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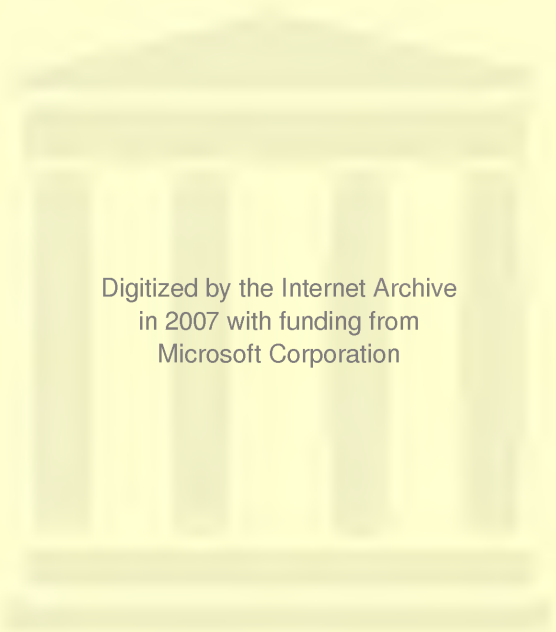

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INSTINCT AND HEALTH

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BY

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DR. HUTCHINSON

INSTINCT AND HEALTH

CHAPTER I

THE ANCESTRY OF HEALTH. HOW THE HUMAN MACHINE HAS DEVELOPED

It isn't so very dangerous to be alive. One would really think it was, to hear the preacher moralise upon the shortness and uncertainty of human life and the doctor discourse on the everywhereness of germs. In the first place we are apt to forget how long we have been at it. If any one were to ask us how long we had been alive, we would promptly give him the number of years which had elapsed since the date of our birth —twelve, twenty-five, or sixty—as the case might be. But we would be wrong. As a matter of fact we are all the same age—and that is at least twelve million years. The torch of life which burns in us has never been quenched since its first appearance on the planet. Each successive generation has kept it alive and passed it on undimmed to the next. There never has been a single break. We have never lost an ancestor by death. If we had we wouldn't be here. There is an absolutely unbroken thread of life, which connects us with our earliest ancestor on this planet, the father of all living things. Just think what we must have been through in all that time, and particularly what it means to us in resisting power.

We are the descendants of the victors, the survivors of countless generations. We have been in the habit

of meeting difficulties and overcoming them for eons. Are we likely to forget these proud triumphs and weakly succumb now? If there is, by any possibility, anything which can come upon us in the way of heat, or cold, or hunger, or wounds, or disease, which our ancestors have not met and conquered, it would be hard to imagine it. Remember then, we represent the dominant strains of millions of generations, and that it is the breath of our nostrils to meet dangers and overcome them. It took nature some thirteen millions of years to make us, and she is not given to wasting her time.

Herein lies one of the secrets of the perfection of the human machine. It is so wonderfully adaptable. It is no carpet knight or fair-weather sailor, or, to use a more modern and appropriate simile, automobile, to run just when the weather is favourable and the roads are good and break down the minute it meets with difficulties. It is ready for all emergencies, and will fight its way out of them in surprising manner, if we only give it a fair chance. We are really wonderful beings, and have good right to be proud of ourselves, physically.

In the second place, it is so easy to notice defects. We don't have to recognise them, they introduce themselves and insist upon our attention in the most annoying manner. When we agree with the Psalmist that we are fearfully and wonderfully made, it is our fearful liability to break down and get out of order that we are thinking of. This is only natural, for it is always the evil in things that most sharply impresses

us. Comfort is a passive, hazy sort of sensation compared with the clear-cut acuteness of pain. Besides there is little need to pay much attention to the good qualities of things. They'll never hurt you. "Well enough" can be safely let alone. Health will take care of itself, disease must be cured at once.

"A healthy man doesn't know that he has such a thing as a stomach, a dyspeptic doesn't know that he has anything else." Hence the defects of the human machine bulk hugely out of proportion in our memories and imaginations. I am afraid that we doctors are apt to drift unconsciously into this attitude toward the human machine. We are kept so constantly engaged in tinkering and fixing it that we come to look on it as a bundle of defects. Even as sanitarians we seem to delight in populating the heavens above, the waters, the earth beneath, the dust of our streets, and the food upon our tables with hosts and swarms of tiny savages to whom the human body is a helpless prey whenever pounced upon. Both the laity and the profession are apt to forget that the human body is not a pulpy victim of circumstances, but the toughest, most resisting, most marvellously adaptable and most ferocious organism that the sun shines on. It can flourish where nothing else can, and kill, eat, and grow fat on any other living creature, not even excepting disease germs.

Another thing which has probably misled us has been the way in which man has avoided specialisation. Because he has not the speed of the deer, or the

strength of the horse, or the size of the elephant, or the teeth and claws of a tiger, we have come to regard him as a feeble and inferior sort of animal. Nothing could be farther from the truth. In fact man's chief superiority consists and has consisted in the singular way in which he has, so to speak, kept in the middle of the road and not gone to any extremes. By the law of compensation, just in so far as an animal has acquired great efficiency in one direction it has weakened itself in another. Man has kept practically all his teeth, all his toes, all his fingers, instead of losing from one-third to two-thirds of them as other animals have, in order to specially develop those that are left. And he has with them retained a power in and over all imaginable circumstances such as is possessed by no other animal.

Man is the best fighting animal in the world. There is not a bird or beast or fish that he cannot beat at its own game, if he sets himself about it. The Blackfoot or Viscayan will settle into his long, springy stride that "eats up the long miles like fire," run down a deer, and kill it with his hunting knife. The Yellow Knife camps on the trail of the wolf in winter and follows him day after day, relentlessly as fate, until even the grey leader of the pack succumbs. The negro of Mozambique will spring right into the water and kill the man-eating shark in single combat with his crooked knife. The Sikh will face a tiger, with his short, heavy cimeter. Club or sword in hand, man is a match for the most ferocious beast of prey in a fair, stand-up fight, and the club or its descendant

is as much a part of us as our bones or skin. It was only after acquiring it that we allowed our teeth and claws to degenerate into such feeble objects. Its use has made us right-handed; right-handedness has specialised the brain-cortex to such a degree that speech was possible, and speech makes thought possible. So that our mental superiority is an outgrowth and a part of our muscular superiority.

In the language of Tommy Atkins in Kipling's ballad, *homo sapiens* is, "a pore, benighted 'eathen, but a first-class fitin'-man," and two-thirds of his virtues—moral, physical, and mental—are the fruits thereof. And yet we talk of him professionally as if he were a clam without a shell.

This middle-of-the-road policy has made him extraordinarily resistant to extremes of climate. There is no known organism that can defy the elements as he can. No other mammal and no bird has half the year-round geographic range of the human species. His best chum, the dog, will accompany him almost everywhere, but only by having his food, shelter, and snow boots provided for him by his superior. We speak of being "as rugged as a bear," but it takes three distinct species of *Ursus* to keep pace with man from the tropics to the pole. Half a dozen species of deer are required for the same match. His domestic animals are far inferior to him in toughness, and one of the chief obstacles to his progress in many regions is the difficulty of finding any beast of burden, or milk-giver, that will live in the climate. Some of this power of defying the elements is, of course, due to

man's power of constructing shelter and making clothing; but this many animals possess also.

Still more depends upon his astonishingly wide range of food materials. He can live on anything that is digestible by any other known animal. In contrast with almost any other animal he can live on some food upon which that animal would starve to death. Thus while the pure *carnivora,* or flesh-eaters, can beat him at both catching and utilising flesh foods, he can live on a diet of roots and herbs or grubs and insects, or fruits, or fish, which they would starve on. On the other hand, the *herbivora* will make a better living on leaves and grass than he will; but are, of course, totally unable to either capture or utilise animals, birds, insects, fish, nuts, etc., on any of which man can survive indefinitely. He can pick fruit and nuts with the monkey, catch fish with the seal, dig grubs or roots with the wild pig, eat ants' eggs with the ant-eater, and grasshoppers with the snake. As a food getter and eater he has no equal. And it is well for him to keep up this wide range of food materials to-day, both because it agrees best with him and because it is necessary to enable him to adjust himself to possible changes in the future. We never can tell what the future may have in store for us dietetically, or otherwise, and it is well to "keep all the pores open." It is this capacity, retained even by the modern white man, of living on rice and fruits in the tropics, and seal oil and bear meat in the arctic regions which has made him such a wonderful colonizer. The worst fault any modern diet can have is monotony.

The same toughness is shown in the way in which he adjusts himself to city life. Crowd him as you will into human hives, deprive him of air, sunlight, pure water, and green grass, he will manage somehow to acclimate himself and resist even his new surroundings. The death rate even in our mediæval cities, abominable as they were, was never so very much above that of country districts, and to-day, in our modern metropolises, with even the imperfect victory won by sanitarians, is actually in some cases lower than that of country villages. It is a singular fact that the one race which has been subjected incessantly to this terrific test of overcrowding for nearly fifteen hundred years—the Jewish—has attained a rate of mortality, even in its ghettos, far below that of the surrounding Gentile population in the open country. The Jew, compelled by class and religious hatred to become a city dweller, has risen to the emergency and scored another of his memorable racial triumphs.

We need not fear that civilised man is going to become degenerate from city dwelling or any of the other strains of civilisation. Contrary to popular belief, the white man of to-day has a lower death rate, a higher average length of life, is taller, heavier, and stronger than any of his predecessors, or any known race of savages. Almost any company of American and English soldiers will contain men who can outrun, outwrestle, and outswim the best athletes of any native tribe.

Moreover his "net" birth rate is higher and his death rate lower than that of any savage tribe. In-

fant mortality among savages is something frightful, compared with even the most ignorant of white communities. Adult savages are perhaps, on an average, slightly freer from certain defects than white men, but for the obvious and simple reason that all who possessed these defects perished in childhood, or famine. Now that reports are fairly well in from army surgeons and medical missionaries, the old superstition that savages have fewer diseases than the civilised man, has been completely exploded. Child-birth, even, has just as many pains and dangers in savage women as in civilised, only nobody takes the trouble to record them, until the explorer or missionary comes. The savage mother, as her time of trial approaches, retires into the depth of the forest, or jungle. If she returns alive with the baby, all is well. If she doesn't, it isn't considered good manners to inquire about her. Her husband simply buys another wife, and the episode is closed. It has been said that, savages living in a state of nature, have no idiot children; but this is readily accounted for by their crude but not wholly irrational habit of knocking them on the head, or leaving them to starve. The only diseases peculiar to civilised man are certain contagions and infections. Even to these he has become toughened to so great a degree that infections which have gradually been worn down to what we term "diseases of childhood," such as chicken-pox, measles, whooping-cough, and scarlet fever, or even influenza, will sweep like wildfire through a savage tribe and kill two-thirds of those they attack.

Altogether civilised man has every reason to be proud of his past, and confident of his future.

It is a good thing occasionally to try and "see oursel's as ithers see us." It gives us a new respect for ourselves, and we're worth it. We are not "worms of the dust" any more. We passed that stage seven million years ago. If we could get a good look at ourselves from the point of view of the other animals, it would really surprise us to find what highly respectable, formidable animals we are. If there is an animal, no matter how large, who doesn't shiver and make tracks as soon as he sees or, especially, smells man, it's only because he hasn't had the honor of our previous acquaintance.

Let us size ourselves up physically from the point of view of, say, an observant and open-minded lion, who since his birth in the fastnesses of his desert has never seen one of our species; or from the point of view of the convent-bred *jeune femme* who when she saw a man is reported to have asked her mother, "What animal is that, mamma?"

Nor will the point of view be so very foreign to many of us over forty, for by our mediæval "classical" system of education we have been carefully trained not only to be ignorant of our bodies but proud of the fact as well.

This is how we should probably strike the lion: a queer, upright animal, with only two legs and a big, round knob at the top. In crawling closer the knob is evidently the head, for the eyes can be seen. But what's it for—a battering ram? No, for there are

on it neither horn-bosses like the buffalo, nor spikes like the antelope, nor a biting-forceps, for the teeth and jaws don't project enough to be seen. A little nearer and there they are tucked in under that funny bump over the eyes, but not big enough to punish anything. Where is the fighting end of the creature? Its feet look like flippers, neither claws to scratch nor hoofs to kick. It must be its short fore legs, hanging on each side of its chest. Now I see one of them clasps in its paw a broken branch with a sharp thorn at the end of it. I'll keep my distance, or it may throw it at me, like those old baboons threw broken pieces of rock the other day when I tried to catch a couple of their babies!

And Leo would be perfectly right.

It is the hand, which has marked man from other animals, which has made him what he is. It was to keep his hand from bearing the weight of his body and leave it free for the club and the stone that he originally rose up on his hind legs and acquired the erect position of which we are so proud. It was the new uses to which the hand was put with the weapon, the tool, that built up the brain so that speech and thought became possible. As shrewd old Benjamin Franklin said a hundred years ago, "Man is a tool-using animal."

