

3. The free imperial cities formed a college divided into two benches,—the Swabian, with 37 cities, and the Rhenish, with 14. They first appear at the Diet under Henry VII., but their position was not recognized till the peace of Westphalia. The power exercised by this municipal constituent of the Diet was small and strictly limited. Only what had been agreed upon by the electors and princes could be submitted to the college of cities for their sanction. The lower nobility, the knights of the empire, and the commons were unrepresented.

Each college voted separately; when the three colleges agreed, the decree or *recess* of the Diet, as it was called, was submitted to the emperor for his ratification; but the emperor had no power to modify it, and no resolution which affected the general interests of the empire could be passed without the approbation of the Diet.

Besides extraordinary meetings, the Diet was regularly convened twice a year. At the spring session the general business of the empire was discussed, laws were passed, alliances concluded, rebels proscribed, and grants of fiefs confirmed. The autumn session was occupied with finance and attended only by dukes, counts, and officers of administration. From 1663 the Diet met at Regensburg.

From the end of the Thirty Years' War the power of the Diet steadily declined. The Peace of Westphalia, while confirming the rights of the Diet as against the emperor, at the same time, by recognizing the territorial independence of the German princes, so limited the province of the federative assembly that, to quote the words of Frederick the Great, the Diet became "a mere shadow, a congress of publicists more busied with forms than things, like dogs who bay the moon."

The most important Diets were the following—

- 1106. Mainz. Henry IV. deposed on motion of his son.
- 1142. Frankfort. Conrad surrendered Saxony to Henry the Lion.
- 1356. Nuremberg. The Golden Bull.
- 1486. Worms. Private defiance forbidden, and Imperial Chamber established.
- 1521. Worms. Edict against Luther.
- 1526. Spire. Choice of religion allowed to the several states.
- 1529. Spire. Edict of Worms re-enacted.
- 1530. Augsburg. The confession of Augsburg presented.
- 1806. Regensburg. Napoleon's envoy announces the dissolution of the empire. Francis II. resigns imperial crown.
- 1848. Frankfort. First Diet of Germanic confederation.

DIETETICS. The application of science to the regulation of the continuous demands of the body for nutriment aims mainly at three objects—Health, Pleasure, and Economy. They are rarely inconsistent with one another, but yet require separate consideration, as under varying circumstances each may claim the most prominent place in our thoughts.

Influence of Diet upon Health.

The influence of diet upon the health of a man begins at the earliest stage of his life, and indeed is then greater than at any other period. It is varied by the several phases of internal growth and of external relations, and in old age is still important in prolonging existence, and rendering it agreeable and useful.

Diet in Infancy.—No food has as yet been found so suitable for the young of all animals as their mother's milk. And this has not been from want of seeking. Dr Brouzet (*Sur l'Éducation médicale des Enfants*, i. p. 165) has such a bad opinion of human mothers, that he expresses a wish for the state to interfere and prevent them from suckling their children, lest they should communicate immorality and disease! A still more determined pessimist was the famous chemist Van Helmont, who thought life had been reduced to its present shortness by our inborn propensities, and proposed to substitute bread boiled in beer and honey for milk, which latter he calls

"brute's food." Baron Liebig has followed the lead with a "Food for infants," in the prescription for which half ounces and quarter grains figure freely, and which has to be prepared on a slow fire, and after a few minutes boiled well. And after all not nearly such a close imitation of human milk is made as by the addition to fresh cow's milk of half its bulk of soft water, in each pint of which has been mixed a heaped up teaspoonful of powdered "sugar of milk" and a pinch of phosphate of lime. Indeed, in default of these cheap-chemicals, the milk and water alone, when fresh and pure, are safer than an artificial compound which requires cooking. And experience shows that the best mode of administering food to the young is also that which is most widely adopted throughout warm-blooded nature, namely, in a fresh, tepid, liquid state, frequently, and in small quantities at a time.

Empirical observation is fully supported in these deductions by physiological and chemical science. Milk contains of—

Water	88 per cent.
Oleaginous matter (cream or butter).....	3 "
Nitrogenous matter (cheese and albumen).....	4 "
Hydrocarbon (sugar).....	4½ "
Saline matter (phosphate of lime, chloride of sodium, iron, &c.)	½ "

These are at once the constituents and the proportions of the constituents of food suited to a weakly rapidly-growing animal. The large quantity of water makes it pass easily through the soft absorbent walls of the digestive canal, and the complete suspension in an alkaline fluid of the finely divided fat and nitrogenous matter introduce more of them than could be effected were they in a solid form. The fat is the germ of new cellular growth, and the nitrogenous matter is by the new cells formed into flesh, which is doubling its bulk monthly. The phosphate of lime is required for the hardening bones, the chloride of sodium and the iron for the daily increasing amount of blood in circulation. Milk may be said to be still alive as it leaves the breast fresh and warm, and quickly becomes living blood in the infant's veins. A very slight chemical change is requisite. Its frequent administration is demanded by the rapid absorption, and the absence of regular meals prevents the overloading of the delicate young stomach with more than it can hold at once.

The wholesomest nutriment for the first six months is milk alone. A vigorous baby can indeed bear with impunity much rough usage, and often appears none the worse for a certain quantity of farinaceous food; but the majority do not get habituated to it, without an exhibition of dislike which indicates rebellion of the bowels.

To give judicious diet its fair chance the frame must be well protected from the cold; and just in proportion as the normal temperature of the body is maintained so does growth prosper, as is satisfactorily proved by experiments on the young of the lower animals.

It is only when the teeth are on their way to the front, as shown by dribbling, that the parotid glands secrete an active saliva capable of digesting bread stuffs. Till then anything but milk must be given tentatively, and considered in the light of a means of education for its future mode of nutrition. Among the varieties of such means, the most generally applicable are broth and beef tea, at first pure, and then thickened with tapioca and arrowroot. Chicken soup, made with a little cream and sugar, serves as a change. Baked flour, biscuit powder, tops and bottoms, should all have their turn; change is necessary in the imperfect dietary which art supplies, and for change the stomach should be prepared by habit.

The consequences of premature weaning are insidious. The external aspect of the child is that of health, its muscles

are strong, but the bones do not harden in proportion, and if it tries to walk its limbs give way, and it is said to be suffering from rickets or "rickets."

