acid," p. 715).

Many acid fruits, however, act as acids, at least for the first few hours after they are swallowed, and thus stimulate—(in the way previously explained in reference to fig. 5)—nutrition, digestion and the production of force and urea. Almost everyone, I suppose, who has gone in for athletics knows the reviving effect of a mouthful of lemon, which is no doubt due to its action as an acid, but even lemon has little or no effect on the acidity of twenty-four hours' urine.

In the same way acid fruits taken in any considerable quantity with breakfast, and unbalanced

by potatoes, influence very decidedly the large morning excretion of uric acid, and so diminish the excretion of that substance for the whole day (see "Uric Acid," fig. 53, and p. 540). Therefore, sufferers from the arthritic group should take no fruit or jam at breakfast, but should take some potato instead, and those who suffer from an ailment of the circulation group should not take much fruit at this meal, or should balance it with an equal quantity of potato.

Garden fruits generally may be regarded as increasing the bulk of the day's food without adding much to its albumen values; but they contribute a useful supply of water, some sugar and some useful salts.

Still, taking the fruit of an ordinary day and deducting stones, skins and stalks, in fact, weighing only the parts eaten, one would probably not be far wrong if one reckoned them as containing about 2 per cent. of albumens.

Dried and foreign fruits are in the original condition very similar to those above considered, but when a large part of their water has been removed by drying, the relative albumen value is, of course, greatly increased. Such things as figs, dates and various kinds of plums and raisins, when eaten in considerable quantity, make a quite appreciable addition to the day's albumens, and those that

contain acids or acid salts also act more powerfully as acids when condensed by drying.

Looking at these groups of foods, I conclude this part of the subject by saying that it is possible to live on a diet which includes some of each of these groups in its daily routine; that it is possible to live on group (1), milk and its products alone; that it is also possible to live on all the rest, excluding milk and animal products entirely, and relying chiefly on (2), (3) and (6), cereals, dried fruits and nuts, for the necessary albumens; but that it is not possible to live on (4) and (5), garden vegetables and fruits, and generally in this country not on (6), dried fruits alone.

Those who wish to make fruits and vegetables a large part of their fare can do so by taking considerable quantities of milk and cheese to make up the required albumen (see Table III.), but it is impossible to live on garden vegetables and fruits unless this is done, and the nations making much use of fruit generally add to it a considerable quantity of milk or cheese.

If man is to be regarded as I believe he should be, as a frugivorous animal (see figs. 6 and 7), nuts and fruit are probably his most natural diet; nearly three-quarters of the required albumens being in this case obtained from the nuts.

It is, however, comparatively rare for anyone to

be able to take this diet who has injured both teeth and digestive organs by years of wrong food. Nevertheless it is an ideal to be aimed at, and all should try how nearly they can attain it.

Here again Table IV. may be used as a stepping stone; the milk and cheese being slowly diminished as the nuts are increased.

Nuts may perhaps be arranged in order of digestibility somewhat as follows, and most of them can be rendered more suitable for weak digestions by cooking:—

Chestnuts...	...	10 % of albumens (43 grs. per oz.).		
Pine kernels	...	15-30 ,,	,,	
Walnuts ...	...	16 ,,	,,	(68 ,, ,,
Brazil nuts	...	17 ,,	,,	(73 ,, ,,
Almonds...	...	21 ,,	,,	(90 ,, ,,

The object of all these forms of diet is to swallow as little uric acid as possible; and by this means I have reduced my own uric acid turnover from about 20 grs. per day to a little over 10 grs. per day; with the result that I am now practically free from the "diseases" under which I formerly suffered.

As regards the uric acid free foods, choose those which suit you best and take the proper quantity, and this advice may be almost condensed into the three words, "live on bread," for bread and cereal foods are those which best suit the majority: they are also the cheapest and most easily obtainable.

CHAPTER IV.

Values of Foods in Albumen and Urea. Quantities Required. Diet of Training and Athletics.

In considering the value of foods and the quantities required and in apportioning these into special diets, it is convenient to treat of diets as they are required for ordinary conditions of life, for special training and exercise, or for the treatment of slight departures from normal health, such as obesity and some minor alterations of function.

We have already seen in chapter i. that the body weight in pounds multiplied by 9, gives the minimum amount of albumens required for a sedentary life, and by 10 or 10·5 those required for an active life, such as that of an out-door labourer.

If we take an active man of 140 lbs., and apply these rules, we find that he requires 1,400 grains of albumen per day, which will produce about 466 grains of urea per day when completely digested and metabolised.

With regard to urea, I may say that the percentages of albumen values to be given in the diet tables that follow, have been found by practical trial to be very close to the truth. For though on a weighed diet continued from day to day, urea will be one day below and another above the quantity calculated from the albumen values of those foods—when taken over days or weeks, these fluctuations tend to balance each other, and over such a period the urea calculated from the albumens generally comes very close indeed to the urea found.

The fluctuations no doubt arise from variations in the time of digestion of foods used, as the digestion and absorption of a food taken one day is not necessarily concluded in time for the twenty-four hours' division of the urine; and again, when albumens have been absorbed, they may, as we have seen reason to believe, remain either in the blood or the tissues as a reserve of force till a special call for force production and activity is made (see fig. 1 and remarks upon it; also "Uric Acid," p. 373).

But when allowance is made for these causes of variation, the values to be given are, I believe, quite sufficiently accurate for our practical purposes.

The albumens required for this man of 140 lbs. can be got from :—

TABLE I.

10 ozs. of bread	8 per cent. of albumens	(= 34 grs. per oz.)	= 340 grs.
2 ozs. of fine oatmeal	12 ,, ,,	(= 52 ,, ,,	)= 104 ,,
2 pints of milk	3 ,, ,,	(= 13 ,, ,,	)= 525 ,,
1½ ozs. of cheese	33 ,, ,,	(=140 ,, ,,	)= 210 ,,
1 oz. of nuts	16 ,, ,,	(= 68 ,, ,,	)= 68 ,,
19 ozs. fruit and vegetables, say ½ to 2	,, ,,	(= 8 ,, ,,	)= 153 ,,
			1,400

It is obvious that such a diet list may be varied greatly in many directions, and that such variations may be used as temporary changes or permanent diets, according to taste, habits, cost, facility for preparation and other concomitant conditions.

For those who do not do well on or like much fluid, the milk can be reduced to 1 pint per day if the cheese is increased to 3½ oz.; others, again, may be able to increase bread or bread stuffs to 16 ozs., which would enable them to reduce the milk to 1 pint or cut out the cheese entirely, and some may take still more bread up to 24 ozs.

Those who do not like or cannot digest nuts in any form or of any kind, may leave them out, slightly increasing the bread, milk or cheese or replacing them by about five times their quantity (5 ozs.) of dried fruit.

It should be remembered that almonds are to be obtained at all times, and that pounded almonds can be made into cakes or biscuits which are much liked, and form a favourite top dressing for

many cakes. Chestnut flour can also be had and used in similar ways.

Nuts have the further advantage, common to many substances that leave undigested residues, of tending to prevent or relieve constipation; in some persons, however, they, in common with other substances leaving undigested particles, may cause intestinal irritation, giving rise to papular and other slight skin eruptions.

I would here refer to what I have already said about indigestible substances on p. 18, for while in some people nuts relieve dyspepsia by putting an end to the constipation to which it was due, if given to those who have suffered from gouty or other intestinal irritation (with or without diarrhœa), they may increase irritation and intensify its evil effects, such as malnutrition and anæmia, thus paving the way for still more terrible enemies, among which tubercle may be mentioned.

Other persons may be able to increase bread, biscuits and puddings, and thus arrive at a diet in which there is no milk or cheese at all, as—

TABLE II.

11 ozs. of bread	8	per cent. albumens	(34 grs. per oz.)	= 374 grs.
12 ozs. of biscuit	10	,, ,,	(43 ,, ,,)	= 516 ,,
2 ozs. of rice	5	,, ,,	(21·5 ,, ,,)	= 43 ,,
2 ozs. of macaroni	11	,, ,,	(47 ,, ,,)	= 95 ,,
2 ozs. of oatmeal	12	,, ,,	(52 ,, ,,)	= 104 ,,
10 ozs of potatoes	2	,, ,,	(8·9 ,, ,,)	= 89 ,,
10 ozs. of fruits	2	,, ,,	(8·9 ,, ,,)	= 89 ,,
1 oz. of almonds	21	,, ,,	(90 ,, ,,)	= 90 ,,
				1,400

This is a bulky allowance, much too bulky for those accustomed to a concentrated meat diet; but when they take Table I. as a transition stage, nearly every one will be able to arrive at Table II., as they will probably find that as they give up milk and cheese their power of eating bread stuffs increases.

This bread stuff diet is one which gives very great variety in foods, for there are many kinds of breads, almost endless kinds of biscuits, and for the rice, macaroni, and oatmeal can be substituted a long list of various meals and pudding stuffs. (See previous remarks about breads, p. 52.)

In every change of diet we must see that the new food is sufficient in quantity and satisfactorily digested by the individual in question, and this can only be done by making alterations very slowly, one meal at a time, and watching and testing the digestibility of each new food as it comes to be used.

For this purpose I am in the habit of advising that only one meal should be altered at a time, and that each meal should be watched for, say, seven, ten, or fourteen days, and regarded as quite satisfactory as to quantity, quality, digestibility, and resulting strength and power for work, before the next meal is taken in hand, thus :—

1st Stage.

Give up tea, coffee, and meat soups.
Replace by milk, milk and water, soups made with milk, &c.

2nd Stage.—ALTER BREAKFAST.

Leave out bacon, egg or fish.
Replace by an increase of porridge, toast, biscuits and bread stuffs, and half to three-quarters of a pint of milk.

3rd Stage.—ALTER LUNCH.

Leave out fish and meat.
Replace by an increase of toast, biscuits, bread stuffs and puddings, half a pint of milk and 1 oz. of cheese.

4th Stage.—ALTER DINNER.

Leave out fish and meat.
Replace by an increase of toast, biscuits, bread stuffs and puddings, a cheese dish and half a pint of milk.

Follow this scheme out stage by stage, making each complete and satisfactory before the next is begun.