Yet a large body of respectable taxpayers protest against the introduction of manual training into our schools as a waste of public money! Train the hand, then answer half the questions that the brain which it builds will ask—and you *have* education at its best.

Look closely at this fore paw of ours. Not only a tool user, but itself the most wonderful tool in the world. It can grip and twist like a monkey-wrench, hang on like a grappling-hook, crack like a nut-cracker, pick like a pair of tweezers, tear like jaw-forceps—the Japanese dentist pulls teeth with his fingers—and grub like a gopher. It can twist and turn like a snake, swim like a seal, climb like a monkey, strike like a horse's hoof. With a stone it becomes a hammer; with a sharp flint, an axe; with a jagged one, a saw; with a thorn, a sewing-machine. No wonder the anatomist finds that it has some thirty muscles in and attaching to it!

It is a tool that needs infinite variety of use to bring it to its highest pitch and keep it there, and while you are giving it this you're developing the brain to similar degrees of complexity and perfection. The thing that marks off the human brain most distinctively from that of any other animal is not its size. A swallow or a titmouse has a larger brain in proportion. Restrict the hand in its movements and the hand and arm area—the so-called Rolandic or central region of the cortex—fails to develop; narrow it down to one thing or one tool, and it becomes cramped and unsymmetrical. Give children every kind of handwork that their play-instincts—the deepest and most useful in their nature—call for, and then brain development will follow. Glue them to the desk, the loom, the handle of any tool, and you dwarf them both physically and mentally. Child labour is the worst race suicide.

No wonder the hand is "full of character." It has done much to build character. We have good basis for distrusting the man with the flabby, nerveless, slippery hand-shake. Turn the hand over and look at the palm. There are three lines, two transverse and one longitudinal. Half close your hand and you see at once what makes them. The upper cross line which starts from the ulnar, or little-finger, side, is the wrinkle made by bending the three outer fingers, the remains of the climbing-hook by which we swung from branch to branch through the tree tops in our arboreal days.

The lower cross line, starting from the other side of the palm, is the wrinkle made by flexing the two inner fingers, index and ring, to meet the thumb, as in picking fat grubs out of a rotten log or nuts out of their shells, or in grasping a handle firmly. The lengthwise line is equally obviously the wrinkle made by the thumb in bending over to meet the fingers. All three lines can be seen in perfection in the paw of a chimpanzee or a monkey.

Yet there is a widely popular "science" of palmistry which dubs these anthropoid wrinkles the "head," "heart," and "life" lines, and proceeds to predict the whole future life of the individual from their degrees of development. There could hardly be a more humiliating example of the incredible ignorance of the simplest facts of our own structure in which we have been brought up. These wrinkles have about as much to do with the head, heart, and life-chances of their possessor as with the price of soap.

Now let us look through Leo's eyes again at the knob at the upper end. Big enough, but evidently no good for fighting purposes. Throw the "featherless biped" out of a window, and its overweight will pull it down first, so that he lands on it and cracks it seven times out of ten. Why did it grow there in that absurdly exposed position, instead of in the middle of the animal—say the pit of the stomach—so that arms and legs and trunk could all be used to protect it?

The eyes didn't determine its location, for jellyfish have eyes all round their bodies, and starfish at the end of their arms. But look a little closer. There's a mouth. That settles it. The first brain had to grow by that. First a couple of (motor) nerve knots *(ganglia)* to control mouth and jaw movements, then a pair of (sensory) smell buds, then a pair of (sensory) eye lobes, next a pair of ear knots, then gullet, body muscles (motor) *ganglia* to match them. Then from the nose-jaw—eye knots began to sprout up an upper-brain *(cerebrum)* to link their messages and movements together. This grew and grew while the basal masses remained stationary until finally it completely "overflowed" them, bulging forward until its forehead-box came to overhang the front of the mouth instead of lying far back of its angles, pushing the eyes down and forward until they lie far below the level of the top of the head, crowding the nostrils down until they open downward instead of straight forward.

This overgrowth is what makes the jaws look so

small and weak. Instead of forming three-fifths of the bulk of the head they are barely one-fifth. But open your lips and look at your teeth. Somewhat reduced in number and size, but every kind of teeth that any animal has or ever had is there and ready for business: incisors, canines, premolars, molars.

Moral: give them all something to do. The worst fault a diet can have, if it be sufficient in amount, is monotony. Eat every kind of sound food that you can get in every season of the year. Flesh, fish, fowl, and "gude red herrin'," vegetables, fruits, grains, nuts, fats, sugars—all have their uses and each its peculiar advantage. No restricted diet for this mouthful of teeth. The stomach and intestines match. They are fit to tackle anything except too much grass.

Glance at the hind paws. Nothing just like them in the world, but not so wonderful as the fore paws. Beautifully balanced, springy arches of jointed bone, braced and supported by elastic muscles and steel-wire tendons. Two of them support the body erect as securely and far more gracefully and effectively than any four paws. They have triple-spring expansions, to give elasticity and poise, lengthwise from heel to toe, crosswise at instep, and broadly across at spread of toes. (What folly to cramp the last by tight shoes, or break the first by thrusting a high heel up into the middle of it. Many a backache, many a headache, and many a nervous breakdown comes of this.) "A soldier on the march, me son," says the inimitable Mulvaney in "Soldiers Three," "is no betther than

his feet." It is equally true of many a business man or housewife, to say nothing of laborers. Like the hands, the feet are ready for any emergency. They're the toughest long-distance runners in the world, they can climb with the goat, swim with the otter, skate over the bog with the frog.

CHAPTER II

SOME DIET DELUSIONS, OR COALING THE BODY-ENGINE

How can a delusion exist in regard to such a matter-of-fact and every-day subject as diet? One would certainly have thought it the easiest of things to put to test and prove or disprove promptly.

Every imaginable experiment upon what would and what would not support life must have been tried thousands of years ago, and yet our most striking proofs of how highly men value their "precious right of private haziness," as George Eliot shrewdly terms it, are to be found in the realm of dietetics. The "light that never was on sea, or land" still survives for the most matter-of-fact of us in the memory of "the pies that mother used to make," and nowhere else do we find preferences so widely accepted as evidence, and prejudices as matters of fact, as in this arena. In fact, if we were merely to listen to what is said, and still more to read what is printed, we would come to the conclusion that the human race had established absolutely nothing beyond possibility of dispute in this realm. Every would-be diet-reformer, and we doctors are almost as bad as any of them, is absolutely certain that what nine-tenths of humanity find to be their food is a deadly poison. One philosopher is sure that animal food of every description, espe-

cially the kind that involves the shedding of blood, is not only absolutely unfit for human food, but is the cause of half the suffering and wickedness in the world. Another gravely declares that the only thing which above all things is injurious is salt. Another takes up his parable against pork. Still another is convinced that half the misery of the world is due to the use of spices; and one dietetic, Rousseau, proclaims a return to very first principles by the abolition of cooking. Another attacks the harmless and blushing tomato, and lays at its door the modern increase of cancer, insanity, and a hundred kindred evils; while Mrs. Rohrer has gently but firmly to be restrained whenever the mild-eyed potato is mentioned in her presence.

There is almost an equally astonishing Babel when one comes to listen to the various opinions as to the amount of food required. Eighteen grave and reverend doctors assure us that overeating is the prevalent dietetic sin of the century, while the remainder of the two dozen are equally positive that the vast majority of their patients are underfed. One man preaches the gospel of dignified simplicity on one meal a day and one clean collar a week, while the learned Fletcher declares that if we only keep on masticating our one mouthful of food long enough, we shall delude the stomach into magnifying it into ten, and can dine sumptuously on a menu card and a wafer biscuit.

Fortunately, when it comes to practice, philosophers, reformers, and doctors alike have about as much in-

fluence here as they have over conduct in other realms —and that is next to none at all. The man in the street follows his God-given instincts and plods peacefully along to his three square meals a day, consisting of anything he can find in the market, and just as much of it as he can afford, with special preference for rich meats, fats, and sugars. Here, as everywhere, instinct is far superior to reason, and a breakfast diet of sausage and buckwheat cakes with maple-syrup and strong coffee has carried the white man half round the world; while one of salads and cereals, washed down with post-mortem subterfuge, would leave him stranded, gasping, in the first ditch he came to.

The basal problems of dietetics were, by the mercy of Heaven, settled long ago, in the farmhouse kitchen, in the commissary department of the army in the field, in the cook's galley amidships, and in the laboratory. There is little more room for difference of opinion upon them than there is about the coaling of engines. Simply a matter of size of boiler and fire-box, the difference in heating power and ash between Welsh and Australian, and the amount of work to be got out of the machine, multiplied by the time in which it is to be accomplished.

It is true that Professor Chittenden has recently published the results of experiments upon a "starvation squad" of soldiers which lead him to the conclusion that weight, health, and vigor can be maintained upon about half the amount of food laid down in standard diet-tables. But this gravely improbable conclusion upon so narrow a basis of fact can carry but little

weight until it has been confirmed by tests upon a far wider scale by other observers. From the reports of colleagues who saw the soldiers at the close of their fast, restless, nervous, so eager to get back to regular rations that they would say *anything* about their feelings which would tend to bring the experiment to a close, it strikes me simply as a test of human endurance like Dr. Tanner's famous fast. We are merely automobiles in human form, literally "steam-engines in breeches," of only moderate range of power, but exceedingly economical in the matter of fuel, and of remarkable adaptability. Given our age, sex, size, horse-power, and the work to be done, the suitable fuel is only a question of cost and accessibility. Every particle of the energy which sparkles in our eyes, which moves our muscles, which warms our imaginations, is sunlight cunningly woven into our food by the living cell, whether vegetable or animal. Every movement, every word, every thought, every aspiration, represents the expenditure of precisely so much energy derived from food. Cut off our supply of second-hand sunlight and our human lamps go out like an arc-light when the current is broken. (We are literally what we have eaten.)

Some diet delusions are of most modern date, like the "fush" fad which is now devastating our breakfast tables, while others are of most respectable antiquity. Among the latter is that very ancient survival, the notion that particular foods are "good" for particular things or effects. This is an almost direct descendant of the notion held with greater or less una-

nimity by nearly all savage and barbarous tribes, that the flesh, or viscera of birds and animals possessing particular qualities will be likely to produce the same qualities in those who eat them. Thus Nero used to banquet on nightingales' tongues in the hope of improving his voice, and the Ojibwa cut out and devoured the heart of the bear, the liver of the buffalo, etc., believing that the strength and courage of these animals would thereby be transferred to himself. It is probable that the most gruesome of ancestral rites—cannibalism—was largely due to the same belief, although, of course, in Neanderthal days primitive man would have no more hesitancy about eating his enemy after he had killed him than he would in devouring a bear or a deer. In fact, the early converts of the missionaries in the South Sea Islands referred to their favourite dish as "long pig." Every known race has at some time been cannibal.

There certainly was a childlike logicality and naïveté about the conception of the Maori warrior who rounded and completed his conquest of his enemy by eating him afterward and thus acquiring all the vigour and energy which had been wont to oppose him. The story told of the old Maori chief who, in his last hour, when urged by the missionary and his favourite wife to a death-bed repentance, and told that he must begin by forgiving his enemies, proudly lifted his head and exclaimed, "I have no enemies; I have eaten them all," appeals to a slumbering chord in us even yet. While certain most intelligent people to-day would indignantly resent the accusation of re-

verting to such days and ideas, they will vigorously denounce the eating of pork as an unholy thing, on the ground that "he who eats pork thinks pork," and the more orthodox of them will even declare that while Scripture records that the devils entered into swine, we have no assurance that they ever came out of them.

The prohibition by Moses of this second most useful and valuable meat-food that we possess and its echo by Mohammed were on purely ceremonial grounds, and had little to do with dietetics, or hygiene. Most of these primitive prejudices against the use of the flesh of a particular animal are traceable to the belief that the animal is the totem, or guardian spirit, or primitive ancestor of the tribe. It is obvious that the table of unclean meats in Deuteronomy is purely ceremonial and constructed with the purpose of excluding pork; though whether upon grounds of totemism or pure taboo it is, of course, impossible to say.

Another amusing modern survival of the same idea is to be found on almost every hand in the popular impression, gravely repeated in works upon voice culture within the last twenty years, that dates and figs are peculiarly good for the voice, while nuts are injurious to it. The only basis whatever for this impression being a sort of crude analogy between the sweetness of the fruits mentioned and that of the tones of the voice, and between the roughness of the shells and skins of the nuts and the coarser and more strident tones.

It will also be recalled that the classical wolf in "Red

Riding Hood" softened his voice by eating chalk; and a score of other similar fairy tales could be quoted.