These consequences follow in other animals as surely as in the human race; and in them it was possible to make the experiment crucial. A gentleman named Guérin set himself to find if he could produce rickets at will. He took a number of puppies in equally good condition, and having let them suckle for a time, he suddenly weaned half of them and fed them on raw meat, a fare which at first thought would seem the most suitable for carnivorous animals. Nevertheless, after a short time, those which continued to take the mother's milk had grown strong and hearty, whilst those which had been treated with a more substantial dietary pined, and frequently threw up their victuals, then their limbs bent, and at the end of about four months they showed all the symptoms of confirmed rickets. From these experiments we must conclude that the rickets depended mainly on the derangements of nutrition brought on by improper diet. A diet which is taken at a wrong season may fairly be called improper. For carnivora, it is flesh before the age of suckling has passed; for herbivora (and an experiment bearing on the point has been made on pigs), it is vegetable feeding begun when they ought to be at the teat.¹

The time for weaning should be fixed partly by the child's age, partly by the growth of the teeth. The troubles to which children are subject at this crisis are usually gastric, such as are induced by summer weather; therefore at that season the weaning should be postponed, whereas in winter it should be hurried forward. The first group of teeth nine times out of ten consists of the lower central front teeth, which may appear any time during the sixth and seventh month. The mother may then begin to diminish the number of suckling times; and by a month she can have reduced them to twice a day, so as to be ready when the second group makes its way through the upper front gums to cut off the supply altogether. The third group, the lateral incisors and first grinders, usually after the first anniversary of birth give notice that solid food can be chewed. But it is prudent to let dairy milk form a considerable portion of the fare till the eye teeth are cut, which seldom happens till the eighteenth or twentieth month. At this period children are liable to diarrhoea, convulsions, irritation of the brain, rashes, and febrile catarrhs. In such cases it is often advisable to resume a complete milk diet, and sometimes a child's life has been saved by its reapplication to the breast. These means are most feasible when the patient is accustomed to milk; indeed, if not, the latter expedient is hardly possible.

Diet in Childhood and Youth.—At this stage of life the diet must obviously be the best, which is a transition from that of infancy to that of adult age. Growth is not completed, but yet entire surrender of every consideration to the claim of growth is not possible, nor indeed desirable. Moreover that abundance of adipose tissue, or reserve new growth, which a baby can bear, is an impediment to the due education of the muscles of the boy or girl. The supply of nutriment needs not to be so continuous as before, but at the same time should be more frequent than for the adult. Up to at least fourteen or fifteen years of age the rule should be four meals a day, varied indeed, but nearly equal in nutritive power and in quantity, that is to say, all moderate, all sufficient. The maturity the body then reaches involves a hardening and enlargement of the bones and cartilages, and a strengthening of the digestive organs, which in healthy young persons enables us to dispense with some of the

watchful care bestowed upon their diet. Three full meals a day are generally sufficient, and the requirements of mental training may be allowed to a certain extent to modify the attention to nutrition which has hitherto been paramount. But it must not be forgotten that the changes in figure and in internal organs are not completed till several years have passed, and that they involve increased growth and demand full supplies. As less bulky food is used, care should be taken that it is sufficiently nutritious, and habits should be acquired which conduce to making the most of it for the maintenance of strength.

The nutritiousness of food depends on *digestibility* and *concentration*. Food is digestible when it yields readily its constituents to the fluids destined for their reduction to absorbable chyme. It is more or less concentrated, according as a given weight contains more or less matter capable of supporting life. The degree in which they possess these qualifications united constitutes the absolute nutritive value of alimentary matters.

The degree of cohesion in the viands influences digestibility. Tough articles incapable of being completely ground up by the teeth, remain unused, while fluids and semifluids lead the van of digestibles. The tissues of young vegetables and young animals are for this reason more digestible than old specimens. It is desirable also that the *post mortem* rigidity, which lasts several days in most instances, should have merged into softness before the meat is cooked, or should have been anticipated by cooking before the flesh is cold. In warm climates and exceptionally warm weather the latter course is the preferable. The dietician, especially when the feeding of the young is in question, will prefer those methods of culinary preparation which most break up the natural cohesion of the viands. And it may be noticed that the force of cohesion acts in all directions, and that it is no advantage for an article to be laterally friable if it remains stringy in a longitudinal direction.

Fat interposed between the component parts of food diminishes its digestibility. It is the interstitial fat between the fasciculi of muscular fibre in beef which renders it to young persons and to dyspeptics less digestible than mutton.

A temperature above that of the body retards digestion. Meat, which is digested by the gastric juice in the stomach, has time to cool before it gets there; but farinaceous food, which depends for its conversion into chyme on the salivary glands, suffers a serious loss if by reason of being too hot it cannot avail itself of the saliva supplied by the mouth. It should also be borne in mind that a temperature much above that of the body cracks the enamel of the teeth.

Excessive concentration impairs digestibility. The principal medium by which nutriment is carried through the absorbent membrane of the digestive canal is water. There is no doubt it passes more rapidly by endosmosis than anything else. The removal, then, of water is an injury to viands, and drying, salting, over-frying, over-roasting, and even over-boiling renders them less soluble in the digestive juices, and so less nutritious. A familiar illustration of this may be taken from eggs. Let an egg be lightly boiled, poached in water, custarded, or raw, and the stomach even of an invalid can bear it; but let it be baked in a pudding which requires a hot oven, or boiled hard, or otherwise submitted to a high temperature for a prolonged period, and it becomes a tasteless, leathery substance, which can be of no more use in the stomach than so much skin or hair. It is obvious then that it is mainly in a commercial point of view that articles of diet can be called nutritious in proportion to their concentration. About this there can be no question; milk adulterated from the pump is worth so much less than pure milk, and a pound of beef steak sustains a man longer than a pint of veal broth.

¹ Trousson, *Clinique Médicale*, vol. iii. p. 424, 3d edit.

