saying a few words in regard to the care of the teeth, although their proper conservation in detail will form the subject of a separate volume of our Health Primers.

Unless the teeth are carefully cleaned (by brushing, for instance, with water and pure Castile soap) after each meal, they are apt to become more or less covered, near their junction with the gum, with the yellow, green, or brown deposit of "tartar," which, besides being very disgusting, is thought by some to cause deterioration of the enamel or of the dentine.

The disgusting odor which proceeds from the fairest mouth if furnished with decayed teeth, the agonizing pain of toothache, and the facial deformity which ensues upon the extraction of those teeth, which all the wonderful skill of the dental practitioner sometimes fails to save, are minor evils compared with the injury to health which results from a loss of the natural apparatus for masticating the food.

Care should be taken to avoid brushing the teeth too much, especially with detergent dentifrices, and thus injuring the gums or wearing away the very enamel which it is our object to preserve. Never break hard bodies with the teeth, nor use them as nut-crackers, scissors, pincers, monkey-wrenches, and other carpenter's tools. Hot and cold liquids, especially in quick succession, should not, as in drinking, be brought in contact with them; and acid medicines, strong vinegar, syrups, and sweetmeats, should likewise be kept away from the teeth.

## CHAPTER XI.

### IMPURITIES OF FOOD AND DRINK, AND HOW TO DETECT THEM.

WHEN we consider that a healthy man of usual size takes into his stomach every year, on an average, about four hundred pounds of meat, five hundred pounds of bread, three hundred pounds of potatoes and vegetables, ninety pounds of butter and fats, and one hundred and fifty gallons of tea, coffee, water, or other fluids, we can soon realize how dangerous the existence of impurities, or adulterations of even a few grains in the pound, must be to us all, and how absolutely necessary to the attainment of long life and the enjoyment of health, is a due recognition and avoidance of articles of diet which contain such noxious ingredients.

Be it observed, too, that whether food be thus contaminated through fraudulent design, or through ignorant carelessness, makes no atom of difference in its effect upon the person who eats it, since, in accordance with the inexorable laws of dietetics, Nature here pays no regard to the intention of an action, and

punishes *errors of diet*, committed through benevolent ignorance, just as heavily (perhaps even with the penalty of death) as if they were the result of the most malicious crime.

Many of the ingenious falsifications of foods and drinks can only be detected with certainty, of course, by a complete microscopical and chemical analysis, which, in England, and a few of our States, is provided for, as it should be everywhere by the appointment of skilful chemists and microscopists under government authority, whose duty it is to examine suspected articles offered for sale in the markets and shops. A few of the adulterations can, however, be easily recognized, whilst others can be detected by simple and inexpensive apparatus, without any great technical knowledge, and these I propose in this chapter briefly to explain.

*Flour* is sometimes largely adulterated with finely ground rice, potatoes, peas, beans, barley, and oats, but these impurities, which can readily be detected by microscopical examination, only diminish its nutritive value; a more serious adulteration is that with alum, which serves to whiten the bread made from it, and so enables dishonest bakers to sell the product of poor or damaged flour at a high price. On the continent of Europe sulphate of copper (blue vitriol) is sometimes employed for the same purpose. The presence of alum in bread, flour, or baking-powder,



may be readily detected by the deep purple color produced on soaking it in a weak solution of extract of logwood, which may be purchased for a few cents at any drug store. In former times, whole provinces in Europe were ravaged by epidemics, of what is called ergotism, a peculiar disease, in which the fingers and toes drop off, caused by living upon rye flour, containing the ergot or smut of rye; but at present this mode of poisoning is rarely met with. Occasionally, painters, plumbers, and other workers in lead, suffer from lead poisoning, and paper-hangers, etc., from arsenical poisoning, in consequence of their eating bread and other articles of food with fingers which have not been properly cleansed from metallic particles adhering to them. The Mosaic injunction against "eating with unwashed hands" would, if universally carried out, obviate this danger; and, indeed, many of the edicts of the ancient Hebrew lawgiver have a scientific sanitary basis, which, considering the state of human civilization at the epoch when they were issued, nearly four thousand years ago, seems to point unmistakably to their origin in a wisdom from on high.

*Butter* is rarely adulterated with injurious impurities, although the purified animal fats honestly sold under the names of butterine, oleo-margarine, etc., are no doubt often mixed with the inferior grades of butter. These contaminations, however repulsive

and disgusting to refined palates, are not as a rule likely to shorten life.