Nor need we delve into folk-lore antiquity for instances of such belief. It was only a few months ago that the writer, during a political campaign, heard one of the speakers, who had an unusually melodious and penetrating voice, approached by a very intelligent gentleman, a lawyer of eminence in the community, with the remark: "That's a very remarkable voice of yours, Major. Do you take anything for it?"

An equally imposing spectre which still occasionally stalks through the pages of the popular magazines is the notion that in some way fish diet is peculiarly good for brain development. This, though of quite respectable antiquity, like many another ancient fiction, has been false-buttressed by "scientific" arguments of late years, namely: that as the principal constituents of brain tissue, neurin and lecithin, are usually rich in phosphorus, and as fish contains a large amount of phosphorus, therefore fish makes brains.

It has also received a historical bolstering up by the citation of the Church's use of fish on fast-days and of the fact that Christ selected His apostles from among fishermen.

An even better citation would have been the extraordinary vigour which is imparted to the imagination of those who catch fish, merely by the contact of landing them, or even that of half pulling them out of the water.

This lovely scientific fairy tale about the phosphorus

has, like the Irishman's corpse, no less than three fatal wounds in it. The first is that while the brain tissue is, it is true, rich in phosphorus, it is no more so than the nuclei of all the cells scattered throughout the body. The ordinary white blood cell, or leucocyte, contains as much phosphorus as does the nerve cell of the same size, and unless the nerve cell could be imagined to have a bigger appetite or a superior intelligence it would get no more of the phosphorus contained in the food than would its healthful inferiors. In the second place the notion that any particular kind of food or any element in the food goes to any particular tissue is utterly without foundation, and is as logical as the belief of little Mary in Holland's "Bay Path," who, adoring the beautiful wavy hair of her young mistress, every morning at breakfast took special pains to push each mouthful of bread and milk up against the roof of her mouth before swallowing it, in the hopes that it would soak upward and make her hair grow.

Every bit of food going into the body is broken down into its simplest molecules and then absorbed by each particular cell and built into its structure. In other words the cells do their own eating, and are not mere bits of blotting paper to soak up what happens to be brought to them. The third mortal wound is widest and most gaping of all; and this is, that fish contains no more phosphorus than meat, eggs, or any other proteid food. How, then, did it get the reputation of containing it? Simply from the fact that dead fish allowed to decay upon the decks of fishing smacks,

or upon the sea beach, display very frequently a greenish phosphorescence in the process of decomposition. This phosphorescent light, however, is due not to the fish at all, but to a group of bacteria which is feasting upon its remains. So the whole fish-phosphorus-brain theory is literally an *ignis fatuus,* or will-o'-the-wisp.

Equally whimsical and interesting as a study in credulity are the numerous impressions abroad, especially in "intense" and intellectual circles, that particular kinds of food are "bad for" particular things.

These are easily traceable to that broad and omnivorous type of primitive human logic which, as Tyler pointed out, enables the Samoyed to see a striking likeness between a cow and a comet, in that they both have tails. To take one of the crudest forms, all through Northeastern Europe there is a firm belief that nursing mothers should never be allowed to eat fish or eggs, because since these foods have not the power of speech, their children might be dumb in consequence.

To come a little nearer home, we have the flight of fancy, carefully reproduced, I am sorry to say, in many so-called scientific works upon dietetics, that spices are to be interdicted in feverish, bilious, or inflammatory conditions because they are supposed to be "heating to the blood." Here the childlike analogy between sensations of warmth produced in the mouth by these substances and a rise of temperature is so clear as to be self-evident, and is precisely of a piece with the

other popular superstition that red-flannel underwear is warmer than white.

As a matter of fact there is little evidence to support the notion that spices heat the blood. A teaspoonful of powdered capsicum, which produces almost unbearable agony if taken into the mouth, put in a capsule and swallowed will produce no more serious effect than a kindly sensation of warmth in the pit of the stomach. The apparent foundation for this superstition, which is almost as prevalent in medical works as it is in popular ones, is that by an abundant spicing and high flavouring of certain dishes the jaded appetite can be whipped into eating things for which it has absolutely no use, and that spices may be, and often are, used to disguise and cover up the taste of putrefying, stale, and otherwise unfit meats. Much of our most vaunted cooking, especially that of the French school, consists in making edible that which should never be eaten, and the poor spices which are used in the process have to bear the whole burden. Really they are, in my judgment, valuable intestinal antiseptics, checking and preventing putrefaction and fermentation of food in the alimentary canal and consequent colics without in any way interfering with its solution by the digestive juices. The extraordinary appetite invariably displayed for them by races living in the tropics and by white men going there, is, I believe, an instinct based upon appreciation of their genuine value. So powerful are they as antiseptics, that mustard-flour has for years been used by one of America's most prominent surgeons as the antiseptic

in sterilising the hands for surgical operations, and powdered cinnamon has been proposed as a dressing for septic wounds. Their universal use for embalming purposes, as in the Egyptian mummies, was due to their antiseptic powers. I had occasion some years ago to study rather carefully the dietary best suited to white men in the tropics as illustrated by our soldiers in the Philippines and English civilians in India, and after consultation with a number of Army surgeons, came to the conclusion that the notion that meats and fats were "too heating for the blood" in the tropics, was apparently as baseless as the spice-heating delusion, and that those messes and regiments which took their full Northern army ration and then turned it over to skilled native cooks to spice, pepper, curry, and bedevil generally at their own sweet will, enjoyed not only better general health and greater working power, but a freedom from dysenteries and kindred ailments, which was really striking as compared with other troops who used no such condiments.

In fact, I do not mind confessing a rapid drift toward the heretical conclusion that the food which we take into our bodies does not go to produce heat first and then energy from that, after the wasteful method of the steam-engine, but rather, after the method of the gasoline engine, produces energy first and heat incidentally as a waste product—in other words, that our vital heat may be a frictional remainder produced by the activities of our bodies and not necessary to life. Plants can do more wonderful things than we in the way of construction, work, and

growth without giving off a particle of appreciable heat. We probably do our life work by a series of intra-cellular explosions, which generate little or no heat, except as a waste or friction product, as in an electric light or fan. As Loeb's brilliant studies on the rôle of oxygen in cold-blooded animals have shown, our respiration is chiefly to burn up the poisonous waste products of the life-activities of our cells, *not* to produce energy by combustion. The food of a healthy man at work should, in my judgment, have practically the same value the year round. Look at the enormous amounts of meat, butter, and starchy foods required by the harvest hand in sweltering July. The only reason we should eat less in the tropics is that the heat will not allow us to do so much work. Woman, always a puzzle, is a far more economical machine than man, capable of doing as much and enduring more upon much less fuel, though it is true she is often underfed. She is twenty-five per cent. nearer the cold-blooded animals in economy of metabolism, as shown by her lessened CO_2 output.

Under this same category comes the prejudice against pork. Because the pig is an unclean feeder, fond of wallowing in the dirt, and apt to make his sty and environment an offence in the nostrils of the neighbourhood, there has grown up a prejudice against the use of his flesh in the more ladylike minds of all ages and communities. Having once received this prejudice they have proceeded to brace it from all possible sources. First of all by harping back to the ancient taboo placed upon the flesh of swine by both Jewish

and Mohammedan ceremonial law. This, as we have seen, and as is now admitted by the more intelligent Rabbis and all the reformed Jews, is purely ceremonial and has little or no hygienic basis. The remarkable comparative longevity and low mortality of the Jews are proudly pointed to as a result of abstinence from the forbidden meat, forgetting that there are a score of other interdictions in the Jewish law which have more to do with the record of which they are so justly proud, and utterly leaving out of account the factor which is responsible for two-thirds of it, and that is the magnificent, unconquerable vitality and inherent racial vigour, both mental and physical, of the Jewish people. It is as rational to ascribe, as is still done in strict evangelical circles, the extraordinary persistence of the Jewish race under every imaginable persecution and hardship to the special favour of the Almighty in preserving them for final conversion, as it is to abstinence from pork.

Deprived of pork, our Jewish brethren have made up for it by eating every other kind of digestible fat that they could secure—butter, suet, fat fish, oil, the fat of geese, etc., so that their dietary is probably richer in fat than that of any class of the Gentile population surrounding them. Any physician of experience will confirm the statement that the diet of his Jewish patients is one of the richest in fats and sugars, most abundant in quantity and most attractively cooked of any of his families, in proportion to their income.

Having deftly supported their prejudice from the

Scripture itself on the one hand, they proceed to buttress it up on the other by pseudo-science.

In our first crude and childish experiments upon digestion and the digestive powers of the human stomach, the first and most obvious test of the digestibility of a food applied was the length of time which it took to leave the stomach. With naïve simplicity we took it for granted that food could only leave the stomach by way of absorption into the blood vessels, and that the whole process of digestion was carried out in that much enduring organ. But the stomach is little more than a place of deposit for the food, where it may be sufficiently churned and partially dissolved in water, with the assistance of weak acid and pepsin before being passed on into the real digestive organ of the body, the small intestine. There is no necessary connection between the ultimate digestibility of a food and the length of time which it remains in the stomach. The old tables of digestibility which still encumber some of our text-books were arranged chiefly upon the ease and swiftness with which particular food substances can be acidulated and passed on out of the stomach. Eggs, milk, sweetbreads, and rice came at the head of the list, for these are either liquefied in the process of mastication by the saliva, or so nearly so that a comparatively short stay in the stomach is sufficient to allow them to be acidulated and passed on for the serious process of digestion in the small intestine. Next came, it will be remembered, oysters, soups, and the lighter meats; then beefsteak and bread, and fat and fried meats; and last

of all pure fats. Naturally, pork comes late in this series because it contains large quantities of fat, and that fat is distributed among its fibres. Moreover, if any fermentation takes place in the stomach from the sugars and starches, gases are formed, eructations occur in the mouth, and the poor pork, which may have been only a harmless spectator of the disturbance, is tasted and blamed for the whole trouble. Even though it takes pork four hours to leave the stomach, and six more to be dissolved and absorbed in the small intestine, what does that matter so long as it is completely assimilated by the end of that time, as it is in ninety per cent. of all digestive canals? It is the slowest, but also one of the surest foods that we have to give off all its energy to the body. Its very slowness of digestion is what gives it its splendid staying powers for hard work, whether muscular or mental. As a matter of fact I have seen more cases of dyspepsia cured by the use of breakfast-bacon than by any kind of drug or restricted diet.

An adult alimentary canal which cannot digest bacon or ham is not to be regarded as healthy, and instead of humouring and giving in to a weak digestion, it should be braced up and under skilled supervision educated to take what is given it and make no fuss. Stomachs can be spoiled by giving them too little to do almost as easily as by giving them too much. A healthy stomach, fit to cope with the emergencies of life must be able to digest not only that which is digestible, but much that is difficult of digestion, and this is the standard which should be aimed at in die-

tetic therapeutics. As Professor Max Einhorn puts it: "The diet in health should not always comprise the most easily digestible substances. For by doing so we weaken our digestive system." Besides, a large bulk of indigestible residue is absolutely necessary to stimulate the lower bowel to proper action. We need "hay" just as horses do. Pork, including ham and bacon, is easily our second most valuable meat food, and has laid the literal foundation of our Western civilisation. What would an army, an exploring party, a railroad gang, a lumber camp, or a harvest-field be without bacon?

Most of the restricted "hygienic" diets on which our patients put themselves are chiefly notable for the fact that they are deficient in proper food value, and whoever lives on them will *be* dyspeptic just as long as he does so.

A subtler and less prevalent form of the same delusion is that known as vegetarianism. This cult, for it is a religious cult and not a dietetic or hygienic school, starts out with the foregone conclusion that animal food of every sort is and must be injurious. Having once cleared their minds upon this point its devotees then proceeded to bolster it up to the best of their ability upon alleged scientific grounds. But this should never be allowed for a moment to disguise the real nature of the contention, which is *that the eating of animal food is morally wrong.* When their attention is firmly but politely called to the fact that their dietary consists very largely of two products which are usually regarded as animal in their nature

—milk, with its derivatives, butter and cheese, and eggs—they promptly reveal the real character of their position by stating that it is only those animal foods *which involve the taking of life* that are injurious. This is purely a matter of creed and belief, not of any sort of reason or logic, and argument can consequently go no farther. Any man has a perfect right to *believe* anything that he pleases, providing that he is prepared to take the consequences.

Hear Gleïzès, one of their earliest prophets in his Thesé 2: "Que le meurtre des animaux est la principale source de notres erreures et de notres crimes," and their latest, Kellogg: "When animal eats vegetable there is no pain, no sorrow, no sadness . . . no eyes forever shut to the sunlight they were made to see, no ears closed to the sweet melodies they were made to hear," etc., etc., etc., *ad nauseam*. As poetry, this picturesque nonsense may be admirable, but as argument!