The attainment of nutritiousness by concentration is of considerable importance to travellers and in military medicine. There are not a few strategists who attribute the success of the Germans in the war of 1870 to the easily carried and easily prepared food supplied to them by the sausage-makers of Berlin. Concentration of viands carried to excess, so as to be likely to affect the health, is usually made manifest by a diminution in the secretion of urine and its condensed condition; while, on the other hand, if dilution is needlessly great, the action of the kidneys is excessive. Now the urine of young persons is naturally of lower specific gravity, that is, more aqueous, than that of adults. If it is found to equal in density the excretion of full growth, or if it is observed to be voided but rarely, the meat should be made more bulky, or better still, more frequent, so as not to overload the stomach.

An over-concentrated diet often induces costiveness. This should be counteracted by green vegetables and other dilute appetizing dishes, and never by purgative drugs. The habit of taking a considerable quantity and variety of fresh green vegetables has the further advantage of preventing that tendency to minor developments of scurvy which is not uncommonly found in youths nourished mainly on animal food. A softness or friability of the gums is one of the first signs of this. If the mouth bleeds after the application of a tooth brush, the use of fresh vegetables at every meal should be enforced.

The young are peculiarly liable to be affected by poisons conveyed in fluids. Their sensitive frames absorb quickly, and quickly turn to evil account such substances, even when diluted to an extent which makes them harmless to adults. The water therefore with which families, and still more with which schools are supplied, should be carefully subjected to analysis. Wherever a trace of lead is found, means should be adopted to remove the source of it; and organic products should have their origin clearly accounted for, and all possibility of sewage-contamination excluded. These precautions are essential, in spite of the grown-up portion of the household having habitually used the water without injury.

Fresh milk has long had a bad popular reputation as occasionally conveying fever, and in some parts of Ireland the peasantry can hardly ever be got to take it "raw." This is quite irrespective of the state of the cattle which furnish it; no cases of disease thus communicated have ever been traced home to sick cows. It is probably always due either to adulteration with dirty water, or to the vessels being washed in that dangerous medium, or to their being exposed to air loaded with elements of contagion.

Up to the period of full development the daily use of wine should be allowed only during illness and the express attendance of a medical adviser. Its habitual consumption by healthy children hastens forward the crisis of puberty, checks growth, and habituates them to the artificial sensation induced by alcohol.

Diet for Bodily Labour.—It seems certain that the old theory of Liebig, which attributed the whole of the force exhibited in muscular movements to the oxidation of muscular tissue, is untenable. There is not enough of the material oxidized, that is to say, destroyed and carried away as urea and other nitrogenous excretions, to generate so much force, as measured by the method of Joule. On the other hand, Traube goes too far when he would make out that in the performance of muscular work the metamorphosis of the organized constituents of contractile tissue is not involved; and that non-nitrogenous substances alone are consumed. The prolonged feats of walking performed by the pedestrian Weston in 1876 vastly

increased the amounts excreted of those elements of the urine which are derived from the oxidation of muscle and nerve.¹ The urea formed by the destructive assimilation of contractile fibre, and the phosphates whose main source is nervous tissue, were each nearly doubled during and shortly after the extraordinary strain upon those parts of the body. As might be expected, the machinery wears away quicker when it is harder worked, and requires to be repaired immediately by an enhanced quantity of new material, or it will be worn beyond the power of repair. The daily supply, therefore, of digestible nitrogenous food, meat *par excellence*, must be increased whenever the muscular exercise is increased. In making the recent extension of railways in Sicily, the progress was retarded by the slack work done by the Sicilian navvies compared with that got through by the English gangs. The former took scarcely any meat, preferring to save the wages expended by their comrades in that way. The idea occurred to the contractor of paying the men partly in money and partly in meat; and the result was a marked increase in the amount of work executed, which was brought nearly up to the British average. A mixed diet, with an increase in the proportionate quantity of meat when extra corporeal exertion is required, is the wholesomest, as well as the most economical, for all sorts of manual labourers.

It is absolutely essential that the fleshy machinery for doing work should be continuously replaced by flesh food, as it becomes worn out. Nitrogenous aliment after a few chemical changes replaces the lost muscle which has passed away in the excretions; just as the engineer makes ore into steel and renews the corroded boiler plate or thinned piston. Now, as the renewal of the plate or piston is a "stimulus" to the augmented performances of the engine, so meat is a "stimulus" to augmented muscular action. Taken in a digestible form during exertion, it allows the exertion to be continued longer, with greater ease and less consequent exhaustion. According to the testimony of soldiers experimentally put through forced marches of twenty miles a day, with loads of half a hundredweight each, "meat-extract" bears away the palm from the other reputed stimulants commonly compared with it (*viz.*, run and coffee). "It does not put a spirit into you for a few miles only, but has a lasting effect; if I were ordered for continuous marching, and had my choice, I would certainly take the meat extract," said an unprejudiced sergeant to Dr Parkes, who was the conductor of the experiments alluded to.²

When the continuous repair of the muscular machinery is fully secured, the production of heat and force is most readily provided for by vegetable aliment, by reason of the large proportion of carbon which it contains. In assigning their physiological functions to the several sorts of food, nearly all the business of begetting active force should apparently be ascribed to the solid hydrocarbons, starch and fat, by their conversion into carbonic acid. It is not necessary to be acquainted with every step of the process, which in the body we confessedly are not, to appreciate the argument. It is clearly important that these elements of diet should be furnished in sufficient quantity and in a digestible form. In additions to diet made in consequence of additional bodily work not only should the stimulus of animal food be attended to, but the bulk of starch and fat in the rations should be augmented even in larger

¹ See Dr Pavy on Weston's walk, in *Lancet* of Dec. 23, 1876. The urea excreted when walking bore to that excreted during rest the relation of 17 to 10, phosphoric acid 19 to 10, lime 15 to 10, &c.

² On the *Issue of a Spirit Ration during the Ashantee Campaign* of 1874, by E. A. Parkes, M.D., Professor of Military Hygiene in the Army Medical School. London, 1876.

proportion, for these aliments are the most direct contributors of force.¹

"Training" for athletic sports is based on the principles above enunciated. The usual time allotted to it is six weeks, and the objects to be attained in this period may be described as—

- (1.) The removal of superfluous fat and water;
- (2.) The increase of contractile power in the muscles;
- (3.) Increased endurance;
- (4.) "Wind," that is to say, a power of breathing and circulating the blood steadily in spite of exertion.