Where difficulties are met with, one food after another should be tried and tested till the best results are obtained; and no matter how slowly they have to go, beginners must always refuse to move the second foot till the first is firmly planted.

In cases where it is of extreme importance that there shall be no failure of strength and nutrition on the new diet, as, for instance, where there is either tubercle in the family, or its onset appears to threaten the individual in question, it is well to take the precaution of estimating the urea for a few days on the ordinary diet, and then to supply

albumens on the new diet in accordance with the results obtained.

Thus, if the average excretion of urea on four, five or six days, either consecutive or taken at random, is 450 grs., we must supply 450 × 3 = 1,350 grs. of albumen per day on the new diet; but if the patient has had a bad appetite on the old diet, so that the average urea is below the physiological level of 3 grs. per pound of body weight per day, then we must go by the body weight (giving a physiological allowance of urea and albumen), and not by the urea found.

If tubercle is actually present, and feeding up is indicated, far more than the physiological allowance of albumens should be given, and the patient stuffed with food to any extent that is possible, as 4 pints of milk, 16 ozs. of bread stuffs and 4 ozs. of cheese in many shapes and forms, with butter and cream *ad lib.* It is certainly no harder to overfeed a patient on this diet than on one of flesh, indeed it is often much easier, and, as I have said in "Uric Acid" (p. 438), much less dangerous.

A further modification of such a diet, and one that is sometimes convenient if only because it entails almost no labour for preparation and cooking, is one consisting of milk and cheese, fruit and vegetables, thus:—

TABLE III.

2½ ozs. of cheese	..	33 per cent. of albumens			(= 140 grs. per oz.)			=350 grs.
3 pints of milk	..	3	,,	,,	(= 13	,,	,,	)=787 ,,
15 ozs. of potatoes	..	2	,,	,,	(= 8	,,	,,	)=126 ,,
16 ozs. of fruit	..	2	,,	,,	(= 8	,,	,,	)=137 ,,
								1,400

I may say that I have several times taken the above diet of cheese, milk, potatoes, and fruit for some months with very good results, and should recommend it for those who suffer from dyspepsia when on cereal foods and bread, or as a change from these. It is convenient for people who desire for a time, either at home or while travelling, to be almost independent of cooking, because except for potatoes, and occasionally a little stewed fruit, almost no cooking is required, and raw fresh fruit can be substituted for potatoes and cooked fruit if necessary.

It is also a diet that does pretty well for children, who are often fond of fruit and vegetables, and as they would rarely require more than some 1,200 grs. of albumen, the cheese could be reduced to 1 oz. or less in their case.

Some may be able to take more than the above quantities of potatoes and fruit, and then the milk could be slightly reduced, as 3 pints is rather a large quantity of fluid, especially in cold weather and for those who are sedentary.

My own experience is that I can take 2½ or even 3 pints of milk quite well in summer, especially if

not sedentary; but 1½ pints are enough in winter and for a more indoor existence.

Others, again, are possibly able to take more than 2½ ozs. of cheese and can reduce the milk while increasing the cheese; and those who get on well with nuts or dried fruits may considerably reduce either cheese or milk, replacing them by one or both of these as mentioned with regard to Table I.

Such are some of the chief modifications of the diet, but it is obvious that it can be altered in an almost endless variety of ways, and those to whom few foods come amiss and who have good digestion, can have a different diet, or at least a considerable change of food, every week throughout the year.

There are some people, however, who do not take kindly to any of these foods and who are in a very poor way, feeble and dyspeptic; with these any of the above modifications of diet may be difficult, and for a time even impossible.

They cannot drink milk, or greatly dislike it; they cannot digest cheese, and can eat but little bread, and so on through the whole list; there is practically nothing but meat, fish and eggs which they like, and there is but a poor appetite even for these.

With such people it is best, I think, to improve

the general health, and get up an appetite by tonics and change of air before altering the food at all, and the meals, if too frequent, may be spaced and reduced to three, two, or even one in the day.

Or in some cases food may be altogether withheld for some days till there is a decided appetite, as recommended by Dr. Dewey (previous reference), and when a good appetite for ordinary food appears, some of the flesh food of the old diet may be gradually replaced by equivalent value in milk, cheese, or bread, and one meal at a time can be changed, with such interval between the changes as may be required.

To put a debilitated and dyspeptic patient suddenly on a diet which is not relished, and may not be digested, is, I think, at best rash, and may even be somewhat dangerous.

I believe that, with care, patience and determination, these initial difficulties can generally be overcome, especially when the fear of serious or painful disease furnishes some *vim a tergo*.

But even in those who get over the initial difficulties, dyspepsia may now and then cause some more or less decided trouble, and I, therefore, mention shortly what have appeared to me to be the chief causes.

Too much albumen, especially in the form of milk and cheese, to which the patient is not accustomed.

Bread is a better and more reliable food, and its bulk generally prevents its being taken in too large a quantity.

I say this without prejudice to my previous remarks in favour of milk and cheese, for practically everyone has to find out for themselves the form of uric-acid-free diet that suits them best.

Too great bulk of food (fruit and vegetables), especially in those accustomed to foods of small bulk, such as meat, fish and eggs.

For this trouble, food may be reduced, at least for a time, to little besides milk, cheese and bread stuffs, the more nourishing and important foods; and vegetables and fruit should be taken only after the former have been eaten in sufficient quantities.

Too much fluid. It should, I think, be a rule with all who go on these diets never to drink when not thirsty, for those who do so tend to have a dilute and watery condition of the blood, and this entails a more or less dilute and watery condition of the digestive secretions poured out from the blood.

Such secretions will act slowly and inefficiently, and more or less fermentation and putrefaction will, meanwhile, be going on in the food masses, resulting in the formation of gases, acids, and decomposition products.

Too much sloppy and pultaceous food, especially

starchy food. This I have already referred to, in pointing out the importance of taking starchy foods as dry as possible. For if such foods are sodden with fluid, the salivary digestive secretion obviously cannot very easily get into contact with its starchy particles, or can only do so slowly and after more or less dilution.

It is certainly a fact that, under some conditions, the disuse of bread and milk, porridge, and milky puddings, and their replacement by toast, biscuits and oatcake, eaten dry or with a little butter (the milk being taken only apart from or after them), may make all the difference between troublesome flatulent dyspepsia, distension and discomfort, and their absence.

It is for these reasons that it is often advisable not to take more milk than one and a half pints in the day, especially in cold weather, and when sedentary; and also not to mix that milk with starchy foods into slops, porridges and puddings. Those who suffer from flatulent dyspepsia should carefully bear these points in mind.

There is no harm in drinking when thirsty, for thirst means that the blood is concentrated and in want of fluid, and Nature will not ask for more than she wants, but there may be great harm in taking fluid by rule or order, and apart from thirst; and it may even make all the difference between

success and failure with the diet. On a meat diet it is possibly necessary to drink considerable quantities of fluid to wash out the poison, though I have mentioned in "Uric Acid" some facts which throw considerable doubt on its utility; but when uric acid is not swallowed it need not be washed out, and to take excess of fluid not only causes dyspepsia, as above mentioned, but may raise the blood pressure, thus making all high blood pressure diseases worse, and even dilating the heart as well as the stomach. In fact, I regard the washing-out idea as one of the most harmful and unphysiological suggestions ever made in clinical medicine; the water practically never increases the elimination of uric acid, but frequently and greatly increases the circulation trouble and suffering.

Deficient mastication, especially in the case of bread stuffs, which are largely digested by mixing with the saliva, is an undoubted cause of some dyspepsia, and Mr. Horace Fletcher has suggested in an interesting little book, "Glutton or Epicure,"[1] that we should all gain by masticating our food till it ceases to taste, swallowing more or less unconsciously the fluid parts and rejecting those hard parts that become tasteless before they are fluid.

There is undoubtedly sound physiology behind

[1] Herbert S. Stone and Co., Chicago and New York, 1899.

this suggestion, and though I see no proof that it has as yet enabled anyone to live on less than the physiological allowance of albumens, I believe it does something to cheat the intestinal microbes, lessen putrefaction and diminish the odour of the fæces; thus rendering digestion more complete and efficient.

Too frequent food. It is a remarkable fact that those who take meat require to be fed more frequently than those who live largely on cereals; and this is due, as already mentioned, to the fact that meat is a stimulant quickly digested, absorbed and worked off; while cereal food is more slowly assimilated, and gives over a series of hours a constant steady supply of albumen, force and urea.

But on relinquishing meat frequent feeding need not be continued, and those who continue it will be more liable to dyspepsia than those who are content with two or, at most, three meals a day.

I frequently see people who take as many as six to seven meals in the twenty-four hours, that is to say, they take three or four chief meals and two or three intermediate meals of milk, &c., between these. They learned this habit on the old diet, and continue it on the new, under the impression that much food is necessary to maintain strength, but the common result of such overfeeding is dyspepsia and debility.

The preservatives mixed with milk may undoubtedly be another cause of dyspepsia. These have possibly but little influence when it is only taken in small quantity in tea, and yet may produce more or less serious effects in those who drink it in the larger quantities advised in the tables of this book.

I have made some experiments with borax myself, and the utmost dose I could take, even for a short time, without producing symptoms of gastro-intestinal dyspepsia, was 30 grs. in the day.

I therefore advise those who can eliminate other causes, and yet find dyspepsia associated with milk or any foods with which preservatives are mixed, to make a special effort to obtain these foods free from such preservatives, and notice whether the symptoms then subside.

Another cause of flatulence and dyspepsia especially affecting the digestion of bread stuffs is excess of acid or deficiency of alkali in the intestines or their digestive secretions. The cause of this may be the taking of excess of acids in such things as fruit, fruit juices, and acid drinks, or it may arise from deficient excretion of acids from the body, as in those who check the excretion of perspiration from the body by exposing themselves to cold with insufficient clothing.

Some who suffer from flatulence are unable

to take acid fruit, or even any fruit at all with their bread stuffs, but they get on much better if they take potatoes, if they clothe themselves very warmly, and if they take occasional doses of alkali, such as bi-carbonate of soda.

Some must reject fruit while they are sedentary and in cold weather, but can take it in hot weather or while taking much exercise and getting warm; and it is a good rule for most people to increase potato in cold and fruit in warm weather, in fact to eat things in season.