Some years ago I had the privilege of attending a session of one of the International Women's Congresses held in London. One afternoon was devoted to the sweet and alluring subject of "Kindness to Animals," Sir Edward Grey, Sir Herbert Maxwell, and myself being the three rash males who were induced to thrust our heads into the lioness's den. We had the audacity to defend, respectively, the pursuit and killing of animals for sport, fishing, and vivisection, and were all cordially hissed several times before we got through our speeches. The feature which was chiefly interesting was, that all these Anti-sport, Anti-

vivisection, and Anti-fish-hook ladies turned out to be more or less devout vegetarians, which position they boldly and frankly based, not upon any dietetic, hygienic grounds, although these all were lugged in by the ears as usual, but on the position that it was inherently wrong for any purpose to take life, either human or animal. One speaker presented the pith of the vegetarian religion when she said that while it might be true that by the torture of a few miserable rabbits we could discover secrets of disease which would enable us to prolong human lives, and that by the ruthless slaughter of animals for food our bodies could be given increased vigour and activity, yet we must remember that all these things were merely temporal and material benefits and must result in serious degradation and hurt to our spiritual selves on account of the cruelty unavoidably involved. There you have it in a nutshell.

With vegetarianism as a creed, we have, as scientific men, no more quarrel than with any other creed. But when it parades in the guise of science we firmly but respectfully protest. Its contention that human life can be maintained in fair health and vigour upon a chiefly vegetable diet is absolutely unchallenged by us. There is no doubt about it. Indeed, nearly one-half of the human race has been compelled from sheer necessity to prove that thesis in its actual experience; but we find absolutely no jot of evidence in support of the contention that there is any advantage or superiority in vegetable diet as such—no more than that there is any inherent superiority in a pure animal diet as

such. Both are excellent in their places, and the best results, physically, mentally, and morally, have invariably been, and are yet, attained by an intelligent and judicious mixture of the two classes of food. Parenthetically speaking, it may be stated that vegetarianism is the diet of the enslaved, stagnant, and conquered races, and a diet rich in meat is that of the progressive, the dominant, and the conquering strains (Virchow). The rise of any nation in civilisation is invariably accompanied by an increased abundance in food supply from all possible sources, both vegetable and animal. There are no purely and exclusively vegetarian races known, and the degree of vegetarianism of a race, or class, is simply the measure of its poverty.

If any individual prefers to restrict himself to a purely vegetable diet, including milk, butter, cheese, and eggs, he is perfectly at liberty to do so; but that he will gain any advantage whatever from his abstention from meat we are utterly unable to confirm. Whoever may be right, the extremist is absolutely sure to be wrong, and the pure vegetarian and the pure "animalian," if such an one exist, alike occupy positions which are in the eye of science irrational and untenable. There is no valid or necessary ground except individual idiosyncrasies, so far as we have been able to discover, for the exclusion of any known article of food, whether vegetable or animal, from our diet list in health.

No food can be mentioned, however indigestible or innutritious, which, in the proper time and place, and

properly prepared, is not only permissible, but useful. Here as everywhere else wisdom is simply a sense of proportion. So far as we can judge from the structure of man's teeth and alimentary canal his diet in the past has unquestionably been a mixed one with a considerable leaning toward the carnivorous side. A close look at his large "eye" or canine teeth, his full set of incisors, and the clearly cusped edges of his molars would indicate that animal food had played a large part in his diet in the past. He still shows his canine tooth when angry, in the sneer, just like a dog or a gorilla. His stomach is barely distinguishable from that of a dog or great cat of somewhere near his weight, while it is separated by a thousand leagues of biological distance from the pouched and ballooned one of the pure herbivora. His intestinal canal is only about five times his body length, as in the pure carnivora, instead of from ten to twenty times, as in the herbivora. If man is to become a pure and blameless vegetarian in the future, his stomach and alimentary canal will have to be reconstructed. These facts of structure are, of course, supported by all we know of the history of man and his immediate ancestors. Contrary to general impression and frequently published statement the anthropoid apes, while subsisting largely upon fruit, nuts, and roots, have a strong liking for animal food.

At one time I had occasion to observe a number of these near cousins of ours in captivity, and was assured by the keepers, both in London, Berlin, Antwerp, and Hamburg, that they required considerable

quantities of beef-juice, milk, eggs, insects, or worms, and even small birds in order to be kept in healthy condition. In fact for years no great ape in captivity ever lived to anything like maturity, largely because they were fed exclusively on vegetable food (Beddard). The same is true of monkeys.

The New World monkeys simply will not live in captivity at all without considerable amounts of chopped meat and insects, eggs and freshly killed birds, and they have a very low death rate from tuberculosis. The Old World monkeys in cages side by side with them, in the same house, fed on precisely the same diet, with much smaller amounts of animal food, die at the rate of from thirty to forty per cent. per annum of tuberculosis.

It may be only a coincidence, but I cannot help mentioning in this connection the surprisingly large number of our tuberculous patients giving a history of having a dislike for meat. The individual suffering from consumption who gives a history of a strong taste for eating large amounts of meat is decidedly rare.

In the animal world, both bird and mammal, tuberculosis sweeps like a pestilence through the grass-and-grain eaters—cattle, antelopes, chickens, pheasants, turkeys, but is decidedly rare among meat-eaters—dogs, cats, tigers, lions, civets, badgers, hawks, eagles, crows.

The final court of appeal, our instincts, is of course overwhelmingly against any exclusive diet. The one thing that primitive, barbarous, and civilised man

alike long for is an abundance of the "flesh-pots of Egypt." The very first use he makes of his increased power and financial resources is to buy new, rare, and expensive kinds of meat. Here again, as we shall further see in reference to his preference for white bread over brown, his instincts are both rational and sound.

Last of these delusions is the breakfast-food fad. Pompous and pestiferous as its present attitude is, it was born of humble and highly respectable parentage, namely, Scotch oatmeal. Its birth and conception would appear to have been somewhat in this wise: "The Scots are a great people; oatmeal is their principal food; therefore, oatmeal is a great food." It has nothing to do with our argument, but it may incidentally be remarked in passing that there is a fatal error in this syllogism, *videlicit*, that the most convincing proof the Scotch have given of their greatness has been their ability to live on oatmeal at all. The secret of their wonderful success, both mental and physical, lies in the fact that any nation trained to survive a diet of oatmeal and the shorter catechism could survive anything and flourish anywhere.

Oatmeal has some value as a food, but to offset this is its capacity as a stirrer up of acid fermentations and intestinal disturbances.

The seductive oat was introduced into England in the early sixties, first of all as a food for children and invalids. For the first of these classes it presented a threefold benefit—it was cheap, filling, and there was no danger of their developing an exorbitant taste for it. The little fellows had a natural liking for cream,

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butter, sugar, and meat, therefore there was danger of their eating too much of these, but there was no danger of their becoming unduly addicted to oatmeal. As a pabulum for the sick-room it presented the advantages of the absence of any particular flavour, being easily swallowed and having a loosening effect upon the bowels. Moreover, it was believed to be strengthening. The ground for this last conclusion was chiefly that because a husky hind could do a heavy day's work on a big bowl of oatmeal "parritch," so stiff that the spoon would stand up in it, with a quart of milk, therefore a few teaspoonfuls of a watery dilution of the same would give strength to the enfeebled.

Most of us can remember the first appearance of the stuff upon this Continent. I can well recall going into a farming community in the Middle West in my early boyhood, and going to the grocery for oatmeal, to be thence referred to the drug-store as the only place in town where a few pounds of it was kept for the purpose of making gruel. And this little trickling thread of a streamlet has swollen within twenty years to the Johnstown flood dimensions of the present breakfast-food deluge.

Now these be the virtues of the cereals: they are cheap, easily swallowed, and of moderate nutritive value. Moreover, they came from Scotland with a consequent flavour of orthodoxy about them. There is an element in the average human mind, half Puritanic, half stingy, which is inclined to count as a virtue the ingestion of any kind of food which is not espe-

cially attractive, but believed to be nutritious. In fact, to eat that which is cheap and filling is one of the petty vices. I call it vice, because it is a defiance of instinct. These are the qualities which give the cereals their fulcrum and the short handle for their lever. Now what forces have conspired to lengthen it to such enormous purchase? As usual two spring promptly to aid which are already familiar faces in this field: one transcendental, the other pseudo-scientific. The transcendental, a mild form of the vegetarian propaganda, which seized upon the virtues of these blameless cereals as a means of saving the race from the horrors of chronic bloodthirstiness.

Everywhere the doctor goes among his patients he finds a sort of vague impression that cereals in some way are cooling both to the blood and to the impulses; that they are as far as possible removed from that most diabolical quality which a food can have—"richness;" that they "thin the blood," stimulate the liver, and act upon the bowels; and that a fast upon some form of them for one meal a day will act as a kind of vicarious atonement for all the fleshly sins which may be committed in the other two. All of which beliefs, with the exception of the "acting upon the bowels" part, are pure delusions and easily traceable to ancient superstitions which have already been discussed. Of course, Scripture has again been quoted in their behalf and the pulse and water upon which Daniel and his three companions outshone the other captive princes have been triumphantly cited.

Then came a most powerful and unsolicited boost

from the side of psuedo-science. It had long been noted that from the earliest dawn of civilisation men had exhibited a decided preference for the cleanest and whitest bread that the combined efforts of millers and bakers could produce. No race ever yet ate black bread when it could get white; nor even brown, yellow, or other mulatto tint, until of recent years. A copy of some of Liebig's and Pettenkofer's earliest analysis of food stuffs happened to fall into the hands of one Sylvester Graham, a dyspeptic New Englander and temperance reformer, about 1830. Finding that nitrogen and nitrogenous substances were given a higher rank in the dietary than starches and other carbohydrates, and that white bread contained less nitrogen in proportion than brown, with the swift intuition of the child and the savage he leaped to the conclusion, bread being the principal staff of life and white bread containing a lower proportion of nitrogen than brown, that brown bread was the better food of the two. It was only a step farther in that grammar of logic which has been the Bible of the true reformer since the world began, that whereas humanity suffers from many dyspepsias and other diseases of the digestive system, and lives chiefly upon bread, therefore bread must be the chief cause of these distressing conditions. He therefore inaugurated a campaign against white bread and in favour of brown, with which the world yet echoes.

This view of his is the keystone of the chief triumphal arch of vegetarians, the discovery of a cheap, edible vegetable proteid; and as it rests upon an utter

misconception of fact, we may as well consider it at once. Graham's delusion, of course, did not stop here, but finding that the coarser grains, oats, barley, rye, and corn contained large amounts of nitrogen, he proceeded to push these forward as superior to the wheat berry. Now, Nature is not a fool. Man, in so far as he is natural, attains to a considerable degree of instinctive wisdom. It is to the biologist a most significant fact that the unvarying and constant struggle of rising humanity, in the realm of diet, has been first toward the securing of meat and second toward the acquisition of white bread, and as much of it as possible. The fiercest wars have been waged for the possession of the broad, level, alluvial plains upon which wheat could be grown, and nobody but a mountaineer or a very far norther would eat either rye, barley, oats or maize when he could possibly get wheat. And now comes science with a full and triumphant vindication of the rightness of humanity's instinct in this regard and a demonstration that white bread, and the whitest of the white, is the best, most healthful, and most nutritious food which the sun has ever yet grown from the soil. But our cereophile says that white bread has less nitrogen than whole wheat meal, and whole wheat meal than rye or oatmeal. Perfectly true, and yet here comes the paradox, that this same whitest of white wheat flour contains per ounce more available nitrogen than any brown, barley, rye, or maize flour in existence. The secret of the error is a very simple one. It is not a question of the amount of nitrogen in a given food, but of the

amount which is *available* for the body, in other words, *digestible* in its interior. While there is a larger amount of nitrogen in whole wheat flour than in white flour, *the whole of this excess is in the form of branny husks,* which are as utterly indigestible in the food-tube as so much sawdust or cocoanut matting.

It is precisely parallel with the "vegetable beefsteak" delusion of the mushroom faddist. Not ten years ago we were told that while we had been straining every nerve to secure unwholesome and indigestible pork, beef, and mutton, we had been overlooking that "meat" which grows at our very doors, the most delicate and nutritious food imaginable—mushrooms, "the poor man's beefsteak," as they were termed. The first examinations showed abundance of nitrogen to be present, but when this was submitted to the second test of how much was in a form that could possibly be digested or made useful in the body, the bubble burst at once, for it was found to consist of compounds more nearly resembling dead leaves in their composition and nutritive value than anything else. As nitrogenous foods and flesh-formers the whole group of the coarser cereals are far inferior in value to the plain, every-day white bread. Instead of white flour being deficient in nitrogen, it is precisely the opposite. Its very richness in digestible and soluble proteid (gluten) has given it its colossal rank among the world's food stuffs. This is what makes wheat bread the best single vegetable food yet discovered. Life and vigour cannot be sustained upon it so long or so well as upon meat alone, but it is far

cheaper and hence more used. Potatoes, cassava, maize, sago, rice, all contain abundance of starch and in a more soluble form, but are fatally deficient in digestible nitrogenous substance, or proteid.