The first is aimed at by considerably adding to the daily amount of nitrogenous and by diminishing farinaceous and liquid food, and providing that it should be so consumed as to be fully digested. The second and third are secured by gradually increasing the demands made upon the muscles, till they have learnt to exert at will all the powers of which they are capable, and for as long a period as the natural structure of the individual frame permits. "Wind" is improved by choosing as part of the training an exercise, such as running, which can be sustained only when the respiratory and circulating organs do their duty fairly.

As an example, the Oxford system of training for the summer boat-races may be cited. It may be considered a typical regimen for fully developing a young man's corporeal powers to fulfil the demands of an extraordinary exertion, a standard which may be modified according to the circumstances for which the training is required. It is as follows:—

A Day's Training.

Rise about 7 A.M.		
Exercise	A short walk or run.	Not compulsory. As little as possible. Underdone. Crust only recommended.
Breakfast at 8.30	Of tea, Meat, beef or mutton Bread or dry toast...	
Exercise in forenoon	None.	Crust only recommended. Not always adhered to.
Dinner at 2 P.M.	Meat, much the same as for breakfast. Bread..... Vegetables, none.....	
Exercise	Beer, one pint..... About 5 o'clock start for the river, and row twice over the course, the speed increasing with the strength of the crew.	
Supper at 8.30 or 9 P.M.	Meat, cold. Bread, and perhaps a little jelly or water-cresses.	
Bed about 10.	Beer, one pint.	

¹ This is well illustrated by a remarkable feat performed on the Great Western Railway in the summer of 1872. It was necessary to shift the rails from the broad to the narrow gauge on upwards of 500 miles of permanent way within a fortnight. The task was enormous, for the Great Western is one of the few English lines whose rails are held down by bolts screwed into nuts. All these had to be unscrewed and replaced after removing the heavy rail two feet. About 8000 men were employed, working double time, sometimes from 4 in the morning till 9 at night; and, without one being sick or drunk, they accomplished the work in the prescribed time. The scheme for generating muscular power was this. The men were hunted along the line, so as not to waste their strength by coming and going, and they brought with them bacon, bread, cheese, cocoa, &c., to provide their usual meals at usual times. But they had no beer, nor alcohol in any form. A pound and a half of oatmeal and half a pound of sugar was allowed extra to each man daily, and for every gang of 21 a cook was provided. The first thing done in the morning was to breakfast; and then the cook and his caldron started along the line till water was found convenient; a fireplace of stones was built, and the pot boiled. Oatmeal was then sprinkled into it with sugar,

The Cambridge system differs very slightly, and in neither is any exaggerated severity of discipline enforced, while some latitude is permitted to peculiarities and a wish for variety, and plenty of time is left for business and social intercourse. Other plans are objectionable, from involving, without any corresponding advantage, a complete departure from the usual habits of the educated classes. For instance, according to Clasper, dinner is to be at noon, with only a light tea afterwards, and no supper. Then a country walk of four or five miles is to be taken before breakfast, and two hours row afterwards, and another hard row between dinner and tea.³ "Stonehenge," again, requires the time between breakfast and dinner to be spent entirely on billiards, skittles, quoits, rowing, and running, in spite of another hour's row being prescribed at 6 P.M. He also requires the aspirant for athletic honours to sleep between 10 and 11 hours.⁴ Only professionals will carry out such rules, and even they do not either benefit their health or lengthen their lives by the sacrifice. For it is notorious that "over-training" leads to a condition of system in which the sufferers describe themselves as "fallen to pieces." The most peculiar symptom is a sudden loss of voluntary power after exertion. It is sometimes called "fainting," but there is no loss of sense, and it is quickly relieved by liquid food. It is to the pathologist a timely warning of that consequence of overstrained muscle which constitutes paralysis scriptorum, turner's palsy, and blacksmith's palsy, and which results in fatty degeneration of the red muscular fibre. To get and to keep its health a muscle needs a constant alternation of active contraction and rest, and an enforced protraction of either one or the other leads to the loss of vital properties. The limbs of an Indian fakir, voluntarily held in a strained posture, or those of a bed-ridden invalid, are equally apt to become useless. Overtrained persons are also liable to a languor and apparent weakness, which is found on examination to depend on an excessive secretion of urea by the kidneys.

Such are not the results, however, of the training adopted at the universities, by which it would appear that the constitution is strengthened, the intellect sharpened, and life lengthened. Dr John Morgan (*University Oars*, 1873), has collected statistics of the subsequent health of those who have rowed in the university races since 1829, and he finds that, whereas at twenty years of age, according to Farr's life tables, average expectation of survival is forty years, for these oarsmen it is forty-two years. Moreover, in the cases of death, inquiry into its causes exhibits evidence of good constitutions rather than the contrary, the causes consisting largely of fevers and accidents, to which the vigorous and active are more exposed than the sick. And

and thoroughly well boiled till thin gruel was made. As soon as the "shout for drink" was heard, buckets were filled and carried round with small pannikins to convey the liquid to the panting mouths. The men liked it exceedingly, and learned by experience the importance of having it well cooked.

The incident may remind the reader of classical medicine of Hippocrates, who considers the culinary preparation of oatmeal ptilan so important that in a short treatise *On the Treatment of Acute Disease* he devotes to it the only cookery recipe he has inserted in his works. He describes how it is to be boiled till it can swell no longer (so that it may swell no more in the stomach), how it is to be settled and strained (through a coarse cullender). He prescribes it indeed for sick people but he would have been the first to agree with our advanced physiologists in the opinion that overstrained muscular effort produces the same effects as continued fever (*is superba kahtaratai pashporev*), its chief dangers lying in rise of temperature and arrested cutaneous action, and that its true antagonist is nutriment capable of rapid absorption, dissolved in that most essential nutriment, water.

² See Maclaren's *Training in Theory and Practice*, appendix to edition 1866.

³ *Rowing Almanac*, 1863.

⁴ Article "Boat-Racing," in *British Rural Sports*, 1861.

it is not at the expense of the mind that the body is cultivated, for this roll of athletes is adorned with the names of bishops, poets, queen's counsel, &c.

Training greatly increases the vital capacity of the chest, so that much more air can be blown in and out of the lungs, and with greater force, than previously. And this vital capacity endures longer than the other improvements. It is evidence of the permanent elasticity of the pulmonary tissue, and an efficient protection against asthma, emphysema, and other degenerations of the organ of breathing.