In all these diets, butter and oil may be freely taken with cereals and vegetables; they are merely left out of the Tables because they contain no albumen or nitrogen, but these and the starches are amply provided for in the diets.

It is, I think, common experience that butter and oil can be much more freely taken on a meat-free diet than on one containing flesh, and it is at least probable that the influence of uric acid in the blood, hindering, as it does, circulation, digestion, metabolism and combustion, has something to do with this. Certainly the digestive, hepatic, and other disturbances that accompany bilious attacks and sick headaches are due to the circulation effects of uric acid, and disappear with this cause.

Though the action of butter and oil in the

production of force is probably indirect, and for the most part unimportant, they are amply provided for, and the assimilation and metabolism of fat is distinctly facilitated when it forms part of a uric-acid-free diet.

I may note in passing that the diet of milk, cheese, potatoes and fruit is that which seemed to best keep the urine clear and free from deposits of urates or red sand; and this was no doubt due to the amount of alkali in the potatoes and of similar salts in the fruit, as well as to the absence from milk and cheese of salts, such as those contained in meat and cereals, which tend to raise the acidity of the urine.

Thus I have pointed out in "Uric Acid" that the ratio of acid excreted in the urine to urea excreted at the same time is, on a diet containing some fish and eggs, 1-6·3, *i.e.*, 1 grain of acid to 6·3 grains of urea. While on a diet such as that in Tables I. and II. it is 1-7, or between 1-7 and 1-8, and on a diet such as that in Table III. it tends to be about 1-9, or between 1-9 and 1-10, and with this the urine is generally quite clear.

It will be understood from what I have said in "Uric Acid" that this is not so much a matter of the quantity of uric acid excreted, as of its solubility in the urine after excretion, though no doubt both are affected by acidity, and a deposit of red

sand in the urine is the index of deficient rather than (as is so commonly supposed) of excessive excretion from the body.

But it may be of some interest to those who are worried about these deposits in the urine of their patients to know that by such diet as the above, which diminishes the relative acidity of the urine, they can be prevented. Those also who are very sedentary should be careful (especially in cold weather) to take no more albumens than are required for strength and nutrition, as acidity rises with urea, and under these conditions it may suffice for a time if body weight is multiplied by 8 in place of 9. With reference to the relatively high acidity of the urine with the diets in Tables I. and II., I think that some part of this must be credited to the bread and cereal foods which are well represented in these Tables, but are completely absent in Table III.; for if we look at the analysis of a cereal, such as barley, we find that it appears to contain a considerable excess of acids.

Thus I see[1] that the ash of barley contains 34·9 per cent. of potash, soda, lime and magnesia, and 61·6 per cent. of phosphoric, sulphuric, and soluble silicic acids, and if wheat and oats have any similar

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[1] In "A Text Book of the Science of Brewing," Moritz and Morris. 1891. P. 75.

excess this will easily account for the relatively high acidity of the urine on the diets of which they form a part.

These cereals often tend decidedly to raise the acidity of the urine, and when taken in quantity over a length of time, especially in cold weather, they may not only do this but also diminish the alkalinity of the blood; hence they tend to cause some retention of uric acid in the body, and, acting with other causes, may even lead towards gout and rheumatism.

Thus horses suffer considerably from rheumatism probably when given too much dry cereal and too little fresh vegetable; they also are very often exposed to cold and wet, and all these things tend to diminish alkalinity of blood.

Arthritis, both in men and horses, can be treated by increasing and maintaining the alkalinity of the blood. This may be done by eating vegetables that contain alkali, such as potatoes, and by diminishing the albumens taken till they are well within physiological limits, for diminution of albumens diminishes the formation of acids in the body, and it is the overfed, both among children and horses, that suffer most from rheumatism. Fond and foolish mothers imagine that children must be fed up: but a little wholesome starvation, with plenty of vegetables, is much more likely to pre-

vent the dreaded disease; but most children who suffer are poisoned with uric-acid-containing foods in addition to being overfed, and horses in hard exercise often get from two to four pounds of beans a day, which means an introduction of from 30-60 grs. of xanthin.

With reference to pulses (peas, beans and lentils), it will have been noticed that they are now omitted in the tables of foods, and this is due to the fact (of which I have given full details in "Uric Acid," p. 856, and fig. 75) that I found out they actually contain even more xanthin than many kinds of animal flesh, and are, therefore, like flesh and alkaloid-containing vegetable substances, such as asparagus[1] and mushrooms, to be regarded as poisonous.

I should now be inclined to consider that the rheumatism met with among vegetarian natives of India is not so much due (as I previously suggested) to excess of cereals with deficiency of fresh fruits and vegetables, and exposure to cold at night, &c. (as in the case of horses), though no doubt all these things have some contributory effects, but rather to direct and considerable intro-

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[1] With regard to asparagus, see paper on "The Human Body as an Analytical Laboratory," in the *British Medical Journal*, October, 1901.

duction of uric acid or xanthin in the pulse foods which so many natives use to a large extent.

I believe it will turn out on investigation that in those parts of India where rice and fresh vegetable substances form the staple foods, not only rheumatism but uric acid diseases generally are little known, whereas in those parts where pulses are largely consumed they are common—almost universal.

I have noticed, much to my astonishment, a passage in "Human Physiology," by J. H. Raymond (W. B. Sanders, London, p. 128), in which he quotes from Dr. Alanus, a vegetarian, the assertion that a vegetarian diet causes atheromatous degeneration of the arteries.

In the passage referred to some very sweeping conclusions are drawn from very obscure premisses.

The teaching of Pathology shows, I believe, quite clearly, that atheroma of the vessels is always associated with pressure and strain, and of late years I have come to regard uric acid as at least the chief cause of such vascular pressure and strain.

Now in the quotation above mentioned, vegetable foods are spoken of in the mass, and no attempt is made to distinguish between such useful foods as the bread stuffs and such poisons as the pulses, so that it is at least open to us to suspect that the terrible results credited most loosely and

inaccurately to vegetarian foods in general, are really due to the uric acid contained in the pulses, mushrooms, asparagus, tea, coffee, &c., which are still constantly taken by almost all vegetarians.

In one passage, however, it is said that "The naval surgeon, Treille, has seen numerous cases of atheromatous degeneration in Bombay and Calcutta, where many people live exclusively on rice."

I believe a careful investigation would show that there are really no such people, for my enquiries point to the probability that all natives of these places add other vegetables to their rice, and only too often the cheap and poisonous dal. In my own experience some of the most terrible cases of high blood pressure and vascular degeneration I have ever seen, have been in dal-consuming natives of these Indian provinces.

The suggestion also made that vegetable foods cause chalky degeneration of the arteries by introducing mineral salts into the blood, is one of the most puerile bits of physiology it has ever been my lot to meet with. How terrible then must be the fate of those who pay frequent visits to the mineral spas of Europe, especially to those, too numerous to mention, which are rich in lime salts ?

I must refer those interested in these points to what I have said on the matter in "Uric Acid,"

p. 218 *et seq.*, this not being a work on pathology; but bread-eaters have in my opinion no reason to frighten themselves over any such physiology.

A similar investigation in Australia and New Zealand would, I believe, trace to the excessive use of flesh and tea an equally long array of serious or deadly diseases, and an almost equal number of mental or moral defects, which only a complete reversal of their present diet habits will render visible by contrast.

In this country, also, I should attribute to the effects of flesh and tea the all-pervading anæmia, which, as seen in London, cannot be due to want of oxygen, since it is equally to be seen in country towns of only half a mile radius; in the same way many mental and moral obliquities are no doubt due to the obstructed circulation of poor blood loaded with these poisons (see "Uric Acid," pp. 401 and 873).

These diseases have crept over us so gradually that we quite fail to recognise the full extent of our loss; and even in my own case I should formerly have said that, apart from headaches, I had good mental and bodily health on meat and tea, because I knew no better; whereas I should now say I have in both directions 50 per cent. better health without them.

I have so often been asked about the structure of

man's teeth in relation to his diet, and such great and widespread ignorance of comparative anatomy