Humanity knew well on which side its bread was buttered when it insisted upon that bread being white. It may be added, in passing, that while twenty years ago the mills rejected some valuable elements ("middlings") in flour, on account of their imparting a slightly yellowish tinge to it, in the new processes these very elements after being steamed, parched, and reground are relied upon as the chief element in the "X X X " brands, so that no flour need be avoided because it is too white. It must be understood, however, that no good flour is a pure white, but a delicate cream colour.

The boasted superior nutritive value of whole grain and cereals is absolutely without foundation. They are good foods in their place, but that place is a long way down the column from white bread. To give the devil his due, however, we hasten to state that it is this very presence of a large percentage of utterly indigestible residue which gives these foods one of their greatest values, their laxative effect upon the bowels. This is purely mechanical and due to stimulation and irritation of the mucous coat of the intestines by the sharp, horny, husky particles of bran which are present, particularly in graham meal, oatmeal, and corn meal. They are, in fact, valued chiefly for the element in them that *will not digest,* but passes unchanged through the

body, actively stimulating the propulsive powers of the alimentary canal in the process. But even this feature is not altogether devoid of danger. It was found out, many years ago by practical experience, and within the last fifteen years by laboratory experiments, that any attempt to eat brown bread three times daily without intermission very quickly resulted in setting up a diarrhœa, with well-marked disturbance of the stomach. This was one of the many valuable contributions to science of Sir Lauder Brunton, who established the fact of this cumulative irritating effect, and even gave to the resultant irritation the title of "Brown-Bread Gastritis." By a parallel series of experiments he also discovered the indigestibility of the nitrogenous elements in brown bread and oatmeal. It is now an accepted rule in scientific dietetics that brown bread must never be eaten in bulk amounting to more than two-fifths of the total bread consumption, as otherwise irritating and unpleasant effects are certain to follow.

Yet another danger lurks in these harmless cereals, and that is the starches which they contain are in a form which so readily lends itself to any form of fermentation, whether lactic-acid or alcoholic. This is well illustrated in the fact that it is almost invariably rye, barley, or corn which are used for the purpose of fermentation into either malt or spirituous liquors, rarely or seldom wheat. All of these mush foods, especially if a certain amount of sugar be added, furnish a magnificent fermentation bed "mash," as the brewer calls it, and any one who has

the slightest tendency to acidity or gas formation in the stomach is likely to be injured by them. Mush makes a superb "sour mash" in a weak stomach. In fact it is a melancholy truth that the tortures of the chronic dyspeptic are aggravated, and in many cases chiefly caused by the very foods which he takes for their cure. A large majority of those who depend upon health foods are dyspeptics *and will remain so as long as they cling to this diet.*

But the greatest drawback of these foods lies not so much in what they are, but in what they are not. Of course, it is obvious to the intelligent that the boastful and flatulent claims of peerless virtue and nutritive value made for most of these products are utterly baseless and absurd.

To sweep aside altogether these inflated statements, born evidently of the greed of the exploiter, it must be frankly recognised that the cereal foods are enormously overrated in point of nutritive value. Their principal danger is the power of producing a feeling of fulness and satiety long before an adequate amount of nutrition has been taken into the stomach. Notwithstanding their virtues they are utterly inadequate properly to nourish the body by themselves. But some one will say at once: "Here are the tables taken from recognised authorities on dietetics and published in various Health and Food Journals, showing that the nutritive value of white flour, corn meal, and graham flour is per pound and per ounce almost as great as that of meat or sugar and only below that of fat." The citation is perfectly correct, but the inference

drawn therefrom is misleading. The substance as referred to in the table is the *dry* flour or meal, and as the mush or breakfast food as it appears upon the table consists of more than eighty per cent. of water, the discrepancy is obvious. If any one will simply step into the kitchen and watch the dish of oatmeal, corn meal, or graham being prepared for the table, he will be astonished to see what a huge panful of thick mush a few handfuls of the dry product will make. As a matter of fact, a large bowl of mush or other cereal is inferior in heating and building-up power to one small rasher of bacon, a single egg, or a piece of beefsteak half the size of one finger. The chief nutritive value of "mush-and-milk" resides in the milk (or cream) and sugar. Again instinct is justified, for no normal human could eat it without the bribe of either milk or sugar. Nobody but a Belgian hare would eat it "neat" of his own accord. To "taste good" is nature's stamp of approval upon a food.

You cannot get something for nothing, and one cent comes nearer buying one cent's worth of actual food value in the market the world over than we at one time believed. If you get a food which is lower in price than some other food, it is almost invariably found to be either lower in nutritive value, less digestible or less appetising. We cannot support life on mushes, salads, and fruit; it will injure our health in the long run if we try. My only advice to those addicted to the breakfast-food habit is, by all means take your ante-mortem serial, germicide, near-food, or

what not, at breakfast—but *be sure and eat your breakfast first.* Mush, like fruit, should come at the close of the meal instead of the beginning. To attempt to live upon it is a slow form of starvation.

Ex nihilo, nihil fit. You can't get something out of nothing: no steady head of steam on shavings in the human engine, any more than in a locomotive.

Yet this is the trick that man's reason is always trying to play upon his instinct. His instinct, of course, knows better. It hasn't been crystallising five million years for nothing. His reason was only hatched yesterday, and has the boundless self-confidence of youth. It is always trying to improve upon nature—sometimes successfully; sometimes not.

One of its favourite "improvement" fads is to try to concentrate our food, so that we won't waste so much time in eating it. Tons of the result are to be seen on every hand, in the innumerable condensed, prepared and patent foods, which stare at us from every magazine cover and roadside fence. They are all failures, because they won't support life alone, except for brief periods. Many of them are frauds. Most are made to sell rather than to eat.

We have now learned by bitter and expensive experience that no food can be condensed below certain very moderate limits without corresponding loss of fuel value. In fact, it might be roughly stated that you cannot reduce the weight of our food as it comes on our tables without reducing its food value, either in calories or in digestibility.

But what of dried foods? asks some one. Foods

do not come on the table dried. They nearly all have to be "wetted" again to about their original bulk, by soaking or boiling, before they are fit to eat, or by the saliva in their slow and difficult mastication. With very few exceptions, the dried meat, fish, beans, apples, etc., when soaked to their original bulk are never equal in nutritive value to the fresh product, and often far inferior to it. Drying is simply for convenience in shipment or in keeping, and rather detrimental than otherwise from a dietetic point of view. Never use dried foods when you can get fresh, has become an aphorism with hard-headed commissariat departments the world over. And the man in the street, to say nothing of the small boy, will toss up his hat and cry "Hooray" to that sentiment. If there's anything he hates it's dried apples and beans and codfish. He doesn't know why, but he's right.

If a food ready to eat has lost weight or bulk, it has generally lost calories, fuel value. Many of our so-called "extracts" and "creams" of things are simply laughable in their emptiness of food-value. All our beef extracts of the famous "Liebig" type, for instance, are practically without food-value, and are pure stimulants, flavouring extracts. Their chief value lies in the cracker or toast which the patient can be induced to eat with them.

The renowned "Ox in a Tea-cup" has lost everything of the animal except the smell, and the solution made from it has about the same nutritive value as so much urine. It is an aid to appetite, little more.

The same is true of soups, broths, and bouillons,

whether home-made or manufactured. They are absurdly overrated. The thing about them that "sticks to the ribs" is the meal, rice, cheese, eggs, etc., that they're thickened with, or the bread or potatoes that can be smuggled into the system under cover of them.

They only contain the merest trace of soluble proteid, real food. Most of the "strength" of the meat they were made out of still lies at the bottom of the pot; little more than the flavour is soluble in water.

Even those highly scientific, strictly up-to-date, nineteenth-century products, the predigested meat extracts and "soluble beefs," etc., contain astonishingly little real food. Not one of them is equal in food value to half its weight in fresh beefsteak, let alone the preposterous claims made for them by the manufacturers. As Professor Graham Lusk has shown, most of them have about the same nutritive value per pint as milk: comparative cost $2 as against six cents. Two of the best known of these were largely used by the profession until it was discovered that their apparently beneficial effects were chiefly due to the alcohol with which they were put up "to preserve them." About the same time analyses by chemists, not belonging to the factory, showed a nutritive value of about twenty per cent. and an alcohol content of 200 per cent. of that claimed for them. Is it any wonder that we doctors are fighting shy of prepared foods? So strong were these "beef-solutions" in alcohol that a number of cases have been reported where patients would buy them by the dozen

and the case, and get comfortably drunk on them every day. Two such have been related to me personally by their attendant physicians, one a clergyman, the other a prominent society woman, both prohibitionists, neither of whom had the least idea of what they were taking that "made them feel so good." We are ready to chorus with Kipling's McAndrew, the "Auld Scots Engineer," speaking of the "food" for his darling engines:

"There's bricks that I might recommend—an' clink the fire-bars cruel.
No! Welsh—Wangarti[1] at the worst—*an' damn all patent fuel!*"

The chief strength of patent foods lies in the advertisements, and eating the printed page is the safest —and cheapest—way to get it. White flour and sirloin steak men buy and eat without urging. It is only the bran and the canned offal that have to be advertised.

The virtue of all "Infant-Foods," whose fat and stodgy "specimen babies" gaze at us from the photographs of the prospectus, lies chiefly in the good old-fashioned cow's milk in which they are administered. Taken alone, babies will starve on them, or get the scurvy.

To sum up, as a class the patent and prepared foods are "bad medicine." They are as far below natural foods in nutrient value as they are in attractiveness; contain usually about ten per cent. of the

[1] An Australian coal of fine steaming quality.

food value they claim; will not support life; easily upset digestion, destroy the appetite, and calorie for calorie are exceedingly expensive. The whole brood of "Fierce," "Foodle," "Gripe Nits," "Fush," "Grapo-gripo-grits," "Shredded Doormats," "Eata-heapa-hay," "Uneeda-paira-blinkers," etc., are like Hancock's tariff, "for revenue only." If they could be swept off the earth, few would be a pin the worse, except the manufacturers.

The raw material out of which the "Breakfast Brans," for instance, are made costs from one and a half to three cents a pound. The finished product in beautifully tinted and decorated cartons sells for fifteen to twenty cents a pound, including the pasteboard. Not one particle of fuel value per pound has been or can possibly be added by any conceivable "process," however miraculous. Claims to the contrary are brazen misrepresentations to sell the goods. The credulous consumer only pays the maker, or more accurately, faker, a trifling profit of about 1,000 per cent.

Is it any wonder that stock in the companies making some of the best known of these products is said to be quoted at $1,000 per original $10 share, and none to be had even at that price? Nearly every so-called "Health Journal" is engaged in exploiting one or more of them. Several have been started solely for this purpose. Bogus "State" and "National" Health Associations, closely imitating the names of genuine scientific or official bodies, have been formed or invented for the sole purpose of endorsing them.

Our leading chemists and physiologists are said at one time to have been flooded with offers of huge fees $500, $1,000, $5,000—to make analyses of these products and sign their names for purposes of publication. A few, I am ashamed to say, accepted them, on both sides of the Atlantic. There is no direct deception about these analyses. The superb list of valuable food substances, the proteids, the glutens, the globulins, the polysaccharids, the hydrocarbons, the priceless organic salts, the iron and the zymases, are all present in the sample. *But so they are in any scoopful of unscreened flour* taken from the bin of a country grist-mill, or handful of "shorts" from a sack of cow-feed.

This the dear public does *not* know, but the scientist and his purchaser do. Such analyses—and they were common a few years ago, until the profession and the scientific societies began ostracising the men who signed them—though honest in form, are dishonest in fact, because of the inevitable interpretation which the public will place upon them, and *is expected* to place upon them.

These statements apply also to nearly all the prepared, condensed, and predigested meat, milk, egg, and fat or oil products, save that the original cost of the materials used is higher and the margin of profit not so huge. The analyses are equally misleading, more complex, and could be duplicated upon any egg from the breakfast table, slice of beef, bacon, or pat of butter. The predigested and peptonised foods are even worse, because some of their original nutri-

ment has been "digested" past the stage at which it can be utilised in the body and turned into waste products which have to be excreted at once.

All are so enormously expensive in proportion to the nutriment per ounce they contain as to be little better than frauds from an economic point of view.

Get the best quality and widest variety of good, sound, toothsome old-fashioned foods that you can, and let the near-foods and patent "improvements" severely alone. You'll save in both health, comfort, and pocket-book.