Indigestion, sleeplessness, nervous indecision, palpitation of heart, and irregularity of bowels disappear under training; but if they exist, the regimen should be entered upon with more than usual caution.

An important modification of training is that which contemplates the reduction of CORPULENCE (*q. v.*), which has increased to the extent of interfering with comfort and preventing active exercise. If an exhausting amount of muscular effort is enforced, the digestion of meat is interfered with, while at the same time there still goes on the absorption of such fat as is unavoidably present in the victuals, so that the muscles and nerves lose strength, while the adipose tissue grows. Besides this, if by violent means the weight is worked down, then, to keep it down, those violent means must be persisted in; and if they be neglected for more interesting occupations, the burden rapidly increases to a greater degree than ever. Many uncomfortably obese persons are very active in mind and body, and could not add to their muscular exercise without risk of harm.

Regimen, then, is more essentially important to them than to other trainers, and they will probably be more induced to attend to it if they understand the principles on which it is based. This is simply to exclude from the bill of fare all those articles which contain fat or which by the chemical actions of the digestive viscera may be converted into fat.

For the reduction of corpulence the following rules may be observed for a three weeks' course:—

Rise at 7, rub the body well with horse-hair gloves, have a cold bath, and take a short turn in the open air. Breakfast (alone) at 8 or 8.30, on the lean of beef or mutton (cutting off the fat and skin), dry toast, biscuit or oat cake, a tumbler of claret and water, or tea without milk or sugar, or made in the Russian way with a slice of lemon. Lunch at one on bread or biscuit, Dutch cheese, salad, water-cresses, or roasted apples, hung beef or anchovies, or red-herring, or olives, and similar relishes. After-noon, drink claret and water, or unsweetened lemonade, or plain water, in moderation. Dine at any convenient hour. Avoid soup, fish, or pastry, but eat plain meat of any sort except pork, rejecting the fat and skin. Spinach, haricots, or any other green vegetable may be taken, but no potatoes, made dishes, or sweets. A jelly, or a lemon-water-ice, or a roast apple, must suffice in their place. Take claret and water at dinner, and one glass of sherry or Madeira afterwards.

Between meals, as a rule, exercise must always be taken to the extent of inducing perspiration. Running, when practicable, is the best form in which to take it.

Seven or eight pounds is as much as it is prudent to lose during the three weeks. If this loss is arrived at sooner, or indeed later, the severe parts of the treatment may be gradually omitted, but it is strongly recommended to modify the general habits in accordance with the principle of taking as small a quantity as possible of fat and sugar, or of substances which form fat and sugar, and sustaining the respiratory function. By this means the weight may be gradually reduced for a few months with safety.

Small quantities of dilute alcoholic liquids taken with meals slightly increase the activity of the renewal of the nitrogenous tissues, mainly muscle; that is to say, there is a more rapid reconstruction of those parts, as is shown by the augmented formation of urea and the sharpened appetite. Life is fuller and more complete, old flesh is removed and food appropriated as new flesh somewhat more quickly, than when no alcohol is ingested. There appears to be a temporary rise in the digestive powers of the stomach, which is probably the initiative act. The

nerve functions are blunted, and a lessened excretion of phosphorus exhibits a temporary check in the wear and renewal of the nerve tissue. The "vital capacity" of the lungs, as indicated by the spirometer, is reduced, showing a diminished oxidation of the blood.

The effect on a healthy man of taking with a meal such a quantity of fermented liquor as puts him at ease with himself and the world around, without untoward exhilaration, is to arrest the wear of the nervous system, especially that part employed in emotion and sensation. Just as often, then, as the zest for food is raised to its normal standard by a little wine or beer with a meal, the moderate consumer is as much really better as he feels the better for it. Where the food is as keenly enjoyed without it, the consumption of a stimulant is useless. But alcohol is not a source of force, and its direct action is an arrest of vitality.

Diet for Mental Work.—An expression of Büchner's—"No thinking without phosphorus"¹—has gained an unhappy notoriety. Strictly speaking, it is a groundless assumption, for we cannot say that intellectual being may not exist joined to any form of matter, or quite independent of matter. We certainly do not know enough of the subject to lay down such a negative statement. And if it be held to mean that the amount of phosphorus passing through the body bears a proportion to the intensity of thought, it is simply a mis-statement. A captive lion, tiger, leopard, or hare assimilates and parts with a greater amount of phosphorus than a hard-thinking man; while a beaver, noted for its powers of contrivance, excretes so little phosphorus that chemical analysis cannot find it in the excreta. All that the physiologist is justified in asserting is that for the mind to energize in a living body that body must be kept living up to a certain standard, and that for the continuous renewal of life a supply of phosphatic salts is required. The same may be said with equal justice of water, fat, nitrogen, chloride of sodium, oxygen, &c. The phosphates are wanted indeed, but wanted by pinches, whereas water is required by pailfuls. A few days without water, or a few minutes without oxygen, will terminate the train of consciousness. The practical points taught us by physiology are that for the integrity of thought integrity of the nervous tissue is requisite, and for the integrity of the nervous tissue a due quantity of such food as contains digestible phosphatic salts.

The most perfect regimen for the healthy exercise of thought is such as would be advised for a growing boy, viz, frequent small supplies of easily soluble mixed food, so as to furnish the greatest quantity of nutriment without overloading the stomach, or running the risk of generating morbid half-assimilated products. For it is essential to the intellectual direction of the nervous system that it should not be oppressed by physical impediments. The presence in the stomach or blood of imperfectly assimilated nutriment impedes its functions in close proportion to their amount, so that not only the constituents, but the mode of administering food, must come into the calculation. "*Repletus venter non studet libenter*" is an old proverb, the application of which saves many a brain and many a stomach from being worked against the grain. Rest from brain-work for twenty minutes before meals, entire abstinence from it during meals, and rest again till the weight has passed from the stomach, are essential to the reconciliation of psychical exertion with bodily health.