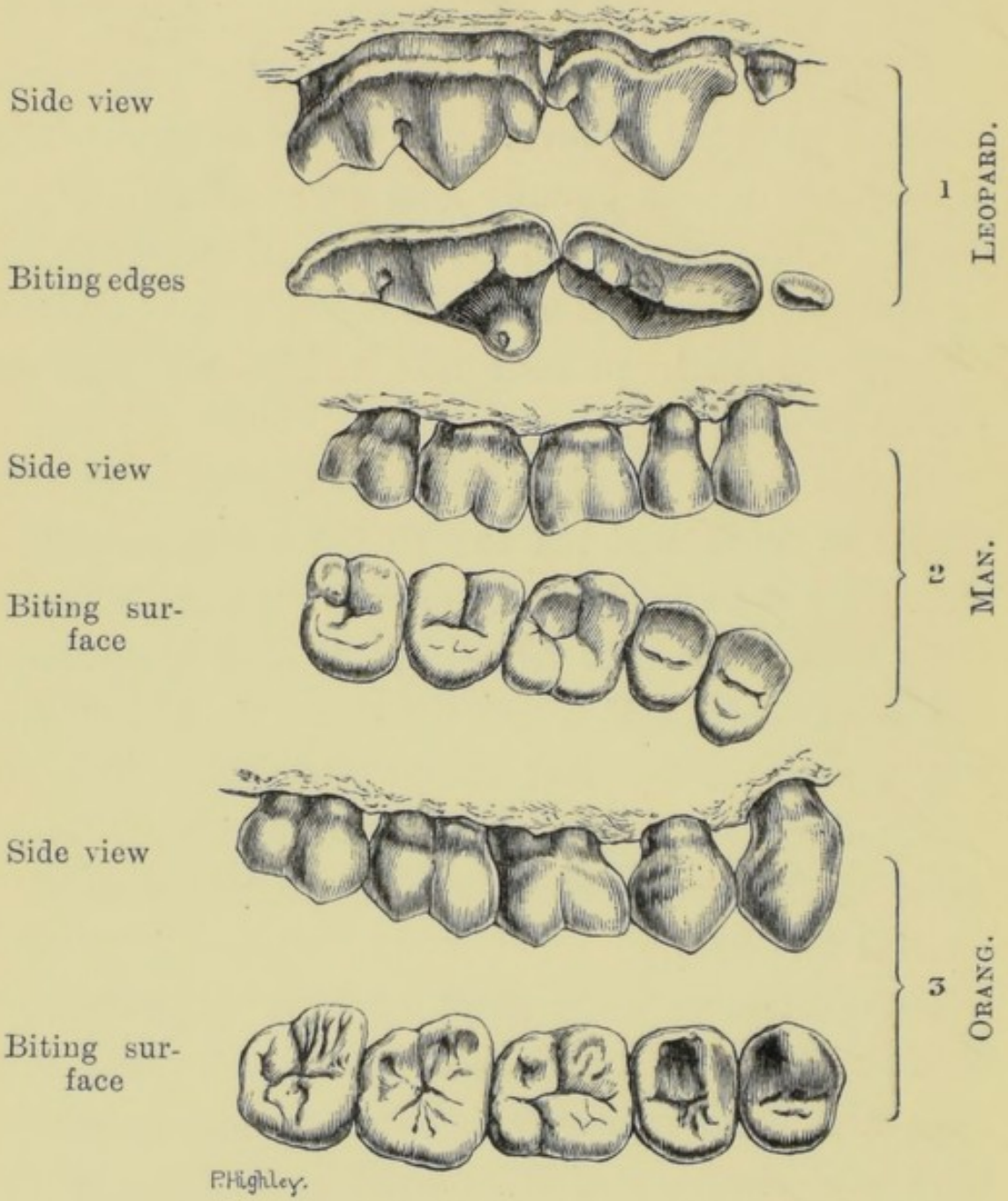

Fig. 6.—Teeth of a Carnivore, a Man and a Frugivore for Comparison.

has been shown by questioners, that I now give two figures which I shall to a large extent leave to speak for themselves.

Fig. 6 shows that the crown of the carnivorous tooth is a knife edge, while that of the frugivorous tooth is a surface, and fig. 7 shows the impression which each set of teeth makes on a piece of model-

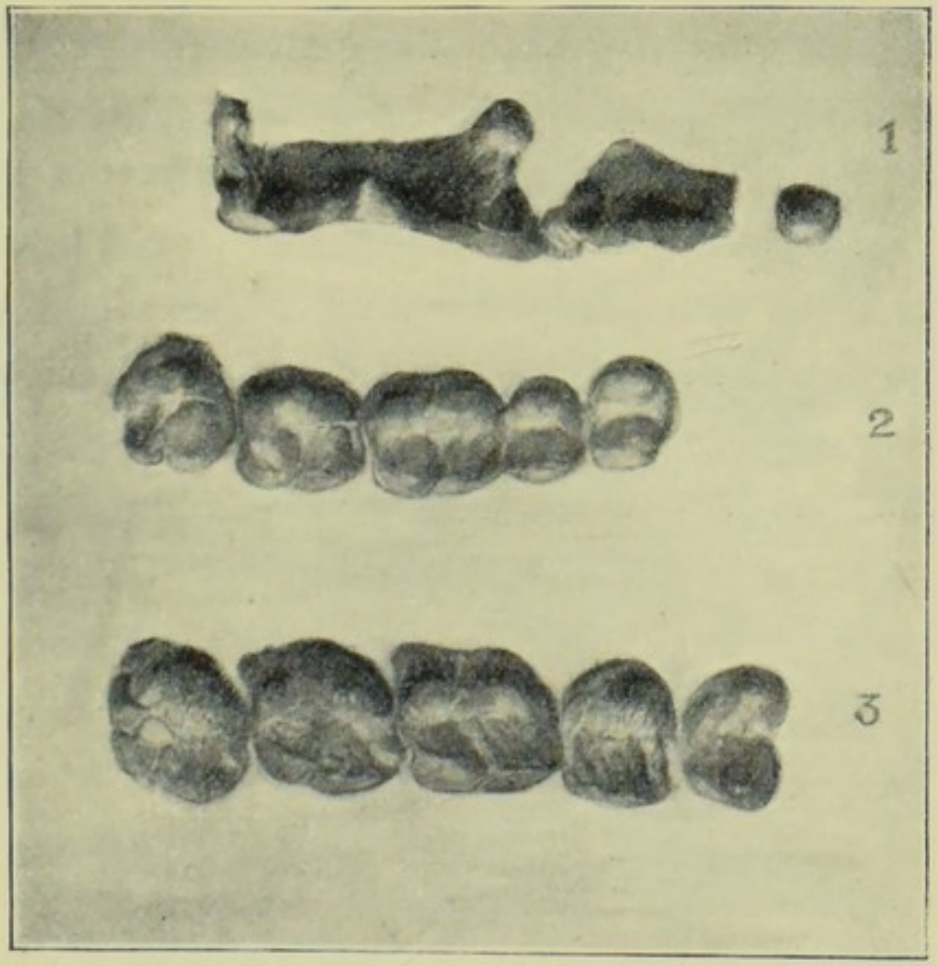

FIG. 7.—Photograph of the impressions made by the same Teeth on a piece of modelling wax.

ling wax, and here again we see that the carnivore's impression is a cut or gash, the dark central parts of the impression (1) being the deep incisions made by the cutting edges and points of (1) in fig. 6, while

that of the frugivore is a print or impression like that of a seal or stamp.

I have also referred in "Uric Acid" (p. 83) to the difference between man and the carnivore with regard to the relation between the excretion of acids and of urea in the urine, and from the facts there given it is evident that human metabolism differs very widely indeed from that of the latter. If we may draw any conclusion from this difference it might be inferred that man would be much more likely to get gout and rheumatism from eating meat, than the carnivore from eating what is his natural food.

In a word, man is provided neither with the teeth to cut flesh, nor the power to hold its poisonous salts in solution and pass them out of his body; whilst the carnivore is provided with these powers to a very considerable extent.

If man imagines that a few centuries, or even a few hundred centuries, of meat eating in defiance of Nature have endowed him with any new powers, except, perhaps, those of bearing the resulting disease and degradation, with an ignorance and apathy which are appalling, he deceives himself; for the record of the teeth shows that human structure has remained unaltered over vast periods of time.

For the benefit of some who may see mountains

of difficulty in details, I will now give an outline of a day's food on the uric-acid-free diet.

For those in good health three meals a day, breakfast, lunch and dinner, are ample; some even do better with a light breakfast or none—this latter course being specially indicated where there is little or no appetite for a morning meal (see Dr. Dewey's works, referred to in chapter i.).

I may say, also, that simple food of not more than two or three kinds at one meal is another secret of health; and if this seem harsh to those whose day is at present divided between anticipating, preparing their food, and eating it, I must ask them to consider whether such a life is not the acme of selfish shortsightedness.

In case they should ever be at a loss what to do with the time and money thus saved from feasting, I would point on the one hand to the mass of unrelieved ignorance, sorrow, and suffering, and on the other to the doors of literature, science and art, which stand open to those fortunate enough to have time to enter them; and from none of these need any turn aside for want of new kingdoms to conquer.

Be that as it may, the best health, strength, and nutrition are not to be obtained by waste of time and money on elaborate food, for, the simplest things are all that are really required and accepted by Nature.

If we take then, Table I., breakfast (before which an hour or an hour and a half's work, if possible in the fresh air, is no drawback) may well consist of oatmeal (2 ozs.) cooked in the form of porridge, with ½-¾ or 1 pint of milk, and this may be followed by some toast or bread (2-3 ozs.) and butter, with or without marmalade or jam. These are the staple foods for breakfast, and should be taken first, and if, when they have been consumed, some appetite still remains, any fresh fruit, or dried fruit in winter, may be taken.

I must say, however, that those who are specially anxious to have a free excretion of uric acid should not take much acid fruit at breakfast, or should divide their attention between such acid fruits and potatoes (which contain much alkali), so that the alkali may more or less balance the acid

For those who are not compelled to be specially anxious about excretion, and who do not suffer from any active gout or rheumatism, fruit at breakfast is probably not hurtful, and acts as a slight tonic and stimulant.

As variations of this diet bread and milk may be substituted for porridge; the oatmeal may be taken as oatcakes, and scones or any other cereal of equivalent nutrition value and quantity, may be substituted for it in any desired form. In this way it is possible to have a new kind of cereal

every morning of the week, or even every morning of the month.

These are all homely foods, to be found in nearly every household or nearly every baker's shop, and their cooking, therefore, presents no insuperable difficulties.[1]

As to fruits in winter; apples, oranges, bananas, figs, dates and various kinds of plums generally afford sufficient variety, and in summer and autumn there are endless fresh fruits to take their place; for though, as is seen in the Tables, many fruits and vegetables have but little direct value as nourishment, a moderate daily supply of these things conduces in many ways to the attainment of the best health, strength and nutrition. On the other hand, the foods to live upon are bread, milk, cheese, and nuts, and of these bread is the most reliable, and those who cannot take and digest a sufficient quantity of one of its many varieties are indeed unfortunate.

Lunch, which is often with advantage the best meal of the day, can begin with some vegetable soup made with milk; this may be like ordinary

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[1] Those who want a guide as to the quantity of each article, and also hints as to the cooking and preparation, will find much useful help in small compass in Mr. A. Broadbent's "Science in the Daily Meal," to be obtained from him at 19, Oxford Road, Manchester, price 4d., free by post.

potato soup, the meat or bone boilings simply replaced by milk, which is much more nourishing; or the same preparation may be used with some of the other kinds of vegetable.

Next course, potatoes, with milk, oil or butter, and the cheese (1½ ozs.) taken with them.

Several ounces of bread, toast, or biscuit should also be eaten with the soup and the potatoes and cheese; the soup and potatoes being the sauces, the bread stuffs and cheese the foods.

A dish of rice, macaroni, barley, or other cereal may be substituted for the potatoes and part of the bread.

I look upon good olive oil as a valuable substitute for butter. It is specially nice with vegetables, and may be eaten with many of these, besides the salads for which it has so long been used. It is useful also in cooking vegetables, and many get to like it so much that they give up the use of butter; others prefer it only now and again as a change. It is necessary to get it good and fresh, when it is free from all strong and objectionable taste.

These are the chief items of nourishment at lunch, and should be taken as a first charge on the appetite; the less nourishing potatoes and garden vegetables must not be allowed to oust the more nourishing cheese, bread and cereals; the sauces should not encroach on the foods.