The last delusion, and not the least dangerous, is that our diet needs to be "regulated." A man who continuously and anxiously considers the kind of food he eats—whether it is going to agree with him or not when he eats it—*is* a dyspeptic, and will always remain so. In the language of a modern writer, "nothing survives being thought of," and the digestion is a striking case in point. The vast majority of men are led by their instincts to a reasonably nutritious and sensible dietary, and the more completely we can keep our minds off our digestions and the "chemical" choice of our food, the better it is for us. It is not even well for us to consider too nicely the amount of water or food taken, or whether it is digestible or not. The really healthy stomach ought to be and is capable of disposing of not only the digestible and the difficult of digestion, but the indigestible. Any other kind of a stomach is not worth having, and that is the standard to which we physicians are now training our dyspeptic patients. The stomach which will melt down

and utilise anything in reason that is given to it is the only one fitted to survive. Stomachs can be "pampered" just as easily by relieving them from the necessity of taking difficult foods as by overloading them. Personally I have met with almost as many dyspepsias due to the former as to the latter. The stomach, like any other instrument, should be kept up to concert pitch. It should not be allowed to shirk its responsibilities or to be humoured too much. This, of course, is by no means to discourage intelligent discrimination in the choice of food.

Some perfectly wholesome foods are literal poisons to certain stomachs, and those which after repeated trials steadily disagree had better be avoided.

Our aim should be to keep our food range as wide as possible. Man's ability to eat and thrive upon *everything* has gone far to make him the dominant animal, living where others would starve.

The sharpest lookout should be kept for any trace of "spoiling" or putrefaction. Nature has provided an instinct and a special sense for this very purpose. If we would only use it and follow our noses we would escape many a ptomaine-poisoning. But Mrs. Grundy says it's rude to "sniff" at table!

The conviction is steadily growing in the profession that disturbances of digestion are due in eight cases out of ten, not so much to the food used, either in quantity, quality, or method of cooking, as to the circumstances under which it is eaten—the disgraceful rush and hurry with which business or pleasure is resumed before the digestion has had time to get fairly

under way, and the utter lack of adequate exercise in the open air to enable proper combustion of the food.

Further than that we are reacting decidedly from the exclusive and rigid diet for any diseased condition whatever, with the partial exception of diabetes. Even where these exclusive diets may relieve the symptoms which they are designed specially to meet, such as obesity, glycosuria, or gout, they are very apt to upset the general balance of nutrition and impair the vitality, frequently in the long run aggravating even the symptoms of the disease which they were prescribed to cure. A starch-free diet may clear a diabetic's urine of sugar and yet shorten his life, if he persist in it exclusively.

It is also realised that no other factor has had so much to do with the increase of longevity, the lowering of the death rate, and the general improvement of health and comfort, which is taking place under civilised conditions, as the more abundant, richer, and varied food supply which steam and electricity have made possible.

Anything which tends to limit and monotonise diet exercises an injurious effect upon the general vigour of the system. Nearly all patent foods sin against these requirements. They are not attractive in taste and hence cannot stimulate the "appetite-juice" of the stomach, which Pavloff has shown to be so indispensable to good digestion. The dictum of the grocer who, on recommending a new health food to a customer, said he was sure it must be exceedingly valuable, because it "looked like dog-biscuit and tasted like sawdust," would apply to most of them.

They are exceedingly monotonous both in flavour and in composition, as the great majority of them are based upon some wretched superstition as to the injuriousness and wickedness of animal foods. Any one living upon these foods will usually get a large excess of the carbohydrate elements and the marked deficiency of proteids, fats, and salts. Nature is not altogether a fool, and the natural articles of diet are now found by chemical analysis, and a more careful and intelligent study of the precise processes of digestion, to contain not only the actual fuel content, or calories, in better proportion than any "Health-food" which has yet been invented; but also, what is usually utterly lacking or deficient in the latter, a number of accessory elements, salts, alkalies, flavouring matters, and acids, which, though not used as body-fuel, are now found to be absolutely indispensable to the proper combustion of the latter.

"Without appetite no healthy digestion" is now our motto, and foods that pall on the appetite are just as surely defective as foods as those that are deficient in nutritive value.

Though it must be noted that by a curious paradox "appetite comes by eating" sometimes and those who habitually underfeed, the tuberculous, the pretuberculous, and a large class of anxious, busy house-mothers, often must force themselves to eat more to restore their lost appetite.

So many varied elements and substances are needed in the "perfect diet," that an intelligent omnivorousness is our only safeguard.

CHAPTER III

POISON FOODS, OR SOME COALS THAT CLINKER

A NATURAL law is only an observed succession of sequences between phenomena; but nothing is more difficult than to induce the average man to believe this. To him the term "law" has so long and ineradicably been endowed with all the majesty and authority of the State or of the Church, that it is impossible for him to disassociate it from a sense of something absolutely necessary and positive, to be obeyed under penalties. This is the source of some of our most troublesome confusions in the realm of popular scientific thinking.

Since the insistent demand and unwavering design of the average individual is to find some rule of conduct, dietetic, hygienic, or what not, which is always and everywhere to be followed, or, as he would express it, "inherently right," he is loath to believe that the rules of conduct in any department of hygiene, for instance, cannot be reduced to a few simple fundamental axioms which are always and everywhere right and guides to safe conduct. Worse than this, he demands that in each separate domain of hygiene these simple principles shall, if possible, be reduced to a single one which shall dominate all other considerations under all circumstances. Nowhere is this ten-

dency more painfully evident and distressing than in the realm of dietetics. How many scores of times is a physician asked in perfect good faith and childlike confidence, "Doctor, what is really the best food?" and looked upon with pained surprise when he endeavours to explain that there is no such thing—if, indeed, his well-meant explanations are not regarded as merely shufflings and evasions designed to keep his patients from arriving too quickly at the true secret of health.

Not only is there no "best food," but, in the very nature of things, there cannot be. No single food yet discovered will alone sustain human beings in perfect health and vigour for any considerable period. On the other hand, no food ever yet invented by the wit of man or resorted to under the bitterest necessity but has certain, it may be very modest, virtues and uses of its own. The utmost that can be said in the way of generalisation is that certain great food staples have proved themselves within the age-long experience of humanity to possess a larger amount of nutritive value, digestibility, and other beneficial qualities, and a smaller proportion of undesirable properties, than any others. These, through an exceedingly slow and gradual process of the survival of the fittest, have come to form the staples of food in common use by the human race all over the world. It is really astonishing how comparatively few of them there are, when we come to consider them broadly: the flesh and the milk of three or four domesticated animals; the flesh of three or four, and the eggs of one species of

domesticated birds; three great grains—wheat, rice, and maize—and a half-dozen smaller and much less frequent ones; one hundred or so species of fishes and shell-fish; two sugars; a dozen or so starch-containing roots and tubers, only two of which—the potato and the manioc—are of real international importance; twenty or thirty fruits; forty or fifty vegetables—these make up two-thirds of the food supply of the inhabitants of the world.

Instead of wondering at the variety and profuseness of the human food supply, the biologist is rather inclined to ejaculate with the London footman immortalised by John Leech, who, when told by the cook that there would be mutton-chops for dinner and roast beef for supper, exclaimed, "Nothink but beef, mutton, and pork—pork, mutton, and beef! Hin my opinion, hit's 'igh time some new hanimal was inwented!"

On looking into the matter further, one finds these various standard comestibles arranged in a sort of rough order of comparative importance which is singularly uniform all over the world. First come the staples, which group includes the mammalian meats, maize, wheat, or rice, butter or oil, sugar, and salt. It is safe to say that two-thirds of the money expended for food by every civilised race and most barbaric ones goes to purchase some combination of these great staples. Science has, of course, long ago vindicated the good sense of humanity's selection by showing that they contain the highest degree of fuel value, digestibility, and freedom from injurious re-

sults that is to be had for the price—in most cases, indeed, at any price.

Next comes a large group of accessory foods whose function it is to fill the gaps between the great staples, or to supply defects which may be present in the latter, or to break the monotony of a diet consisting too exclusively of these. Such are the green vegetables, the fruits and salads of every sort, the rarer and less nourishing kinds of meat, such as fowl, game, shellfish, etc., cheese, milk, butter, and certain spices and condiments.

Lastly, another rough group of largely ornamental foods, luxuries, relishes, stimulants to the appetite, or sources of pure enjoyment to the sense of taste or smell, such as flavourings and aromatics, tea, coffee, tobacco, alcohol, sweetmeats, sweet herbs, cordials, and rare delicacies generally.

The subsidiary and accessory flavouring foods in the second class—while a thousand times more numerous than the solid staples, and often commanding large prices and becoming important articles of commerce are yet almost never relied upon as an important part of the dietary, except in periods of necessity or famine, in the absence of more substantial viands. For the most part, the reason is obvious. The vast majority of these subsidiary and accessory foods do not contain a sufficient amount of energy (calories) in proportion to their bulk to make them seriously valuable as fuel for the body engine. Others, again, are so expensive, or so restricted in their seasonal occurrence, or so difficult to procure in sufficient quanti-

ties, that they are practically excluded from the daily dietary.

But these limitations by no means apply to all the members of this great class. There still remain a large number of accessory foods which are exceedingly rich in nutritive content, and no more expensive than the staples—in some cases even less so; and it has been one of the chief objects of enthusiasm with the modern food reformer, both scientific and pseudo-scientific, to discover one of these nutritive and inexpensive accessory foods and proceed to "boost" it forcibly into the ranks of the staple foods. Hitherto we have been a little at a loss to account for their curious failure to widen the range of substantial foods embraced within the first class. This, however, has been largely due to the fact that naturally our earliest scientific studies have been chiefly confined to the positive side of a food's qualities, namely, its nutritive value and its digestibility. Does such and such a food contain so many calories per ounce? Is it digestible in the human stomach? asks the laboratory scientist. If so, it is a good food. Upon this basis the most determined efforts have been made by well-meaning food reformers to introduce among the staple articles of diet a considerable number of subsidiary foods which have high nutritive value at relatively small cost, particularly such as peas, beans, pulses, chestnuts, peanuts, and other so-called nuts, brown bread, bananas, cheese, milk, olive-oil, and a score of other things which rise in the memory. Of late, however, studies made from another point of view in the laboratories

are beginning to throw a flood of light on the reason for the failure of these foods promptly to meet with favour on the part of the public, revealing the surprising fact that many articles of food contain, combined with their high percentage of nutritive value, substances which are irritating to the stomach, disturb digestion, or may even behave as active poisons.

These so-called poison foods fall roughly into three main groups: first, those which contain such a large amount of poisonous or irritating matter that they are entirely unfit for ordinary human use, unless subjected to some special treatment, or unless the race has become habituated to them by generations of stern necessity; second, a large and important class of foods possessing high nutritive value, but containing at the same time a small amount of poisonous or irritating element, so that, while they can be taken in moderate amounts without injury by the majority of mankind, they can be taken *only* in such moderate amounts; and, third, a great group of so-called "ornamental" foods of low fuel-value, which possess the odd and bizarre quality of acting as acute poisons to a certain number of susceptible individuals, usually not exceeding from five to ten per cent. of the race, though perfectly harmless, in ordinary amounts, to the remaining ninety to ninety-five per cent. Nearly all of this group, however, easily become poisonous to the great majority of individuals if taken in excess.

The interesting facts about this classification are, first, that not a single staple food of civilised man is to be found in any one of these three categories; and,

second, that nearly every secondary food which, on account of its high nutritive value and low expense, the reformers have attempted to list in the ranks of the staples, lies in the second class of poison foods.

The first and comparatively small group of "poison foods"—those which combine valuable nutritive qualities and a virulent poison in one and the same substance—is strikingly exemplified by the manioc or cassava-root. This forms the staple food of hundreds of thousands of human beings in the tropics, yet its juice is so intensely poisonous that every particle has to be driven out by crushing under great pressure and by heat before the remaining starchy part is safe for human food. Some of the most distressing tragedies connected with tropical explorations have been due to ignorance of this fact and the attempt to live upon either uncrushed or imperfectly crushed manioc-roots. Another example comes still nearer home. The stems, leaves, and berries of the potato, that harmless and beneficent tuber, are highly poisonous, the so-called root being the only portion which is safe for human food—and even this under certain circumstances may become poisonous.

The second great class of poison foods, containing those accessory articles of diet which agree with the majority of mankind when taken in moderate amounts, but, owing to their small percentage of poisonous element, *only* when taken in moderate amounts, is of the utmost interest and practical importance; for it is this class which furnishes the great majority of secondary foods from which the reformers

have unavailingly attempted to recruit new staples of diet. Take, for instance, the case of the bean. We regard it as an affront to our intelligence to be told that we "don't know beans," but there are several kinks in the physiology of these innocent-looking legumes which we are only just beginning to unravel. One of these is that, coiled amid its rich store of proteid and fat, like guardian dragons, lie an aromatic oil and a bitter alkaloid, both poisonous to the susceptible stomach in small amounts, and to the average one in larger. These explain the well-known unpopularity of beans as a staple on the boarding-house table, in the lumber-camp, on the march. Nothing will goad a grading gang or company mess to mutiny quicker than an excess of beans. They will take bread, bacon, "salt-horse," apple-sauce, potatoes, oatmeal, rice three times a day for weeks at a stretch without a murmur; but let beans be served as the principal dish at a meal more than two or three times a week, and hear the "roar." Every boarding-house knows that beans are the cheapest and most "filling" food to be had in the market, equal to the classic "brimstone and treacle" of Dotheboys Hall; but is also keenly and regretfully aware that the boarders "won't stand for them" more than once or twice a week. Even the sacred bean of Boston is only consumed by the elect on Saturdays or Sundays.