The physiology of the action of alcohol has a very important bearing on the physical management of the mental functions. Alcohol has the power of curbing, arresting, and suspending all the manifestations of the

¹ Ohne Phosphor kein Gedenke. *Kraft und Stoff*, sect. 122.

nervous system, so that we feel its influence on our thoughts sooner than on any other part of the system. Sometimes it brings them more completely under our command, controls and steadies them; more often it confuses or disconnects them, and then breaks off our power over them altogether. When a man has tired himself by intellectual exertion, a moderate quantity of alcoholic stimulant taken with food acts as an anæsthetic, stays the wear of the system which is going on, and allows the nerve force to be turned to the due digestion of the meal. But it must be followed by rest from toil, and is in essence a part of the same treatment which includes rest—it is an artificial rest. To continue to labour and at the same time to take an anæsthetic is a physiological inconsistency. The drug merely blunts the useful feeling of weariness, and prevents it from acting as a warning. There is no habit more fatal to a literary man than that of taking stimulants between meals; the vital powers go on wearing out more and more without their cry for help being perceived, and in the end break down irrevocably.

As to quantity, the appetite for solid food is the safest guide. If a better dinner or supper is eaten when it is accompanied by a certain amount of fermented liquor, that is the amount most suitable; if a worse, then an excess is committed, however little be taken.

The aim of the diet should be (to quote the words of John Milton) "to preserve the body's health and hardness, to render lightsome, clear, and not lumpish obedience to the mind, to the cause of religion and our country's liberty, when it shall require from hearts in sound bodies to stand and cover their stations."

It is especially when the mind of genius is overshadowed by the dark clouds of threatened insanity, of hypochondriasis, or of hysteria, that a rational mode of life preserves it. Nothing but daily exercise, temperate meals, and a punctual observance of regular hours of rest and study could have kept burning the flickering reason in poor Cowper.

As regards the proper quantity of alcohol that may be used the two following questions naturally occur—How is a man to know when he has had enough? and what are the signs of too much? The ancients used to wear dark red or purple engraved gems, which they considered preservatives against excess, and called them *ἀμειβοτοί*, "sober-stones," "amethysts." The name is now limited to the violet rock crystal, but in early times it was applied to several other stones, cut in intaglio, and worn on the fingers at festive gatherings. So long as the wearer could decipher the minute works of art they bore, he had not reached excess. A more delicate test still is the appreciation of temperature by the skin; if a draught does not chill, if a hot room fails to produce the usual discomfort, the wise man knows he has exceeded and must stop at once. In short, the safest rule is that when there is a consciousness of any psychical effect at all beyond that of satisfaction at the relief of bodily weariness—such a satisfaction as is felt on taking a good meal by a vigorous person—then the limits of moderation have been attained. On ordinary occasions of daily life, and "for the stomach's sake," no more should be taken. Each fresh drop is a step downwards to the evil results of alcohol. But to the practiser of daily temperance, festive occasions are safe and may be beneficial. A man may from time to time keep up without harm the above mentioned sense of satisfaction by good and digestible wine in good company without fear of getting drunk or failure of health, if he makes it a law to himself to stop as soon as he experiences any hurry of ideas or indistinctness of the senses.

Diet of Mothers.—During pregnancy as much care should be taken not to get too fat as is taken by an athlete

training for a race. The rules for modified training explained above will afford hints on the subject, but it is not desirable to carry the process so far.

There is a temptation at this time to increase the usual allowance of stimulant; alcohol is taken between meals to overcome the nausea and depression incident to the state of body. And by this mistaken expedient the nausea gradually becomes dyspeptic vomiting. On leaving it off the sickness ceases. A mother should also remember that nearly all the alcohol she consumes mixes with her blood, which now is one with the blood of the foetus.

During lactation the most suitable drink for a mother is cow's milk, fresh and unskimmed. If it turns sour on the stomach, lime-water mixed with it not only corrects the acedence, but also supplies a valuable aid to the growing bones of the infant. In her solid dietary also milk may be fairly taken as the type of a due admixture of alimentary principles, because it is not individual growth, or the production of muscular force, but the secretion of milk, that is the object of the selection of diet.

Supposing the full diet to consist of three pounds of solid food, that will require six pints extra of uncombined aqueous fluid to make it as fluid as milk; and, to combine the nitrogenous and carbonaceous constituents in due proportion, the three pounds of solid food should consist of

14½ oz. of meat.
13 oz. of fat, butter, and sugar.
20 oz. of farinaceous food and vegetables.
½ oz. of salt, lime, &c.

At first, from the exhaustion consequent on childbed, from the want of exercise and of fresh air, the appetite turns against meat. Let then milk, especially boiled milk with arrowroot or the like, chicken broth, or egg custards, fill up the deficiency.

Any increase in the habitual allowance of alcohol is as unfitting to this period of life as during pregnancy.

Diet of Old Age.—It is a remark extant from the rough times when famine was more frequent than now, that the older a human being is the better deficiency of food is borne. Old men suffer least from abstinence,¹ and benefit therefore most from temperance in eating. Everybody who has passed the age of fifty, or thereabouts, with a fairly unimpaired constitution, will act wisely in diminishing his daily quantity of solid food. There is less demand for the materials of growth, and consequently animal food should bear a smaller proportion than heretofore to vegetable, and it is mainly in that ingredient of the diet that reduction should be effected. Neglect of this rule in declining years is often punished by gout, a disease attributable to excess of nitrogenous aliment, and for this reason common in elderly men.

In the autumn of life the advantages derived from fermented liquor are more advantageous, and the injuries it can inflict less injurious to the body than in youth. The effect of alcohol is to check the activity of destructive assimilation, to arrest that rapid flux of the substance of the frame which in healthy youth can hardly be excessive, but which in old age exhausts the vital force. Loss of appetite is a frequent and a serious symptom in old age. It usually arises from deficient formation of gastric juice, which, in common with other secretions, diminishes with years. It is best treated physiologically rather than by drugs.

Diet in Sickness.—In all that has gone before health has been presupposed. The modifications necessitated by sickness are of three kinds:—first the avoidance of such articles of consumption as would increase the disease under the special circumstances, although ordinarily wholesome; second, the maintenance of the functions

¹ Hippocrates, *Aphorism* xiii.

or parts of the frame which remain normal; third, the administration, for a special curative purpose, of peculiar food which would not be recommended for general use.