*Milk*, on the contrary, is very frequently the subject of dangerous adulteration, and in view of the fact that it constitutes the staff of life for most of our children during a large part of their infancy, and at a time when their hold upon life is of the frailest character, it becomes a most important question how such fraud can be absolutely prevented. The true successors of King Herod in our day are the milkmen, who slay the children "of two years old and under" by thousands with swill milk, adulterated milk, and milk loaded with the poisonous germs of scarlet-fever, typhoid fever, or various other diseases; and, as I have elsewhere remarked, it seems to me only needful for the danger of this mode of propagation of disease to be forcibly presented, and fairly understood, to ensure that the people, through their legislators, would put an end to the abominable traffic in impure milk, which costs the lives of so many thousands of their beloved children annually. Swill milk, and milk from stall-fed cattle, which are generally diseased, and often consumptive, has been proved to be very unwholesome, and in the light of recent developments in regard to the innoculability and communicability of consumption, scrofula, and other tubercular diseases, should be absolutely avoided, as a probable cause of these terrible maladies, from which,



in some temperate climates, nearly one-third of the earth's inhabitants perish. In England, numerous wide-spread epidemics of scarlet-fever and typhoid fever have been unmistakably traced to the milk supply, which was contaminated with the germs of these complaints. In one instance, case after case of typhoid broke out among the customers of a certain milkman, and when at last an investigation was held, this person admitted that his milk cans had been "*washed out*" with water from a certain well which was proved to be infected by sewage from a neighboring cess-pit containing typhoid-fever excrement.

The use of milk diluted with water, however, as it is commonly supplied in cities, has no injurious effect if the "iron-tailed cow" is a healthy one, except that its nutritive properties are, of course, lessened. This sophistication can sometimes be detected by the lactometer, or milk hydrometer, an instrument for determining the specific gravity of the milk, which is, of course, reduced if water only is added; but artful dairymen frequently bring up the specific gravity to the proper standard by dissolving salt or sugar in the diluted milk, so that this test cannot be implicitly relied upon. Many infantile disorders are probably caused by giving children milk which has begun to sour a little in consequence of the growth in it of a minute fungus which develops very rapidly in warm rooms or during warm weather. This danger, as

well as the disadvantage of using an article too much diluted, may be avoided by employing condensed milk, which is a great convenience whilst travelling. Care should be taken always to boil the water shortly before it is mixed with the condensed milk, in order to destroy, if possible, any organic germs of disease which it may contain; and when its use is continued for any considerable length of time, the chance of lead poisoning from the solder of the tin cans in which it is put up for market must not be overlooked. Such an unfortunate result would probably occur only in a child who was unusually susceptible to the action of the metal, and its first symptoms are generally colicky pains in the abdomen and obstinate constipation of the bowels.

A committee of Boston physicians reported some years since that over a million and a half gallons of water were sold *as milk* in their city that year, nearly $500,000 being paid for it by the defrauded customers. They further point out that this water was probably not even pure, but apt to be taken, when thus used to adulterate milk, from impure streams and barnyard wells, and hence to produce typhoid fever and other infectious diseases in those who drank it. One instance is noted where, in twenty different families, thirty-four cases of typhoid fever were caused by drinking milk thus adulterated with water from a well sunk near a cess-pit. They declare the high death-



rate among city infants from cholera-infantum is largely attributable to poisoned and weakened milk.

*Meat* of various kinds can scarcely be said to undergo adulteration, although the presence in it of trichina and the larva of tape-worm are fruitful sources of disease, which will be treated of in a subsequent chapter. (See Chap. XV.) The ordinary danger from meat, and especially from fish, is that which arises from commencing putrefaction, and to detect this the sense of smell is usually a sufficient guide. In cases of doubt, cut a small portion of the suspected flesh into small pieces, and pour over it a few ounces of hot water, with the vapor of which a disagreeable odor will rise if any be present.

Good *eggs* may be recognized by putting them in a strong brine made with one ounce of common table salt to ten ounces of water. In this a sound egg sinks to the bottom, whilst the stale one will float at the top.

*Tea* is not unfrequently adulterated with the leaves of other plants, and with those of the true tea shrub, which have been dried after most of their virtues are extracted by infusion in water. Black tea is sometimes colored with "black lead," which, as it contains no lead and consists almost entirely of pure carbon or charcoal, is quite harmless. Green tea, however, often owes its glaze or bloom to a mixture of Prussian blue, indigo and China clay, which, if not

poisonous, is at least indigestible, and quite inappropriate as an article of food.