This toxic principle is really little short of a dietetic calamity, for beans, peas, and lentils contain an abundance of the cheapest proteid or nitrogenous food to be had. All our text-books inform us that one shilling

will purchase twice as much proteid in the form of dried peas or beans as in the form of cheese, five times as much as in beef, and eight times as much as in eggs. Therefore, all diet reformers, and especially vegetarians, have urged the use of the "poor man's beefsteaks" as a substitute for meat. But the crass, obstinate man in the street simply shrugs his shoulders. And, as usual, the man in the street is right. He doesn't know much, but he does know beans and his own stomach. Like most "highly recommended" foods, they show up beautifully in the analysis, but you can't live on them. Careful experiments have shown that whenever beans or peas are taken as the sole source of proteid in the diet, or in excess of about one-fifth of the proteid requirements of the body, they promptly produce burning of the stomach, flatulence, loss of appetite, and, if persisted in, failure of nutrition. Stock-raisers have found the same thing true of horses and cattle. Other members of the bean-pea family *(Leguminosae)* have this bitter toxic principle so highly developed that they produce a chronic poisoning in range-cattle, known as lathyrism (from *lathyrus,* a vetch), while the much-dreaded "loco-weed" of our Western plains is another member of the group.

It is possible that a certain degree of tolerance of this poison might be acquired in time, as several low-grade races and classes, like the Pueblo Indians, the Mexican cholos, and the Trappist monks, make beans (frijoles), or pulses, a staple article of diet; but that any live, intelligent white race will eat beans as a staple

while it has the energy to get meat is highly improbable. As an occasional element of the diet beans have their uses, but as a constant source of proteid they're a failure. "Cheap, but nasty," describes them precisely, if to nasty you add "and poisonous."

Another much-vaunted source of "vegetable" proteid is cheese, and it does seem strange at first thought that this should so rarely have succeeded in getting itself adopted by the race among the great group of staples. As a proteid food it is decidedly cheap and gives more than twice as much proteid for a shilling as beef and nearly four times as much as eggs. It is also pleasant to the taste and, in moderate amounts, fairly digestible. And yet the average man persists in taking it, in the country, chiefly as a means of coaxing down huge hunks of bread, or, in the city, as a relish at the end or beginning of a meal. A little study of the effects of cheese on the human stomach quickly shows the reason for this—that the ferments *(zymases)* and flavouring extracts which develop in cheese in the process of ripening irritate the stomach, upset the digestion, and constipate the bowels, whenever it is taken in excess of very moderate amounts. Even in the mildest and greenest of cheeses these substances are present in sufficient quantity to interfere with their use as a serious article of diet, while the highly ripened and odorous cheeses, like Stilton, Roquefort, Brie, Camembert, and Limburger, are still more acutely irritating and can only be taken in still smaller quantities, as flavouring extracts. Practically, indeed, the chief nutritive value of cheese re-

sides in the bread or crackers which can be relished with it.

Next as the darlings of the would-be food reformer come nuts of all sorts. These are urged upon us with special fervour and enthusiasm by those who regard all foods of animal origin as "tainted money," besmirched by the foul crime of murder. Here, we are told, are food-stuffs—walnuts, hickory-nuts, Brazil nuts, pecans, peanuts—of a high degree of toothsomeness and attractiveness, not excessive in expense, and containing a large percentage of both proteid and fat. Analyses made in the laboratory absolutely confirm the truth of the statement: fats and proteids are both present in large amounts and in readily digestible form; and yet practically no "unemancipated" specimen of the human race—except the Shawnee Indian in hickory-nut time—will attempt to make a meal on nuts. They are still commonly regarded simply as a *bonne bouche,* to be taken after the serious business of the meal is over, merely as a dessert. The classic phrase of "the walnuts and the wine" expresses precisely where they stand in the scale of the normal diet list.

Now we are just beginning to find out why we have all had more or less violent attacks of colic or headache after a gorgeous spree on nuts and candy in our boyhood days—attacks which we were usually content to put down to the sheer piggishness of the young human animal. An irritating principle has been found present in all nuts, partly in the kernel itself and partly in the skin which surrounds the kernel,

which, even in cases of very moderate amounts, is a decided irritant to the digestive canal. Peanuts—which, of course, are not nuts at all, but the seeds of a species of pea which is artificially caused to develop underground—are particularly strong in these poisonous extracts. Physicians now regard them as exceedingly undesirable articles of diet for children, on the ground that they frequently produce attacks of colic, diarrhœa, and even, it is asserted, of appendicitis. All attempts to use nuts in considerable amounts as a staple article of diet for any length of time, except by a few enthusiasts who are committed in advance to a belief in their superiority, have proved unsatisfactory.

A somewhat similar situation confronts us with regard to the banana, that great food-fruit of the tropics. While rich in both sugar and starch and capable of being ingested in sufficient amounts to be a real food, it is excluded by three serious drawbacks from admission to the rank of a staple: first, that the starch is swallowed raw, and thence is difficult of digestion; second, if a little underripe it is as indigestible as salt-cucumbers, and if overripe is exceedingly apt to set up fermentations in the stomach—and the golden mean is very difficult to secure in our far-shipped Northern fruit; third, even when in perfect condition, its delicate flavouring essences act as an irritant to a fair percentage of stomachs. I find that many people, especially rheumatics or asthmatics, have found by repeated experiences that bananas "don't agree" with them. If the banana stood alone

in this respect, we might perhaps dismiss the complaint with a shrug of the shoulders and a pitying allusion to personal fancies or individual whim or even mere coincidence. But, on the contrary, it stands in this aspect as a fair sample of the third and most interesting class of poison foods.

Comestibles of this class, which, though harmless to the multitude, are acutely toxic to an unfortunate few, might be called the eccentric poison foods, or the casual criminals of our court of dietetics. What they lack in consistent viciousness they make up in numbers, and until one has had occasion to pay some continued attention to them, it is difficult to realise, or even believe, how numerous they are. I have been studying these foods for some seven years past, and am already inclined to the conclusion that a large proportion of human beings have one or more of these pet antipathies.

The peculiar characteristic of this class of poison foods is that while readily capable of producing fermentative or toxic symptoms in the majority of individuals if taken in excess of rather moderate amounts, they are as a rule comparatively harmless and useful to, say, ninety-five per cent of the species, but are acute and irritating poisons to the remaining luckless five per cent. Depending as they do upon individual peculiarities or idiosyncrasies for the production of their poisonous effects, they are naturally very numerous. But, world-widely various as they are, they all have one feature in common—that it is practically impossible to use them in amounts and with

sufficient frequency to obtain any considerable quantities of nutrition from them, on account of the ease with which they lend themselves to, or set up, fermentative or toxic processes in the alimentary canal. They never can become much more than luxuries, flavouring elements, ornaments of the menu, breakers of monotony of diet. This, it can easily be seen at a glance, is precisely the rôle which is assigned to them on the average dinner-table. Numerous as they are, only a mere glimpse of their fascinating rogues' gallery can be given.

One of the most widely known members of the group, and one which will serve excellently as a typical illustration, is the strawberry. That delicious fruit has the extraordinary vagary of acting as an irritant poison to probably somewhere in the neighbourhood of one out of twenty of the human species. So common, in fact, is this action, that probably every one has known of from one to a dozen instances in his own experience. The singularity of the effect lies in the fact—and this is typical of all this group of the poison foods—that it is entirely independent both of the general condition of health or vigour of digestion of the individual affected, and of the ripeness, freshness, and soundness of the berries.

Mental suggestion and anticipation may also be excluded, for the victims will be affected by even the smallest trace of strawberries in preserves, puddings, etc., when they are entirely unaware of the presence of the fruit. Not only will the digestion be disturbed, but, in the more susceptible sufferers, rashes and erup-

tions upon the skin, pain in the joints, swelling of the lips and tongue, will also be produced. Nor can this result be attributed, as Metchnikoff has recently suggested, to contamination of the berries with fertilisers in the soil, or to the presence of insect parasites or of moulds or bacteria which may have developed upon the berries during shipment or exposure in the shops.

It will occur with equal prominence and certainty in susceptible persons from the eating of jams and preserves in which the berries have been thoroughly sterilised by prolonged boiling, from eating berries which have been carefully washed and cleansed, or even taken from vines known to be free from contamination, or plucked wild in the meadows. The fault is not in the berry, but in the make-up of the unfortunate individual eating it—and once "strawberry-marked," always strawberry-marked, as a rule.

With this for a type or sample, a roll-call of our remaining casual criminals can rapidly be made. More of them lie in the fruit class than in any other. Cherries appear to come next in frequency, though at a considerable interval. Then come raspberries, prunes, bananas, melons, grape-fruit, oranges, apricots, peaches, plums, and, last and least frequent, apples.

All of these have been known to produce more or less severe and definite poisonings, entirely independent of the amount taken or of the condition and ripeness of the fruit. Oddly enough, that "fruit," the tomato, which has the worst popular reputation

in this regard, seems comparatively free from actual offence.

Poisonings by oranges show one marked peculiarity, and that is that they seem to occur only—or at least generally—where the fruit is picked directly from the trees. In southern California they are comparatively common; in other parts of the United States I have been able to find few instances.

The next longest list of these eccentrics is found among the vegetables, and includes asparagus, spinach, string-beans, potatoes, cucumbers, cabbage, sage, parsley, onions, radishes, and turnips. Most of these, of course, contain considerable amounts of cellulose and woody fibre, and quickly and readily undergo poisonous changes in the process of spoiling, lending themselves readily to the furthering of any fermentative process that may be present in the alimentary canal; but, apart from all these possibilities, they also have comparatively definite specific poisonous effects upon certain individuals, entirely independent of the amount taken, the state of digestion at the time, or the condition of the vegetables.

The list of animal products which are, in sound condition, poisonous, even to "freakish" individuals, is very short, covering only crabs, lobsters, clams, oysters, salmon, cheese, and very, very rarely eggs and milk. The latter two are the rarest gems of our poison-food collection, but perfectly clear-cut. I have known personally six persons upon whom eggs acted as a poison. Four were only affected when one or more eggs had been eaten, but the other two could

touch no food containing the smallest trace of egg, such as custard, cake, or pudding, without promptly paying the penalty. The susceptibility is well recognised in medical literature, though only as a curious anomaly. The symptoms are those of a violent poison like arsenic, and are absolutely independent of the freshness or condition of the egg eaten.

This is, however, not quite so incredible as it might appear at first sight, for the yolk of an egg is an exceedingly complex body, capable of "exploding" into a great variety of waste poisons—witness how exceedingly offensive it becomes when even slightly decayed.

Moreover, while the eggs of birds are rarely poisonous, those of fishes are not infrequently so. Fish-roe is proverbially risky as a food, and the closed season observed for many fishes even by savages is probably largely due their unsafeness as food during the spawning season.

The other sea-foods mentioned—crabs, lobsters, clams, and cockles—are already blacklisted in popular report as "very indigestible." Much of this bad reputation is undeserved, and due to the remarkable rapidity with which they undergo putrefactive changes; but part of it rests upon the fact that, to a certain number of people, they are distinctly and essentially poisonous.

Cockles and mussels are so frequently followed by burning in the stomach, griping, and nettlerash, that only the less intelligent classes of our population, chiefly foreigners and Indians, will eat them at all.

Any old fisherman will tell you that if you eat the "beard" *(byssus)* of a mussel, it will "pizen" or even kill you; if you avoid this, you're safe. This is about as reliable as the similar myth regarding the cherry in a cocktail.[1]

A few luckless babies are poisoned by cows' milk in any dilution or modification, and can only be kept alive by albumin water or a wet-nurse, while a fair sprinkling of adults find that raw milk does not agree with them even in small amounts.

Last of all among the third group of poison foods come the so-called stimulants, tea, coffee, tobacco, and alcohol. They are typical members of the group; poisons even in small amounts to a small percentage; in large amounts to the majority of the race. We are only just beginning adequately to appreciate the large part that individual susceptibility plays in their injurious effects. (Probably eighty per cent. of men can use them in moderation without injury and without any serious temptation to go to excess.)

[1]A few unfortunate individuals cannot eat salmon without suffering from urticaria, and a very few are unpleasantly affected by fish of any sort.

The meats proper and the starches are the two classes of foodstuffs freest from any of those occasional toxic effects. One meat, mutton, like its cousin venison, occasionally produces vomiting and purging in a few susceptible persons. A few others are susceptible to veal, and I have known one rheumatic patient who declared that a single helping of beefsteak would bring on a fresh attack of pain.