The following experience may illustrate my meaning. One autumn day a party of cyclists were riding, and finding in the middle of the day that it was extremely hot and that there were a large number of blackberries at the side of the road, they spent half an hour in eating the fruit. This was about 12.30 or 1 p.m., and when it came to their ordinary lunch time, 2 p.m., none of them had much appetite as they were digesting the blackberries; the consequence was that a poor lunch was made.

The blackberries, however, containing very little albumen and the supply at lunch being deficient, at about 5 p.m. they were all short of albumens and force, and had to call a halt for more food to enable them to continue their ride, while as a rule no food was required from the 2 p.m. meal till 8 or even 8.30 p.m. This is pretty much what is done by those who fill themselves with the almost valueless vegetables and fruits, leaving the bread, milk and cheese to the last; they have then but little appetite, and, unless they eat by measure, either do not take enough, or get dyspepsia from excess of bulk.

The rest of the meal may consist of milk pudding (to be taken not as a slop, but cooked till it is firm and solid, and not, of course, containing any egg), tart, or stewed fruit, the cereal in the pudding

making up for any deficiency in the oatmeal or cereal taken at breakfast, and last, the nuts, with fresh or dried fruit to any required extent.[1]

If lunch is a good meal eaten with appetite, nothing but a drink of water, or aerated water with fruit juice in summer, will be required till 7.30 or 8 p.m., when all that remains of the milk and bread should be taken with some more potato or other vegetable, butter or oil being always allowed *ad lib.*, except to those who are too stout.

These may be followed by junket, or stewed fruit with cream (the latter being only equivalent to butter or oil, and the junket taking the place of some of the milk), and these, as usual, by fresh fruits.

When a meal such as lunch has to be taken out of doors and away from home, the cheese can be made into sandwiches; either being cut in slices or grated for the purpose with the addition of pepper or mustard, if liked.

Similar sandwiches may be made with various vegetables, such as mustard and cress, lettuce, beetroot, cucumber, or tomatoes.

In this way the chief ingredients of the lunch can

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[1] If nuts are taken in larger quantity than that mentioned in Table I., they should be given an earlier and more important place in the meal, and indeed, may be better digested if taken before the meal and by themselves.

be supplied, and milk, aerated waters, and fruit will complete it.

A similar lunch, quickly provided and easily carried, may consist entirely of biscuits, with more or less butter, some cheese and fruit.

What I shall say about stimulants, presently, of course applies to all alcoholic beverages ; milk, water, aerated waters and fruit juices are the best drinks ; but cider, when made from the pure juice of fruit, has little in it that need be objected to, and many nice drinks for hot weather can be made from lemons, apples, raspberries, &c.

Another point is (and this applies to drinks, fruit, vegetables, and all kinds of additional foods), that nothing must be taken that interferes with digestion or upsets the stomach ; otherwise digestion may come to a standstill, there will be no rise of urea as in fig. 1 at 3 p.m., and no increased power of working and force production, no matter how nourishing and rich in albumens the foods taken may be.

Very acid fruits, tough or sour vegetables, a glass of raw spirits, or a strong pipe or cigar, or an ice after food, in those not accustomed to them, sometimes act in this way, and either cause nausea and the entire loss of the meal by vomiting, or at least suspend digestion, the absorption of albumens, and the production of force for some hours, more or less.

Thus, a boy of 13, out with a shooting party and having lunch with them, was given whisky after it, with the result that he presently brought up his whole meal. The wine had been forgotten, and as it was thought the boy must have something other than pure water with his lunch (crime that such should ever be thought), he was given whisky, to which he was not accustomed, in its place, and this acting as an irritant to the stomach (as shown to a minor degree in "Uric Acid," fig. 67), first stopped digestion and then produced the above result.

This is, of course, not intended to be a work on cookery, and what I have said above has been with the intention of indicating a few directions in which others may exercise their knowledge and ingenuity, and of removing perhaps some of the worst uncertainties from the paths of those whose knowledge lies in different directions.

Gluten can be made into palatable biscuits by mixing it with half its weight of butter and a quarter of its weight of sugar, though if the gluten is very pure some flour should be added or the biscuits will be too hard; or gluten may be mixed with the porridge or any milk pudding, &c., without its presence being obtrusive.

It is difficult to give exact rules for the feeding of children; such rules requiring constant revision, since the rate of growth alters considerably with

their age. But practically any child who takes 1½ to 2 pints of milk a day, and has the offer of plenty of bread, biscuits, puddings, and some dried fruit with a little fresh fruit and vegetable, will not starve. The weight must be watched to ascertain that it rises steadily, and the colour of the gums to see that it remains somewhere about the highest standard by the colour card (see "Uric Acid," 6th Edition, chapter xii.).

Later on, when the child is strong and well nourished on this diet and the teeth are all in place, small quantities of nuts (such as chestnuts, walnuts, pine kernels, and pounded almonds) may be gradually given under close observation.

As the permanent teeth make their appearance, nuts and fruit can be increased, and milk and bread stuffs gradually diminished, till a diet of nuts and fruit only is attained with the development of the wisdom teeth.

On this system children begin with milk, they get gradually to a mixed diet of bread stuffs, vegetables and fruit, and eventually to a nut and fruit diet as the teeth required for these come into place.

At 13 or 14 a child may be fed largely on nuts and fruit, but only using the more digestible nuts, and from 17 onwards might be entirely frugivorous,

taking all kinds of nuts, since the teeth necessary for their mastication are now available.

Of course some children may for various reasons do better on nuts and fruit with a little bread and even milk, but all should try to reach the frugivorous diet and be guided by results.

With regard to the convenience of these diets when away from home, it is only necessary to ask friends to provide a pint of milk and the offer of cheese twice a day; for, given 2 pints of milk and 2 ozs. of cheese, there is practically certain to be enough bread, cereals, vegetables and fruit in any ordinary diet to make up the rest.

Indeed, it often seems absurd, considering the very small amount of daily nourishment that really comes from flesh, and remembering how much is (on all diets) already obtained from cereals, vegetables, milk, nuts, and fruit, that people should suffer from so much fear of failure of strength and nutrition in giving up the former source of nourishment. If this fear is justified at all, it can only be so by the dense ignorance of the value of foods which is almost universal.

As regards cost in London, the diet in Tables I. and II. is cheaper, and that in Table III. dearer: in fact, this latter is quite as expensive as an ordinary flesh diet, and may easily be made more so by using fruits and vegetables without regard to season and cost.

On the other hand, the diet in Tables I. and II. is cheaper than an ordinary flesh diet, and may be made still more so if bread stuffs and potatoes are chiefly used, or if cheap fruits only are taken. Probably 7d. or 8d. a day would then cover everything.

But this is not by any means the cheapest form of diet, since it is possible to live on bread and fruit for 5d. per day. Thus we shall get 2 lbs. of bread for 2½d., and ½ lb. of dates for 1d., and there is 1½d. still left for nuts and fruit. Of course these things must be bought in quantities sufficient for a week or more, if good quality is to be obtained at these prices ; and further saving may be effected by buying flour and making bread at home. Or if a more varied diet is wanted : 1½ lbs. of bread stuffs (viz., 8 oz. of bread, 8 oz. of biscuit, and 8 oz. of pudding), 4 oz. of dried fruit and 4 oz. of almonds, or 8 oz. of chestnuts will supply about 1,300 grs. of albumen a day ; a quantity sufficient for any man of average size. These can be obtained at a daily cost which is little above what working men often spend on stimulants alone.

It seems to me that this question of cost is of great importance, as the power of providing food always in the end controls the possibilities of life.

Many nations (as their under-nourished poor demonstrate) have already multiplied up to the food supply limit.

Yet the food supply is not limited by any barrier but ignorance; and with the diappearance of ignorance it will become possible to multiply further, and with more power and wiser co-operation to obtain much better terms from Nature both as to food supply and in other directions also.

Ultimately the problem of cheap living controls the existence of the nation as well as of the individual.

Such nations as our own, spending vast sums on stimulant poisons, cannot hope to survive even if the poisons themselves were less injurious than they are.

It is demonstrable ("Uric Acid," pp. 336 and 875-878) that stimulant poisons would never have gained their present position if unnatural foods had not opened the door, and that where these foods are rejected, the stimulants soon follow.

Therefore it becomes evident that DIET is the greatest of questions for the human race, for not only does his ability to obtain food determine man's existence; but its quality controls (see pp. 22 and 29) the circulation in the brain, and this decides the trend of being and action, accounting for much of the difference between depravity and the self-control of wisdom.

However far the eye can range over the past,

there is no iota of evidence that the laws of Nature have altered their working by the fraction of a hair's breadth. The path of self-indulgence has always led to decay and extinction, while that of abstinence and self-control opens upon the possibilities of a mighty evolution. And the nature of man's food largely determines which path he will follow.

There is thus much hope for the regeneration of the race, for its present plight is the result of unnatural feeding; in a word, of food poisoning, and since the cause can be removed the result can be reversed while there is yet time.

The question then arises: Are men whose faculties are obscured by a pernicious diet capable of realising the danger and avoiding it?

Diet of Training and Athletics.

Those who take an unusually large amount of exercise require an extra allowance of albumens to produce extra force, and it may be gathered from the researches which I have already published in (pp. 379 and 403) "Uric Acid," that for cycling exercise and my own body, the urea produced is proportional to the distance traversed; that is, to the work done, being about 1 to 1½ grs. of urea for a mile, or from 3 to 4½ grs. of albumen for a mile; and as my weight is about

125 lbs., this gives from ·024 to ·036 grs. of albumen per lb. per mile.

And if we take it that from 75 to 80 miles is as much as I am likely to do in this line of exercise on any given day, and that 125 × 9 is my ordinary allowance of daily albumens when sedentary = 1,125 grs., then 125 × ·03 (which is half way between ·024 and ·036) and the result multiplied by 75 = 281 grs. of albumen extra, and this added to 1,125 = 1,406 grs., say, 1,400 grs.

In other words, I must add to the diet of sedentary life the equivalent of 2 ozs. of cheese, or a pint of milk, to enable me to perform daily the above amount of exercise.

If I did not provide the proper amount of albumens, I should either collapse under the exercise and training and fail to produce the required amount of force, or I should take the necessary albumens from my albumen reserves, or from the body tissues as far as they could supply me, and so lose weight and break down when they came to an end.