In all fevers, which are classed together as being apparently due to a poison multiplying itself in the blood, the art of diet consists in giving an almost continuous supply of liquid nutriment, holding very soluble aliments in a dilute form. There is nothing so digestible as water, and we take advantage of this high digestibility to get whatever it can dissolve digested along with it. For the first three or even four days patients previously strong should have only farinaceous food, well boiled and cooled to the temperature of the body. Evidence has been already quoted of the power which oatmeal gruel possesses of sustaining force under the trying circumstances of excessive toil. Now, fever closely resembles muscular effort in its arrest of the digestive functions, at the same moment that it makes an urgent demand for nutriment. With ultra-Egyptian rigour, while straw is withheld, "the tale of the bricks is doubled," and we know by the quantity of urea and phosphates in the urine, and by the fecal excretion, that the muscles and nerves of the bed-ridden sufferer are melting away as fast as if he were scaling the Alps with nothing to eat. It is quite reasonable to transfer the experiences derived from health to sickness, and to feel satisfied that we are not wasting precious opportunities when we are giving fever patients such a time-honoured diet as oatmeal gruel, care being taken that it is thoroughly well boiled. After three days the tissues are beginning to suffer, and it is advisable to add chicken broth, meat jelly, and strong soup. Let that be supplied which the emaciation shows to be passing away—nitrogenous tissue.

The administration of alcohol is to be regulated partly by the temperature and partly by the condition of the nervous system. Usually if the heat of the blood (as taken at the axilla) is above 103°, and always if it is above 105°, there is a necessity for it. Again, if there is great prostration of strength, or tremor of the hands, or quivering in the voice and respiration, if there is low muttering delirium when the patient is left quiet, it is required.

Green-sickness, or anæmia, is characterized by the rapid disappearance of the red particles which float in the blood. To what a strange extent this goes may be seen by looking at the insides of the lips, which naturally hold such a quantity of the fluid as to be quite scarlet, but which now are pale like those of a corpse. It is calculated that the loss of material in marked cases of green-sickness may amount to three pounds of this important constituent of the blood.¹ Yet it is capable of complete renewal by diet. If by dint of remedies, notably iron, the appetite can be so regulated as to enjoy meat in excess of the immediate wants of the body, that meat is converted into hæmatine, and the healthy hue returns to the cheeks as quickly as it left. Wine is useful at meals on account of the stimulus it gives to the appetite; it is injurious between meals by spoiling it.

Acute rheumatism and acute gout are best treated on an opposite principle. A nutrient nitrogenous diet, which the patient assimilates only too readily, retards recovery, and will even bring on a relapse during convalescence. If meat in any form, solid or liquid, be eaten, it seems to turn into acid, which is already in excess in the blood. The power of fully converting it into living flesh is wanting, and until this power is regained a semi-conversion into an organic acid takes place. The redder and more muscular the meat is, the more it disagrees.

Chronic gout is indubitably due to good cheer indulged in, either by the sufferer or his ancestors. When a man day after day swallows more nitrogenous food than is wanted

¹ Chambers's Lectures, chiefly Clinical. Lect. II.

for the repair of his tissues, the following results may be expected, with variations dependent upon his original constitution. If the digestive solvents are weak and scanty, the excess passes through the canal in an undigested state, and is partially decomposed there. Thereon ensue all sorts of abdominal derangements, which, however, have the advantage of getting rid of the offending matters. If, on the other hand, the stomach secretes vigorously on being stimulated, then indeed the excess is digested and absorbed, and is subject to the future changes consequent on assimilation. An active out-of-door life neutralizes this in some measure by augmenting oxidation; much of the albumen goes to form glycogen, and acts as a fuel for the maintenance of muscular force. The balance is wasted in an unexplained way, and does not necessarily injure a hardy frame. The violent muscular exertion and high training needful for oxidation being inconsistent with the habits of intellectual society, a man in the prime of life who puts too much meat into a good stomach habitually retains in his blood an excess of uric acid, into which the nitrogenous waste converts itself. Uric acid in the blood has been distinctly traced as the essence of gout. Perhaps this imaginary first offender develops the full consequences; and that is the best thing that can happen, inducing greater carefulness in future.

These views can suggest but one line of preventive treatment. The children of gouty families should be brought up to a life of strict abstemiousness and muscular activity. From the earliest years vegetables and "meagre" soups should form a considerable portion of their dietary.

Gouty adults require meat but once in twenty-four hours. The bill of fare should be varied from day to day, but as simple as possible at each meal. Rich sauces are to be eschewed, and a lemon, an infusion of herbs and pepper, bread-sauce, or a purée of vegetables, adopted in their place. Sugar at the end of meals generates an excess of organic acid, and is to be avoided; if cheese is eaten it should be new, and is best toasted and creamed.

Dilute alkaline waters containing soda, such as Apollinaris or the weaker Vichy, are a rational drink during meals; but it is probably best to keep to pure water. Those who live idle lives require no alcohol; and it should not be an habitual accompaniment to meals.

Red gravel is evidence of a constitution so closely allied to gout, that nothing need be said further about its appropriate regimen.

In Bright's disease of the kidneys, in contracted liver, and in short in all degenerative lesions, alcohol has a baneful influence. Its action upon the tissues is directly the same as theirs. Moreover, if we agree with its latest expositor, Dr Sibson, that Bright's disease is closely associated with increased arterial tension, alcohol (whose effect is also to increase tension) must be peculiarly poisonous.²

For the cure of these diseases, independent of the nutrition of the rest of the body, a milk diet has been proposed, and it seems to offer a fair prospect, if the patients can be persuaded to persist in it. How safely a milk diet may be adopted in middle life is shown by the example of Dr Cheyne, a Bath physician of the last century, who at about fifty-five restricted himself entirely to milk and biscuits, and yet was able to fulfil the duties of his laborious profession. He took at first of the former six pints, of the latter twelve ounces; but he shortly diminished the quantity to half, and after sixteen years' experience found it fully sufficient, and indeed capable of further reduction in quantity.³

Weak and slow digestion is a condition which enforces ap

² Sibson's Harveian Lectures, *British Med. Jour.*, Feb. 10, 1877.