*Coffee* is chiefly adulterated with chicory, burnt peas or beans, acorns, saw-dust, etc.; these frauds may, of course, always be avoided by purchasing the coffee berries unground, either roasted or in their green state.

In regard to the condiments, it is sufficient for me to mention that Cayenne pepper has been found largely adulterated with the dangerous impurity of red lead, and vinegar is often manufactured from oil of vitriol, diluted freely with water, and flavored with a little genuine cider or wine vinegar to give it the proper odor. Fraudulent vinegar of this kind, if used for a long time, would be apt to bring on diarrhœa, dysentery, and ulceration of the bowels. It may be detected by the absence or scarcity of the minute vinegar eels when examined microscopically, or even with a magnifying-glass, and by its giving an abundant white precipitate when a few drops of solution of barium chloride are added to a suspected sample.

Occasional examples of serious or even fatal poisoning from partaking of stale fish, oysters, crabs, etc., and of sausages which have been long on hand, render it advisable to reject all articles of food of this kind, unless we have every reason to believe they are fresh and in good condition.



The subject of "Proposed Legislation on the Adulteration of Food and Medicine" is ably discussed in a recent monograph with this title, by my friend, Prof. E. R. Squibb, M.D., of Brooklyn, N. Y.; and his sagacious conclusions will, I trust, soon be embodied in the laws of our various States.

Cooking fruit in brass or copper kettles, although now less common than formerly, before its dangers were properly understood, is still sometimes practised, as is also the making of pickles in such metallic vessels for the purpose of giving them a fine green color. This is, of course, due to the beautiful but deadly acetate of copper, or verdigris, formed by the action of vinegar upon copper or brass. Preserved green peas have sometimes been found to owe their fine fresh color to a salt of copper, and should then be eaten with caution, *or* not at all.

The acids of preserved fruits generally are liable to act upon the lead of the solder joining the tin cans in which they are put up, and thus give rise to lead colic in people who partake of such delicacies.

# CHAPTER XII.

## EXERCISE, AND HOW TO TAKE IT.

EXERCISE, in the strict signification of the word, means the performance of its function by any and every organ of the body; as, for instance, exercise of the stomach is digestion, and exercise of the liver is the formation of bile. As usually employed, however, it signifies the action of the voluntary muscles, that is, those under the control of the will; and in this sense it will be used here. Since not only the circulation of the blood, but also the formation of its elements, and the destruction of these elements when worn out and useless, are powerfully, and, as a rule, favorably, influenced by this action of the voluntary muscles, it is obvious that without such movement health will almost inevitably be impaired or lost.

The most important effect of exercise is to be seen in the lungs when the circulation of the blood is hurried much above the ordinary rate. As a consequence of this greater influx of blood to be aerated, or rather oxygenated, in the air-cells, the quantity of air inspired, and the amount of carbonic acid exhaled, are both largely increased. From the experi-





ments of some physiologists, it would appear that the unusual amount of carbonic acid given off from the lungs during exercise is really formed in the muscles which are actively employed, and *must* be speedily carried away from them, dissolved in the blood, to the air-cells of the lungs, whence it finds its exit from the body. If this is not accomplished with sufficient rapidity, the muscular substance soon becomes oppressed with the poisonous carbonic acid, and so debilitated as to grow almost powerless, as we often find to be the case when workmen are compelled to make violent muscular exertion in a confined space cut off from the free access of the atmosphere.

If either the supply of carbon to the muscles, or its elimination from them through the blood to the lungs, and from thence into the open air, is interfered with in any way whatever, capacity for exertion of the muscles in question is quickly lost. Hence, during exertion no clothing should be worn which interferes with the free play of the chest; a larger amount of carbon should be furnished in the nourishment, and experiment has shown that this is more efficient if supplied in the form of fatty than of starchy food. Furthermore, since alcohol has a tendency to lessen the quantity of carbonic acid given off by the lungs, it should not be used in the shape of brandy, whiskey, or wine, during exercise.

Muscular exertion very speedily increases the force

and frequency of the heart's pulsations, and the amount of blood flowing through all parts of the body, including the heart itself, in a given time is much augmented. The number of beats of the heart may be altered from about seventy, which is the natural rate, up to ninety, one hundred, or even one hundred and twenty to the minute. After the cessation of exercise, however, the beats fall below the usual number, and if the exertion has been very severe or long-continued, may descend as low as forty per minute, and become intermittent.