I have known people who have attempted to produce considerable amounts of force while living on a diet of cabbages and potatoes in insufficient quantities with little or no milk and cheese, and the result has been a breakdown during exercise and afterwards, resulting in prolonged debility,

with considerable cardiac and general muscular failure, and a marked loss of body weight. No doubt the weight lost would have accurately corresponded with the amounts of force and urea produced.

I do not mean to say that the above figures and quantities hold good for every one ; I give them because a rough guide is better than none, and to show the way in which my experience has led me to the belief that nothing comes out of nothing, and that without the necessary quantity of albumens no force can be produced.

Practically, a man who requires about 1,200 grs. of albumens per day for ordinary work will want about 1,400 grs. for training and the hardest exercise he is capable of doing, *i.e.*; he must add about one-sixth to his ordinary diet.

To supplement these observations it may be said that, if the day's work is not done easily and without anything approaching exhaustion, an increase of albumen is required, and should be tried to see if it produces improvement.

It is a good rule to take nearly the calculated quantity of albumens in the form of milk, cheese and bread; and then, if on account of increase of exercise there is increase of appetite, let the useful but not strong foods, such as rice, bread, potatoes and fruit, be eaten to the desired quantity.

If the increased appetite is sated on such concentrated food as cheese, too much albumen may be taken and this cause dyspepsia and upset the course of training.

During severe exercise, milk is probably the best food to take; its digestion, as we have seen reason to believe in fig. 2, proceeds quickly and its albumens are soon available for the production of force; this, I believe, agrees with the common experience of athletes.

Milk is easily and quickly swallowed during a temporary halt, but if time is available, it should be taken in sips. In this way it will be more quickly and satisfactorily digested, for if any quantity above half a pint is taken in a draught it tends to form large masses of curd, which not only are slow and difficult of digestion, but by their bulk may more or less seriously interfere with respiration and circulation.

Another way of treating milk is to mix it with oatmeal, or a little dilute gruel, or barley water, which not only improves its chances of satisfactory digestion but increases its nourishment value.

Cereals are good foods for training, because they give out a steady supply of albumens, force and urea, over a series of hours, and their salts act as stimulants to digestion, circulation and nutrition.

An absolute excess of albumens does little harm

so long as exercise is plentiful, regular, and taken under climatic conditions that favour warmth and perspiration; but under the opposite conditions it may cause high acidity and retention of uric acid, thus leading to rheumatism and other troubles.

It follows from my researches, published in "Uric Acid" and elsewhere, that a diet entirely free from flesh, tea, coffee and similar alkaloid-containing vegetable substances is the best for training and athletics.

As shown in preceding pages, the material (albumen) necessary for production of the required force can thus be had and is lacking neither in quantity nor quality in the foods to be used, while at the same time the enormous advantage is obtained of a free circulation through tissues, nerve-centres and muscles alike, keeping them well supplied with fuel and free from waste products and refuse during their time of trial.

One does not need much mechanical knowledge to see that if power is kept constant while friction is diminished by half (this fact can be made visible even to untrained and unaided eyes by observing the rate of the capillary circulation), more and better work can be got out of the machine.

Hitherto the knowledge we now have has been applied more or less by rule of thumb and yet even thus has achieved some wonderful results.

Some of these I have already recorded in "Uric Acid," and another appeared in an article in the *Daily News* of June 29, 1898. It was from their Berlin Correspondent, and was thus headed, "A Vegetarian Victory—Meat-Eaters Walked off their Legs."

It stated that fourteen meat-eaters and eight vegetarians started for a 70 miles' walking match. All the vegetarians reached the goal "in splendid condition," the first covering the distance in fourteen and a quarter hours. An hour later than the last vegetarian came the first meat-eater, and he was "completely exhausted." He was also the last meat-eater, for all the rest had dropped off after 35 miles of endeavour.

These results, so far as I know, were produced without scientific knowledge and in more or less ignorance of the facts above stated; and if so much has been achieved, how much more may be possible if knowledge is applied intelligently, if we ensure sufficient albumen and force while rigidly excluding the poisons which cause friction in the machinery.

An almost exactly similar illustration of the effects of diminished friction is furnished by the Dresden to Berlin walk of 1902. For this eighteen vegetarians and fourteen meat-eaters started, and ten vegetarians, but only three meat-eaters, came in. The winner (Karl Mann) was upwards of seven hours before the first meat-eater.

The last meat-eater only just got in within the time limit, and was beaten by more than four hours by a man of 59, who had been a vegetarian for thirty-eight years.

In this race the championship of Germany was decided and the winner made two world's records. The proceedings were watched, and the organs and circulation of competitors measured and recorded by a committee of physiologists, for the benefit of the German Government and Army.

A week or two after the race I had the pleasure of examining the winner, who had to a large extent arranged his diet by the aid of previous editions of this book, and as I found that neither his colour nor circulation were quite up to my highest standards, I ventured to prophesy that he would do still better in the future and beat his own records.

His circulation was far better than that of any meat-eater, which to a large extent explains his victory ; and the records showed that his heart was smaller at the end of the race than at the beginning. I have little doubt that the meat eaters who broke down had dilated hearts, owing to obstructed circulation. (See facts about Fatigue in "Uric Acid," chap. viii.)

It is right to mention that the winner had some albuminuria on the day following the race, which shows that even in his condition so great a strain

could not be borne with absolute impunity, and, as I have said above, he was not up to my highest standards.

During recent years most interesting experiments on diet have been made in the United States; some of these demonstrating that soldiers can live well and work hard for many months on milk and cereals, and that in certain cases it may be possible to do this on smaller quantities of albumen than those I have here advised.

But as my results in myself and others were constant over long periods of time (five to seven years), and are in practical accord with the previous results of physiologists, I should not be inclined to alter the ratio of albumen to body weight previously given (pp. 7 and 9) till I had seen men living on a lower ratio without loss in any direction (temperature, colour, circulation) over similar long periods.

Of course those who carry 14 lbs. of adipose tissue (if they calculate this in body weight) will get on with a relatively lower ratio than those who are not in the same case, but my results are calculated for the latter and this must be kept in mind when the ratios are compared.

In my opinion a few more hard facts like these (and plenty more of such records will be forthcoming) will dispel the lingering delusion that

strength and endurance can be attained on no foods but flesh.

The truth is that 50 per cent. more endurance and strength can be obtained from many other foods, and the chief reason for this can now be gauged in a moment by the rate of the capillary circulation of the individuals concerned. This capillary circulation is proportional to the uric acid in the blood (see "Uric Acid," chap. v.), and is therefore slowed and obstructed by the introduction of uric acid in meat.

A point of interest in this connection is recorded by Prof. Dr. Baelz, of Tokio, in the *Berliner Klinische Wochenschrift*, 1901, p. 689 (a reference to which I owe to the kindness of my friend, Dr. W. Veit, of Berlin).

Prof. Baelz made some experiments on vegetarian natives of Japan and after measuring and recording some of their feats of endurance he gave them meat, which they took eagerly, regarding it as a luxury because it was used by the upper classes. After three days, however, they came and begged they might discontinue it as they felt tired and could not work as well as before. The Professor then made some smaller experiments on himself, with the result that he also was sooner tired and more disinclined for exertion when meat was taken.

I cannot agree with his conclusion that man is

omnivorous, but I do agree that splendid power and endurance can be attained on vegetable food, and if Prof. Baelz had measured the capillary circulation on both diets he would have seen the explanation of his results. I believe he is right in saying that the amount of albumen said by Voit to be required is somewhat high, for 120 grammes of albumen is equal to 1,848 grs. of albumen, and, as the figures in this book show, there are not many people who require much more than 1,400 grs. a day. But in my opinion it is absurd to name any definite amount as necessary, for obviously quantity must vary with the weight and activity of the individual.

The Japanese are just now, for many reasons, an interesting people. It seems to be clear that they have great strength and power of endurance, and considerable freedom from rheumatism. It is also noticeable that they possess remarkable mental activity which has displayed itself on the intellectual side in much artistic talent, and on the practical side in the organisation of military power and the development of commerce. And since their diet and mode of life are such as to give them considerable freedom from uric acid, it is not unreasonable to trace many of these advantages to this cause. Indeed it follows, from what I have here and elsewhere written, that they ought logically to

display exactly the advantages which we see them enjoying.

The staple of their diet is rice, which is free from uric acid, and though many of them take with this a little fish it is very little, and the almost universal tea is, I believe, very dilute in comparison with that used in England. Probably their intake of uric acid is thus only one-fifth or one-sixth that of the sedentary Londoner, and their fondness for vegetables and devotion to healthy, outdoor life, their use of hot baths and muscular exercises does not a little to prevent the accumulation of such small quantities of uric acid as they swallow. Hence they are to a very considerable extent free from its accumulation (rheumatism), and from its evil effects on the circulation of the brain and the muscles where it causes mental lethargy and bodily fatigue.

There are thus not a few points in which we could take a hint from our ally with advantage.

I must leave those engaged in practical athletics to test these suggestions and record results ; when once they grasp my points and the great practical gain thus promised I feel sure that they will not be slow to do so. Indeed, as the above and other records show, the thing is already being done, but with a little more scientific knowledge it might easily be done still better.

I would also point out to pathologists that, if I am right, and if the poisons in meat and tea do cause friction (especially vascular friction) throughout the body, it is evident that training and athletics as at present carried on upon a diet containing these poisons must bring a ruinous strain upon the vascular system, especially the heart and large vessels. Speaking as a physician, I believe that more or less serious functional or organic trouble in this system is no rare result of the process, even in the young and presumably healthy, and such signs as palpitation, sleeplessness, dyspepsia, and more or less hypertrophy and dilatation of the heart may be taken as evidence of the fact.

It is quite evident from one of the walking records just given that the meat eater who completed the distance ran considerable risk of doing himself serious injury. On his arrival he had to be given brandy and put to bed in a state of exhaustion, while the vegetarian feeders were little, if any, the worse for their performance.