³ *The Natural Method of Curing Diseases of the Body*, &c., by Geo. Cheyne, M.D. 1742.

especial care for meat and drink. The cause of the imperfection lies in a deficiency in the supply of nerve power to the stomach, so that it both secretes its solvent fluid and also rotates its contents too slowly; and the more it is loaded the slower it goes. Of the medicinal means of curing such a state this is not the place to speak; but none of them will avail without the aid of a rational dietary. Time must be given to the oppressed organ wherein to empty itself of every complete meal, and such a period of rest given as will allow of the recovery of force; or if the meals are frequent they must be very sparing. The observations of Busch (*Virchow's Archiv.* xiv) show that a period of five hours elapses in the healthy subject before a fully filled stomach can empty itself, and in the dyspeptic the process is still longer. Whenever, therefore, the organ is loaded as healthy people rightly load it, a man should allow at least seven or eight hours to elapse before sitting down to another meal. And he must never eat till the need for food is announced by appetite. Perhaps a more generally applicable and easier obeyed law is not to make full meals at all, but to stop short at the feeling of repletion, and when that has gone off, again to take in the supply allowed by circumstances. Three moderate meals are usually sufficient to keep up the strength.

Meat should be once cooked. Mutton, feathered fowl, venison, lamb, and beef are digestible in the order they here are placed in. The more difficult dishes should have the longest time allowed to them. Of the farinaceous articles of diet, bread and biscuits are the most easily penetrated by the gastric juices, and all their preparations are safe. The best bread is the "aerated," which is free from decomposing yeast. Macaroni is good if soaked till quite macerated. Pastry is difficult of solution. Vegetables are very necessary; cauliflowers, Jerusalem artichokes, beetroot, French beans, soft peas, stewed celery, turnip-tops, spinach, are the most readily disposed of.

When the usual mixture of meat and vegetables is found to induce flatulence, it is a good expedient to eat vegetables only at one meal and meat and bread only at another. The principle on which this plan is based is that starchy food is dissolved mainly by the alkaline saliva, whereas meat is dissolved by the acid gastric juice. In a vigorous person both these are copious enough to render immaterial their mutual neutralization, but when they are scanty, their separate employment is a physiological economy.

Consumption is a disease whose treatment is almost wholly dietetic. The children of a mother whose pedigree exhibits proof of a consumptive tendency may with propriety be put to a healthy wet nurse immediately on birth, and, on being weaned, be fed from a Channel Island cow. The milk should be boiled and then cooled down to tepidity. A small tea-spoonful of "saccharated solution of lime" may be advantageously added to each quart of milk when the coming teeth require the elements of their nutrition to be added to the diet. The rules already given for the healthy management of the young should be adhered to with unusual strictness, and any departure from them should be made only to provide for some peculiar necessity of the case according to medical advice.

In cases of consumption it is difficult to say that drugs are useless, but certainly those that come nearest to aliments have most evidence in their favour, such as iron, cod-liver oil, and the phosphates of lime. Their effect on the appetite must be sedulously watched, and the end must not be sacrificed to the means; that is to say, if they spoil the appetite, they must be left off. The reason for administering oil is to afford an easily assimilated basis of renewed organic growth, to take the place of the abnormal tendency to form tubercular matter. If anything pre-

vents its easy assimilation it is obviously useless. The use of climate in the treatment of phthisis may be tested by its dietetic action; if it improves the appetite, it is doing good; if it injures the appetite, it is doing harm.

In chronic jaundice the function of the liver is best restored by the free use of green vegetables at all meals.

Diabetes, when it has once assumed a chronic form, is never really cured, but life may be much prolonged by the employment of a diet from which sugar and starch are excluded as far as practicable, and the patient nourished on animal food. The best fare for diabetic patients is that given by Professor Bouchardat in his work *Du Diabète sucré*, Paris, 1852.

In functional nervous diseases, such as hysteria and hypochondriasis, the appetite, muscular elasticity, and mental powers will often be observed to be deficient in the early part of the day, and to recover their tone in the evening. At this latter time, therefore, it is advisable to make the principal meal.

Scurvy is a notable example of a disease of which, more than any other, the prevention depends on the adoption of a suitable diet. Its symptoms so far resemble those of general starvation that from the earliest time of its appearance in history it has been suspected that it is due to a dietary defective in some necessary ingredient; and practical observation soon showed that this was fresh vegetables. It was found on every long voyage that the crew suffered from scurvy in proportion to the length of time they were restricted to dry food, and that they recovered rapidly as soon as they got access to a supply of succulent plants. This requisite for health is obviously the most difficult of all things to procure aboard ship, and efforts were made to find a substitute capable of marine transport. From the time of Hawkins' (1593) downwards the opinion has been expressed by all the most intelligent travellers that a substitute is to be found in the juice of fruits of the orange tribes, such as oranges, lemons, &c. But in its natural state this is expensive and troublesome to carry, so that skippers and owners for a couple of centuries found it expedient to be sceptical. The pictures of scurvy as it appeared during the 18th century are horrible in the extreme. But the statute of 1795, passed through the exertions of Captain Cook and Sir Gilbert Blane, has enforced the carrying of lime-juice. This invaluable preventive has shown its influence all the more decidedly by the disease still appearing occasionally under strong promoting circumstances, and to a certain extent in spite of the antidote; but it is so modified as to be usually more of the nature of a warning or demonstration than of a serious invasion. Some indeed have questioned and even denied altogether the blessings derived from the enforced use of lime-juice. But they make a very scanty show when weighed with those whom they undertake to oppose; and it is superfluous here to enter into the arguments and results of observation constituting the ponderous *Report of the Committee appointed by the Lords Commissioners of the Admiralty to Enquire into the Causes of the Outbreak of Scurvy in the recent Arctic Expedition, &c.*, and presented to both Houses of Parliament, May 7th 1877, which seems to settle for ever the preventive powers against scurvy of the use of lime-juice.

The committee alluded to was appointed in consequence of one of those exceptional outbreaks of scurvy induced by exceptional circumstances. The ships sent on the exploring expedition of 1875 were amply provided with lime-juice, and with printed expositions of its value. During the voyage out and in the long inaction of the winter the men's health was so well preserved by general attention to

¹ Sir Rd. Hawkins's Voyage, edited by Hakluyt Society, p. 60.