Going up a steep hill, or even a long staircase, gives rise to a very severe strain upon a fatigued heart, and is especially apt to bring on cardiac disease, although this is liable to result from any excessive exertion. Under such circumstances, actual rupture or bursting of the heart has been known to occur, the individual literally dying, in such instances, of that malady so rare in real life, but so terribly fatal to the heroes and heroines of novelists, "a broken heart." Very commonly, however, palpitation, enlargement, or disease of the valves of the heart are brought on by excessive exercise, especially in ascending heights.

On the other hand, deficiency of exercise is apt to lead to weakening of the heart's action, probably from its dilatation, or swelling up, while its substance grows thinner, or from a change (which is frequently observed in fact) of the muscular structure into fat (fatty degeneration).



A stern warning against omitting to exercise all the faculties (mental and physical) with which we are endowed is furnished by the fate of the crabs in the Mammoth Cave. Similar crabs outside the Cave are supplied with very keen eyes, at the end of movable stalks, which afford them a wonderful range of vision; but the Cave crabs are punished for neglecting to use their sight by complete loss of the eyes, although the stalks which, generations ago, no doubt, carried the optical apparatus, still remain in position upon their heads.

Severe muscular exertion increases the flow of blood in the small blood-vessels of the skin, and causes a profuse discharge of perspiration, which may be even doubled or trebled in amount. During active exercise, there is little danger of chill, but immediately afterwards, and also during the intervals of rest, the skin should be so warmly protected as to prevent the least feeling of coolness of the surface. For this purpose, flannel is by far the best covering.

Moderate exercise causes the muscles employed to increase in size, become harder, and respond more readily to the commands of the will; but if the exertion is too prolonged or excessive, the opposite effect is produced, and they begin to soften and waste. This fact gives us the foundation of a simple rule for determining when the physical strength is overtaxed by any habitual labor or athletic sport.

The circumstance that the ancient athletes, as the runners, gladiators, etc., in Greek or Roman games,

were called, had the name of being proverbially stupid, is often urged as an evidence that unusual physical cultivation interferes with, or even prevents, high mental activity, probably because the nervous fluid or influence is partially withdrawn from the brain to the severely taxed muscles. There is, I have no doubt, a good deal of truth in this notion, especially as it is amply demonstrated that deficient exercise causes a heightened sensitiveness of the nervous system, generally a sort of morbid excitability, and a greater susceptibility to the action of external influences of every kind.

Inclination for food is largely increased by exercise, especially the disposition to eat meat, and fatty articles of food in general. On the other hand, deficient exercise leads to the avoidance of meat and of fats, with partial neglect of even starchy and saccharine diet.

But, my reader may ask, what is the amount of exercise a healthy man should take every day, in order to promote and sustain the most perfect sanitary condition of his body? And this question is the more important, because there is no doubt that great errors in this respect are constantly committed by whole classes of persons, chiefly in the direction of deficiency of exercise.

According to the late Prof. Parkes, our eminent English authority upon sanitary science, we may consider that, in the most healthy life of a vigorous man engaged in active labor in the open air, a full day's work



will probably be equivalent to lifting three hundred tons one foot high, or what is, of course, the same thing, equal to raising one ton to the height of three hundred feet. This, however, is a hard day's work; and, therefore, as an approximation, we may estimate that the daily amount of exercise for every man in good health ought to be equal to half this much, that is, to lifting a hundred and fifty tons to the height of one foot. It has been calculated that for an individual weighing one hundred and fifty pounds, this amount of muscular exertion would be about equal to that put forth in walking eight and a half miles upon level ground. If, now, we suppose that the expenditure of force in going up-stairs, and moving round the house, is equivalent to a two-and-a-half mile walk, this would reduce our allowance of open-air walking to six miles every day, a distance which is by no means too great to be paced over by every vigorous man who wishes to attain long life, and enjoy good health up to old age.

For females of average strength, a smaller amount of pedestrian exercise, amounting to three or four miles daily, would generally be appropriate, although the brilliant complexions, robust health, and perennial youth of English ladies are no doubt largely due to their habits of constant and, it would seem to most Americans, excessive out-door exertion; many British women having no hesitation in starting off for a

ten-mile walk, of an afternoon, without any important object except the benefit of exercise.