I by no means wish to assert that men or animals who live entirely on a uric-acid-free diet may not dilate and strain their hearts by over-exertion. Comparative anatomy alone contains sufficient evidence in the moderator band of the herbivorous heart that such a thing is possible; but I do maintain that, for reasons which are clear as daylight,

the meat-eater and tea-drinker is much more likely to do it and to do it badly. He may produce the same amount of force as the man who is free from these poisons, but he will consume a greater quantity of albumen in doing it, and it will be done at a far higher cost in pressure and strain upon all the tissues and organs, so that they will wear out sooner and more frequently give rise to functional disturbance as the result of the treatment to which they are subjected.

A very remarkable record has been published by Mr. E. H. Miles, the well-known tennis champion,[1] who states that altering his diet has not only cured him of several serious or threatening diseases, but has given him 50 per cent. more power and endurance, both in muscle and brain.

His results are the more valuable because being a champion, his performances have been recorded and there is no doubt about his improvement at a time of life when, as he himself points out, he ought to have been deteriorating.

I have discussed some of his records and a few points in which he appears to have misunderstood me in "Uric Acid" (prev. ref., pp. 367, 407, 889), and shall not repeat this. But those who fear

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[1] "Muscle, Brain and Diet." Swan Sonnenschein and Co., London, 1900.

that strength and endurance cannot be attained (to say nothing of being much increased), on a non-flesh diet, should not fail to read his book.

Obesity.—Not only is there no necessity for those who make use of these diets to become stout, but they can easily be modified so as to reduce the obesity of those who suffer from other diets.

Of course if anyone begins on one of the above diets containing two or more pints of milk, and takes cream and butter freely, he may increase a good many pounds in weight even in a month or two.

I mention this specially to point out that such increase in weight, if due to fat, is no proof of satisfactory nutrition, and does not demonstrate a due quantity of albumens daily consumed. Under these circumstances the only proof that the supply of albumens is sufficient is a more or less constant feeling of abundant strength, with ample powers of endurance; which, by the way, are almost never met with in those who are too stout.

Stout people have in my experience very often decidedly high blood-pressure, and it is at least probable, as I have elsewhere suggested, that the cause of the high blood-pressure, namely, collæmia and defective capillary circulation, is also the cause of the obesity.

Defective or obstructed capillary circulation

produces on the one hand high blood-pressure, and on the other deficient metabolism or combustion in the tissues (see "Uric Acid," prev. ref., p. 866), one effect of which may, under certain circumstances, be an accumulation of uncombusted material in the shape of fat. We see then that it is no mere coincidence that stout people so often have high blood-pressure, or that stoutness is connected in the popular mind with a tendency to apoplexy.

It follows also from my first principles that those who have defective circulation cannot have much power of endurance.

But if the weight tends to make a decided increase on any such diet and it is not desired that it should increase further, reducing the butter and cream and skimming, or, better still, separating the milk, is generally sufficient to bring it to a standstill.

Those who are already too stout and wish to reduce must further modify any of the above diets.

Taking Table I., the milk must be lessened, and the cream separated, while cheese may be specially obtained poor in fat or made from skim milk.

Bread must be reduced, or even entirely replaced by rice, which is not fattening, together with gluten, which is practically fat-free. Thus:—

TABLE IV.

1	pint of milk	3	per cent. of albumens	(= 13	grs. per oz.)	= 262	grs.
3	ozs. of cheese	33	,, ,,	(= 140	,, ,,)	= 429	,,
1	oz. of gluten	90	,, ,,	(= 344	,, ,,)	= 344	,,
4	ozs. of rice	5	,, ,,	(= 21	,, ,,)	= 84	,,
2	ozs. of almonds	21	,, ,,	(= 90	,, ,,)	= 180	,,
5	ozs. of dried fruit	3	,, ,,	(= 13	,, ,,)	= 65	,,
6	ozs. of fresh fruit	2	,, ,,	(= 8	,, ,,)	= 45	,,
						1,400	

In this way a sufficient supply of albumens is obtained with very little fat and a reduced quantum of starches, and the patient supplies what may be required in this direction from his own tissues, just as he would on the dangerous diet of meat and hot water used for the same purpose.

But he escapes the perils of this latter diet which are due to the xanthin, uric acid, and other effete nitrogen contained in flesh, and in this way he can reduce his weight with much greater safety and considerable ease. In other cases no milk or cheese should be taken, but a diet of bread stuffs, nuts and fruit will produce a gradual return to normal weight; while in suitable cases a diet of fruit only may be taken for a time, and will quickly reduce weight. This at least is much more pleasant than meat and hot water.

In some of these ways weight can be safely reduced without any failure of nutrition or strength and without the injurious after-effects of the animal-tissue poisons in the meat diet.

A dry diet of bread and fruit is also far and away

the best for all conditions of high blood-pressure, in which there is already a more or less large excess of fluids retained in the body by the obstructed circulation (Dropsy).

In many such cases marvellous cures have been produced by taking only these natural foods, and allowing for a time no fluids save those in the fruits; all high blood-pressure conditions are quickly relieved, and fluids re-absorbed into the circulation from the interstices of the tissues.

Much has been said and written of late about the cure of tuberculosis by fresh air and overfeeding.

No doubt such overfeeding, if it makes the human fire, so to speak, roar up the chimney, may help to cure a local tuberculosis, as I have suggested in "Uric Acid," p. 439; but I must point out that it is by no means necessary to abandon a uric-acid-free diet on this ground, for the diet in the table just given is a very ample one for persons of ordinary weight, and several items of it—milk, cheese, and gluten—could be doubled, or even trebled, if necessary. There is no doubt whatever that the required albumens can be obtained from these substances.

It is obvious that this stimulation of combustion is a temporary expedient for a temporary object, and that, when once the destruction of

the microbe has been accomplished the excess of food has necessarily to be considerably reduced, since disease would be produced in other directions by the accumulation of the waste products of such excessive combustion. It follows (as an advantage) from all my previous arguments that these waste products will be less in quantity and less injurious in quality if the necessary albumens have been obtained from a uric-acid-free source.

Alcohol, Tobacco and other Stimulants.

We have already seen that stimulants such as acids do not produce force, they merely alter its distribution in time. When an acid causes feelings of well-being and increased excretion of urea, it merely brings about the metabolism of a certain amount of albumen which was there before and independent of it; it merely alters the time relation of the metabolism of this albumen, converting it quickly into available force and urea in one hour, while without the stimulant the same albumen might have been slowly converted into force and urea during three or four hours.

But after the force has been produced and urea excreted, the body is poorer in albumens than it would have been at the same hour if no stimulant had been taken; and the urea curve falls more quickly, as we have seen in chapter i., fig. 5, than if no stimulation had taken place.

It is followed, indeed, so long as no fresh albumen is introduced from without, by an exactly corresponding depression, for the body must economise in the following hours to make up for the increased loss of force in the hour of stimulation.

It is no doubt sometimes necessary for the preservation of life that an extra quantity of force should be available in a given time, and Nature provides for this need by keeping a reserve of albumens in the blood and tissues. The natural stimulant of a call for extra force and exertion brings this reserve out and uses it up; a corresponding rise of urea showing what has taken place.

But as there has been no fresh introduction of albumen and force, the body is poorer in these constituents than before, and must economise and rest, or obtain fresh supplies from without.

And if this is the effect of the natural stimulant of a call for exertion, it must also be the effect of the unnatural stimulant, alcohol; this introduces no albumen and force, it merely affects circulation. nutrition, and the metabolism of the albumens already in the body, and this call on the resources of the body is invariably followed by a corresponding depression or economy in the future.

All artificial and unnatural stimulation is therefore wrong, it only calls out the reserves of force

and makes the body poorer in the following period to a corresponding extent, for every up is followed by a down, and nothing is really gained.

There is, however, one exception to this rule, and that is, when the body is much in need of fresh supplies, and urea has run down so much that force for digestion is scarcely available. A stimulant may here do good by calling out some of the remaining reserves, thus furnishing the necessary force for digestion and bringing fresh albumens more quickly into circulation, until nutrition moves up again.

Even here artificial stimulation may be replaced by rest and economy of force, and is not really necessary if such rest is possible.

Stimulation then is merely a call on the reserves of force already in the body, and the more these reserves have already been called upon the greater will be the stimulus required to produce still more ; whereas if the alcohol were itself a force producer, the effect should be the same each time for the same dose.

A food introduces force from without ; a stimulant calls out force already in the body, and athletes know they must not take stimulants till near the end of the race, for when once their final reserves have been called out and used, collapse results. On the other hand, if milk instead of alcohol is taken there is an access of strength, and this is experienced with each fresh supply.

Here, then, is a fundamental distinction between food and stimulant, and one already well known to athletes; it can be easily tested by anyone who will take the trouble.

A stimulant increases available force only so long as there is albumen for it to act upon.

Force is thus proportional to the quantity of food (if within the limits of digestion); but it is not proportional to the quantity of stimulant, and bears a constantly smaller and smaller proportion to it as stimulation is repeated.

It is useless to argue that force is got out of sugars and starches apart from the temporary rise of urea they indirectly produce (fig. 4). If this were so, then they would sustain life indefinitely and apart from albumens, and these last would not be a *sine quâ non* of life. The contrary has been proved by physiologists, and can be proved again and again by anyone who will repeat either the experiments of the athletes or those of which I give figures. Neither alcohol nor sugar is a food in the same sense as albumen.

What do we see in Nature? If a man is only slightly tired when urea is falling but reserves are still fair, a teaspoonful of brandy may keep him going for some distance. At the end of that time his reserves will be considerably reduced, and three or four teaspoonfuls of brandy will have less effect than one.

The same applies to those who constantly resort to stimulants; they are drawing on their reserves, the amount of stimulant must be increased as the reserves diminish, and this, again, is exactly what we find in Nature.

It has been truly said that the man who relies upon stimulants for strength is lost, for he is drawing upon a reserve fund which is not completely replaced, and physiological bankruptcy must inevitably ensue.

This is what the stimulants, such as tea, coffee, alcohol, tobacco, opium and cocaine do for those who trust in them; they none of them introduce albumen, available for conversion into force and urea, they merely aid the calling out of reserves.

Alcohol and tobacco are stimulants only, and by improving the circulation (like the acids previously spoken of), they call out a certain quantity of albumen, force, and urea (see fig. 5); but tea and coffee are infinitely worse, for though at first they act as stimulants in something the same way as the acids and alcohol, later on they come into the blood as the very uric acid which is causing the depression. We have seen above that fatigue is partly due to deficiency of albumens, and partly to impaired tissue circulation rendering the stock of albumens useless because they cannot get to

the tissues,—this defective circulation being the effect of uric acid to which the xanthins in tea and coffee are equivalent.

The first action of these xanthins is as acids; they clear the blood of uric acid, and hence they are stimulants; later they come into the blood as uric acid and increase the depression.

Those who cannot get through their daily work without a call on the reserves with alcohol or tobacco (the action of which I have considered in "Uric Acid," p. 111), are either weak or diseased, and their path leads to physiological bankruptcy. And of what sort are they? Not those who live on the diets in the above Tables, for such persons commonly move in the opposite direction and give up alcohol and tobacco, if they had used them before.

These stimulants are necessary, however, to flesh eaters and the reason is simple, for on all flesh diets they are constantly taking uric acid and the xanthins, and these are first stimulants and afterwards depressants. They unnecessarily call out the reserves and then plunge all into depression and feeble nutrition by blocking the circulation; and, while this is going on, other stimulants, such as alcohol, tobacco, or tea, must be called in to keep things going (see also p. 40).

It follows that the only way to get clear of stimulants is to give them up; if any are retained you must of necessity be led to take more, and gradually to add others which are more powerful.

On the other hand, to keep the reserves entire and untouched for the day of trial which is sure to come to all; to work clearly and steadily without effort and without friction is alone sufficient to make life worth living. So great is the difference between physiological solvency and bankruptcy that I do not exaggerate when I say the knowledge of how the former is attained has repaid me a thousand times for the time and trouble given to experiments. The physiologically solvent know to the full the joys of strong and useful life, while the bankrupt retains them only in the memory of what he was before his reserves were exhausted; for as these diminish, the stimulants, even the more powerful ones, such as morphine and cocaine, fail more and more to bring him even for a moment to the level of physiological health.

But the difference must be felt and cannot really be described, and there are conditions of ignorance combined with prejudice on which mere words produce no effect. People living under these conditions may for practical purposes be divided into

those who do not know and those who do not want to know.

The case of the latter is beyond remedy, but for those who are ignorant, and have no objection to knowledge if it is within reach, a demonstration which is far more powerful than words can always be obtained by testing the calculations of albumens for body weight and watching the result. It will not do to measure milk by the cupful, or to imagine that an ounce of cheese is no larger than an hazel nut; these foods must be measured and weighed at first, till the proper quantity comes to be accurately known at sight.

Part, at least, of the *bonâ-fide* doubt of the ignorant may be due to the fact that numbers of people, who call themselves "vegetarians," or others who for one reason or another have abjured flesh as food, have no physiological knowledge and have often failed to substitute an adequate quantity of albumens. The result has of course been in such cases that their nutrition has often failed either to satisfy themselves or to commend their methods to others.

Here also probably originates the doubt not infrequently expressed, as to whether patients can "stand" the diet. I can only say that the great majority of people I see have no difficulty in digesting most of the foods enumerated in the above

Tables, and that if they take sufficient of these and digest them, there need be no anxiety either about nutrition or strength, and they are likely to find their powers of endurance much increased. (See previous records.)

No doubt those whose bodies are full of urates, from years of flesh eating and tea drinking, are likely to get pale at first on the new diet as it will bring a large quantity of uric acid into their blood on its way to elimination, but this is merely the evil of the old diet becoming apparent. If they persevere, they will, in from twelve to eighteen months, have a better colour than most meat eaters, for when the uric acid is eliminated the blood recovers and improves. (See "Uric Acid," chap. xii.)

I have found the colour and condition of the blood such a useful guide to the effects of treatment that I have been led to produce a card of colours,[1] for the approximate estimation of the blood decimal from the corresponding colour of the mucous membrane of the patient.

Thus a patient whose colour, as seen in tongue, gums, or eyelids, corresponds to that marked 4 on the card, may, at the end of three months on

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[1] To be obtained from Messrs. Bale, Sons and Danielsson, Ltd., 83-89, Great Titchfield Street, W. Price 1s. each.

diet, be the same, or the colour may have fallen to 3, or improved to 5 (these being intermediates between 2 and 4, and 4 and 6).

If he is the same I am content, for the blood does not improve much at first on diet; if he has improved to 5 he has done more than usually well, but if he has fallen to 3 he has done badly, and the uric acid of the old diet has been rushing too quickly into his blood, and this requires to be moderated. I investigate and probably find that he has not been taking enough food, or has not been digesting what he takes, or that there is over-fatigue or overwork, or life in a hot, relaxing climate; any of which increase the rush of the uric acid into the blood. I then proceed to adjust the diet, or give a tonic to restrain the uric acid flood for a time.

Later on, after six and still more after nine and twelve months on the diet, the colour should show very decided improvement, being perhaps somewhere near 6 at the end of twelve months, and about 7 after eighteen months. Failure to attain these colours is a sign that all is not going well; that care and attention are required. The colour 8 is one attained only after a good many years on diet, or by children who are thus brought up; adults can hardly expect to attain to it.

For further information I must refer my readers

to chapter xii. of "Uric Acid," in which the whole subject of the condition of the blood and its relation to uric acid is treated.

Again, if the muscles produce force more smoothly and continuously, and with less friction, on a supply of albumens free from the poisonous products of dead animal tissues, and if muscular life becomes more pleasant from this cause, how much more important this physiological solvency, when we realise that it applies also to the great nerve centres, the organ of the mind, and find that here also the result is better work more easily performed, and not only this, but a more kindly, true and noble relation to all the conditions and phenomena of life.

This is seen even in the ordinary mental attitude of meat-eaters.

Meat eating (or for that matter uric acid taking in any form) induces laziness, since it brings about a sluggish, defective circulation in brain, muscle, bone, and throughout the body; hence people are what is called "bone lazy," but are really brain, bone, muscle, and generally lazy because circulation is everywhere defective.

This means selfishness, effeminacy, degeneration, decay, and extinction, if continued. It produces the love of riches that a luxurious idleness may be attained. Whether this, with its

consequent satiety and distaste of life, is the ideal for the unit of a healthy nation, let the nation judge.

Anæmia, lethargy, selfishness, degeneration of mind and body (which are all forms of disease) abound, few or none know what healthy life means, and the great majority live but half their span. The ways are full of the lethargic who do not want to walk, the arthritic with crippled joints who cannot walk, and the obese who can only crawl.

To those who are free of disease life presents a very different aspect, all is energy, labour is a glory, the power to do is a pleasure, there is the healthy instinct for longevity, and indolence offers no attraction.

The one attitude of mind is sanity and health ; the other disease, degeneration, insanity, and death.

Indeed I think it is not too much to say, that as with force and nutrition insolvency leads to less work worse performed (as the reserves are one after the other called out and used up), so with regard to the mind does insolvency lead to less mental range and activity, and (worse than all) to a narrowing view of the world and all it contains, with a tendency to magnify the importance of self. This attitude is, in many cases, as is well known to those who have studied the subject, the prelude

to that complete loss of mental power and balance —insanity. Our asylums are full to overflowing, and we daily build new ones. Would it not be wiser to spend a little money in cutting off the stream at its source? Should we not put our insane population in these asylums on a diet which at least does not increase the mischief?

On the other hand, perfect solvency of mind and body lifts both to higher levels of power and knowledge; forming the highest attainable development of the *mens sana in corpore sano*, and leading upwards "into the higher sunlit slopes of that mountain which has no summit, or whose summit is in heaven only" (*Sartor resartus*).

In the foregoing pages I have not attempted to give a complete physiological explanation of all the conditions; I have tried rather to put the knowledge gained into the most useful form for practical purposes. To recapitulate, I think we may say that the force produced by muscle is, other things equal, proportional to the albumens available.

The same quantity of albumens will produce the greater result the less friction they have to overcome; that is to say, when the muscles are in training the same excretion of urea will correspond to a greater number of miles covered than when the muscles are soft and out of use.

Similarly, a given quantity of albumens will pro-

duce a greater result when the circulation of the blood is free and complete; that is, when it is clear, and kept clear, of the obstructing and friction-causing xanthins and uric acid.

And when the circulation is thus obstructed a greater quantity of albumens will be used up by the heart muscle in the increased work imposed upon it, and, therefore, less albumen will be available for the body muscles in general.

It is a natural sequence that 1 oz. of albumen from bread, milk, or cheese, will produce a greater external result than a like amount of albumen from the tissues of dead animals.

Man has no doubt been misled by the stimulating properties of animal tissues and their extracts into exactly opposite beliefs, and this is specially noteworthy in the case of beef-tea, which is almost universally used in spite of the fact that it contains little or no albumen available for force production, and is thus nearly as pure a stimulant as a glass of wine.

But facts now admit of no doubt, and can be easily noted and verified, and the sad certainty that the path of stimulation once entered upon has too often led to the ruin of mind and body, can scarcely at this period of the world's history require further demonstration.

As regards pathology, it will one day, I doubt

not, be evident to all that many diseases now called by different names are really not diseases at all, but are effects of uric acid and similar substances. A trial of the uric-acid-free diet for a few months generally suffices in itself to convince people that they had previously been living on foods so deleterious as to deserve the name of poison.

A still more convincing experiment is to live on the diet for a year or two, so as to get free from poisons, and then to take them again. The result is that all the old troubles at once show signs of returning.

The full effects of these poisons on the physical, mental, and moral nature of man will only be recognisable when large numbers live on a uric-acid-free diet for the whole of their lives, and transmit an untainted heredity to their descendants. Then only will it be possible to calculate the price we now pay for the stimulant poisons.

Mr. Miles estimates his mental and physical gain at 50 per cent., but it would be probably considerably more for those who begin diet before they become diseased, and who thus have the advantage of growing and developing on foods which are natural and wholesome.

For my part I think I may safely promise that no one will ever regret changing his diet if he

takes care to *provide constantly a sufficient quantity of albumens*, and not to make the change more quickly than this all important condition will allow.

As will be evident to those who read "Uric Acid," if the poisons have produced serious and extensive organic changes, the sad words "too late" may have to be written over the case; but I have never seen a condition where some little improvement was not possible, and very many who had given up hope have been restored and received new life.

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