In the great English Universities of Oxford and Cambridge, it has been proved by centuries of experience that, as a rule, the most indefatigable scholars make better progress in their studies, if they take two hours out of their fourteen or sixteen working-hours for constitutional exercise in rowing, walking, or cricket, than if they attempt to perform mental work continuously, without allotting a proper period to mere bodily exertion.

As I have already remarked, the quantity of carbonic acid given off bears a nearly constant relation to the amount of muscular labor performed, and in this we have a valuable guide to the relative usefulness, as promoters of health, possessed by different kinds of exercise. If we consider that the amount of air inspired, and therefore required by the body to carry off the carbonic acid formed, whilst lying down be considered as the standard, and called 1, we may show, by direct experiment, that standing up in the erect position raises the quantity of inspired air to 1.33; walking at the slow pace of one mile an hour nearly doubles it; walking at the rate of four miles an hour renders five times as much air requisite to carry off the carbonic acid; and riding on horseback necessitates the breathing of about four times as much.

Although I earnestly recommend an increased amount of out-door exercise as a most important aid



towards the restoration and maintenance of health, I would caution my readers against too great or too sudden alteration of their habits in this respect. Moreover, no greater mistake, from a hygienic point of view, can be made than in increasing the amount of physical exercise, when the mind is overworked, without a corresponding reduction of mental labor, and *vice versâ*. Very often it is only by resting the brain more at the same time that the muscles are exerted longer and to a greater extent, that the required balance of action in the system is brought about, and health is restored or retained.

The amount of exercise in childhood and youth should be most carefully regulated, as, in many instances, ambitious children will far exceed their strength in the effort to avoid being outdone by older or more robust companions. In infancy, the almost incessant movements of a baby's limbs show how imperative is the instinct of Nature for muscular exercise. A baby seems to rejoice in putting in action every muscle of its body, and often the sole cause of its uneasiness appears to be disappointment over its inability to solve, with its arms, legs, and head, all at once, the problem of perpetual motion. Hence it is important not to restrict too much the movements of infants, and care should be taken to prevent their clothing being too tight to allow ample freedom of the limbs. Even the cry of a young child is often useful as a means of exercising the muscles of the

chest, and, in moderation, must not be discouraged. After the baby begins to walk, the amount of this kind of exercise which it is stimulated to indulge in must be guided for a year or two by the extent of ossification (or bony development) of the leg-bones, otherwise these may become bent by the weight of the infant, and permanently deformed.

During childhood and youth effort should be made to exercise every important muscle in the body, each in its turn, so as to secure for all a complete and symmetrical development, and consequently a robust health. To accomplish this the light gymnastics, with dumb-bells, rings, etc., for girls, and the sports of the play-ground, with rowing, swimming, running, leaping, and riding, for boys and young men, are vitally necessary.

The mistake which sadly diminishes the benefit of gymnastics for girls is, that they are generally performed in a close room, or, at best, one wherein the windows are opened for a few minutes only; and statistics show that persons who sit still in the open air, such as apple-women, enjoy better health, as a class, than those who take plenty of exercise in the house. By some additional trouble and expense, this drawback could usually be avoided, as I trust will soon be the case in all well-conducted schools.

Bodily exercise, as well as mental exertion, should be regulated with especial care in young girls about the epoch of puberty, since the changes of the constitution at that momentous period often render ordinary rules and habits useless or even injurious. In cases of doubt, medical advice should always be summoned in order to avoid laying the foundation of life-long imperfections of development as a consequence of temporary overstudy or overwork. The same caution is applicable in regard to boys, although to a less extent.



Where systematic gymnastics do not form part of the exercise indulged in, attention should be paid to the varieties of muscular exertion, in order that, even during adult life, all the different parts of the body should receive a share of the benefit. In leaping, walking, and running, the muscles of the legs and back are chiefly brought into play, and those of the arms and shoulders have but little occupation, whilst in rowing, boxing, and fencing much of the work is performed by the muscles of the upper half of the body. In swimming, riding, and climbing, the contractile effort is more equally distributed among all the chief muscles of the frame.

In advanced life, the power, as well as the inclination for active exertion, alike fail, and the strongest inducements are sometimes requisite to postpone the period when all exercise is omitted and the individual becomes completely bedridden. This unfortunate condition should be put off as long as possible, and every means employed to encourage the patient not to neglect the regular, even if moderate, exercise of which his reduced physical strength still renders him capable.