One or two calamitously "freaky" individuals are on record as being acutely poisoned by even man's best friend—wheat flour. It can be imagined what difficulties they had when away from home getting in things that were safe for them to eat.

Tea and coffee depend for their comforting effects partly upon the hot water in which they are infused; partly upon their agreeable odour and taste, due to an aromatic oil; and partly upon an alkaloid, caffein, or theine, now more accurately known as trimethyl-xanthin. These three factors are nearly equal in influence. Caffein is a mild stimulant to the circulation, the brain-cells, and the kidneys. To about five per cent. of individuals it is poisonous; to the remainder absolutely harmless in the amounts usually drunk. Few discoveries of the wit of man have added more to the comfort and happiness of life and less to its miseries than tea and coffee. Like soups, broths, and cheeses, though not foods themselves, they enable the majority of people, and especially women, to eat with a relish considerable amounts of bread, butter, crackers, meat, cake, etc., for which otherwise they would have little appetite. In other words, they are a splendid "introduction committee." Instead of diminishing the amount of food consumed, they increase it. Moreover, they are usually taken with sugar and cream or milk, and a cup of tea or coffee with plenty of these "trimmings" is the nutritive equivalent of a small saucer of breakfast-food.

Outside of the luckless five per cent., their injurious effects are chiefly due to the excess of tannin present when they are unintelligently made. The average boarding-house or farm-house cup of tea resembles most a weak decoction of oak-bark, on account of its excess of tannin, due to boiling or stewing on the back of the stove. It is the astringency of this element,

which may reach seven per cent., and not the caffein, that deranges digestion.

To take either tea or coffee as a substitute for food is, of course, absurd and can end only in disaster. Most of the "tea-poisoning" symptoms of the poor seamstress or working-woman are signs of starvation, not due to the tea which she *can* get, but to the lack of food which she *can't* afford. If you take either late at night, they'll be likely to keep you awake; that's what they were introduced for originally—one by the bonzes of Thibet, and the other by the monks of Arabia. The "dyspepsias" attributed to them are due nine times out of ten to the food taken with them. No disease known to the medical profession is directly attributable to them.

Even this hasty review of poison foods suggests reflections of considerable importance and interest. We find, in the first place, that the staple foods of the civilised world—the meats, the flours or meals, the butters or oils, fish, eggs, milk, and sugars—have won their position purely upon their own merits: first, by possessing adequate fuel-value in digestible form at a moderate cost; second, by being almost entirely free from poisonous effects, even in large amounts and after prolonged use.

Next in importance upon the list comes a much larger group of secondary, or occasional, or temporary poison foods, which, though also possessed of high nutritive value at nearly as little expense as the staples —and in some cases even less expense—never reach anything like the figure of the staples in the total of

crop reports or price-lists. Such are beans, peas, nuts, cheese, cornmeal, oatmeal, and graham-meal.

These are nearly all found to be disqualified from heavy and continuous use by the possession of poisonous elements or coarse and irritating particles or fibres which upset the average digestion, and are poisonous or irritating even in small amounts to a moderate percentage of individuals. A certain degree of immunity to these principles or particles may be acquired under the pressure of stern necessity, as among soldiers and frontiersmen. But they are never willingly used as more than occasional and supplementary elements in the dietary where other food materials are accessible.

Finally comes a great group of food-stuffs which are used chiefly as flavours, sauces, salads, fillers of gaps between the solid staples, relievers of monotony. Their function, though from a fuel point of view they are of little importance, is practically of enormous value, and yet they intrinsically belong just about where the market reports class them and the menus place them, namely, among the luxuries and the decorations: first, because they are usually deficient in actual fuel-value in proportion to their bulk; second, when taken in sufficient amounts to act as a genuine food and to supply an appreciable share of nutrition, they are apt to set up fermentative changes in the alimentary canal; and third, because nearly every one of them is more or less inherently toxic to a small percentage of individuals.

The bearing of these considerations upon reform or exclusive dietaries is of interest. The economist and the vegetarian who, for utilitarian or humane or moral reasons, urge the substitution for meat of beans, peas, cheese, corn-meal, oatmeal, nuts, fruits, etc., are promptly baffled by the fact that these cheap and highly nutritious substances all contain elements which are poisonous or irritating to the average stomach when taken in excess of about one-third of the actual needs of the body, and, in the case of the fruits and vegetables, are markedly deficient in fuel-value in the amounts which can be sufficiently ingested or digested.

The school of dietetic reformers who hold that food should be eaten raw also find themselves confronted by obstacles of this same character, in that they usually, either from obvious reasons or upon moral grounds, avoid the use of meat, and are thrown back upon the same great sources of vegetable proteid as the vegetarians—beans, nuts, cheese, etc.; moreover, they expose themselves to an ambuscade of other dangers, through the possibility of bacteriological contamination of their food. Indeed, the great bacteriologist, Metchnikoff, goes so far as to raise the banner of bacteriology against the use of any uncooked fruits, vegetables, or grains which cannot show a spotless and unsullied pedigree from stem to mouth.

To sum up, poison foods, while intensely individual in their action and at first sight little better than curiosities of dietetics, have exercised a profound in-

fluence on the menus of civilised races. Moreover, the sanction which the latest discoveries of the laboratory have given to their age-long exclusion from the list of staple foods is a fact to be reckoned with by that huge and well-disciplined army of food reformers who, actuated by the highest motives, are desirous of reconstructing the dietary of mankind.

CHAPTER IV

EXERCISE AND ITS DANGERS

MUSCULAR movement is almost synonymous with life. The essence of life is movement. Paralyse our muscles and we are dead. More than that, paralyse our voluntary muscles only and we might as well be, for we can neither move, speak, nor think. Thought is a function of muscle. It could neither originate nor continue without words, and words are made by muscle. *Homo alalus* is separated from *homo sapiens* solely by a little special manual training. For the real origin of speech is not sound, but gesture. And it was the changing of the paw into a hand capable of wielding a club that made oratory possible.

There is, then, little danger of any physiologist underrating exercise. As will be seen in the chapter on Play, he knows too well that it has not only built the body, including the brain, in the past, but is its chief supporter in the present. Muscle makes up nearly half (forty-three per cent.) of our bulk, almost three times as much as any other tissue or system. Its importance is in proportion to its bulk. The brain is simply a telephone exchange to carry out the business of muscle. The bulk of our food is consumed in the muscle-cells, and two-thirds of our vital heat is produced by them. The only way to nourish the brain is

through the muscles. Destroy a group of them and the area of the brain cortex, which attends to its business, wastes and atrophies at once.

It is therefore not on account of any lack of respect for the importance of muscle or any tendency to classify it as a relatively low-grade tissue as compared with brain that I wish to say a few words in regard to the dangers from its overuse. On the contrary, it is its high rank in the organism that makes its abuse so dangerous; and there is an even more vital reason for a note of warning. This is that muscular tissue is the only tissue in the body which is under the direct control of our will, as is implied in its name—"voluntary" muscle. You may order your stomach to serve a certain quality and flavour of gastric juice, or your liver to secrete a certain colour of bile, and keep on ordering, with about as much result as whistling down the wind. You have absolutely no control over your heart-beat. You cannot stop breathing beyond the point of a very moderate degree of suffocation. You cannot even stop your brain from thinking; all you can do is change the subject—sometimes. But you can order practically any voluntary muscle in your body to contract, and it springs to your service at once, and will keep on obeying you until it fails from sheer exhaustion. It is on this account that the muscular system is so peculiarly defenseless and liable to abuse—because it is under the will, or reason, instead of instinct. A man cannot add a cubit, or even an inch, to his height by taking thought, but he can increase the girth of his biceps or the expansion of his

chest, the lifting-power of his gastrocnemius, or even the bulk of that hybrid between voluntary and involuntary muscle, the heart, from twenty to fifty per cent. Muscle is the one tissue through which a man can directly modify and change his body. Naturally, therefore, in all our unscientific methods of bodily culture, and they are innumerable, increasing the vigour and size of the muscles is made the chief and criterion of progress. While this increase may be attended by general bodily improvement in seventy per cent. of all cases, in the other thirty per cent. the real vigour and resisting power of the body may have been moving in the opposite direction, and this is where physiology must lift its note of warning.

Probably the greatest danger of exercise for most of my readers lies in the direction of their not getting enough of it. But this is by no means true of the community as a whole. Two-thirds of the total community get a great deal too much muscular exercise and suffer for it. Honest toil is not the unmitigated blessing that we once supposed it to be. The Scriptural view of "By the sweat of thy brow," as a curse, has some truth in it. The very voluntariness of muscular effort has permitted its abuse. There is a certain and fairly definite limit to the amount of food which even the wealthiest individual can consume. We are utterly unable to force more air into our system than the tissues demand and can utilise. But the work that we can impose on the muscles has absolutely no limit except that of utter exhaustion. There is, of course, an instinct called fatigue, which tells us

when we have laboured enough, but our whole training from the cradle up has been to make us not only disregard this indication, but esteem its ignoring a virtue. The man who stops work just because he is tired is generally deemed a lazy, shiftless good-for-nothing; the man who stops eating because he feels satisfied is a rational, praiseworthy being.

As a result, muscular effort has been pushed to extremes, both in amateur athletics and in daily toil. Though highly beneficial and absolutely essential to life and happiness in considerable amounts, it has been made physically injurious and mentally degrading. Trades-unions were overwhelmingly right when they demanded as the first prerequisite for the mental, moral, or physical improvement of the labouring man a shortening of the hours of toil. Nothing more degrading or benumbing to all that is best in human nature has ever been devised than the grinding, treadmill routine of muscular labour which was exacted of the labouring world fifty years ago, and is yet exacted to-day in regions where labourers are unable to protect themselves. Particularly is this true in the rural districts. My attention was first called to this some twenty years ago, on beginning the practice of medicine in a well-to-do country district. I was simply astonished at the number of intelligent and independent farmers, owning their own land but driven by the lash of the mortgage, who were little better than physical wrecks at the age of forty-five. I had known, of course, as a mere matter of text-book knowledge, that the average longevity of farm labourers was low, and

that of farmers little better, both lower than that of business and professional men; but this was an unexpectedly vivid illustration. From that time I have watched carefully the limits of physical vigour in farmers, ranchers, lumbermen, miners, section-hands, and others engaged in prolonged and excessive muscular exertion, and have been surprised to find how rarely individuals over forty years of age are still able to do a full day's work. Between forty-five and fifty our farmer is pretty certain to be a broken man, though still retaining good colour, good appetite, and fairly vigorous appearance. I have also compared notes with my brother practitioners, and find them almost invariably agreed that there are as many broken-down nervous systems, dilated hearts, fibrotic kidneys, and the supposed results of our high-tension civilisation generally, to be found in quiet rural districts as in the city. The death-rate in the country is now only a fraction of a per cent. lower than that in our greatest cities, slums and all. Farmers' wives show the highest percentage of insanity of any class in the United States, chiefly from overwork, overworry, and lack of proper amusements and recreation.

Any one who has lived on a farm does not need to be told the reason, for he knows of the strain under which the American farmer lives during the five months of spring and summer. His workday is from four or five in the morning until eight or nine at night, including chores—fifteen to seventeen hours of the hardest kind of physical labour, and every minute of it at high tension, especially during harvest. Then

comes a period of relaxation in the fall, the one time in the year when he has just enough muscular exercise to keep him in health. Later, the winter season, approaching stagnation, in which he takes on flesh, gets "logy," and then a furious debauch of hard labour through the spring and summer again. No wonder that by forty-five he has had a sunstroke and "can't stand the heat," or has "a weak back," or his "heart gives out," or a chill "makes him rheumatic"; and when you add to this furious muscular strain the fact that the farmer sees his income put in peril every season, and his very home every bad year, so that each unfavourable change in the weather sets his nerves on edge, it can be readily imagined that the real "quiet, peaceful country life" is something sadly different from the ideal.

The same conditions prevail among the working classes in our great cities, except where the eight-hour law has been put in force. It has long been known that the labouring classes have a low average longevity and a high disease and death-rate, and they are subject to an enormous number of diseases from which, according to popular impression, their "active, natural life" ought to have protected them. The percentage of cases of Bright's disease, of heart-disease, of nervous breakdown, of insanity, is higher among them than in any of the so-called leisure classes. Nor can alcohol longer be made the universal scapegoat. Overwork is a far more potent factor in their production than drunkenness.

The injurious effect of city life consists not merely in

overcrowding or the increased development of infectious diseases, but especially in the outrageous and abominable overworking of the labouring classes. Overwork and underfeeding have been recognised for half a century as the chief causes of the large death-rate of the labouring classes as compared with the well-to-do. Even with all the improvements that have been effected in the condition of the labouring classes, the last United States census (1900) still shows the highest death-rate among them of any "earning" class —20.2 per thousand. Farmers came next with 17.6, as compared with mercantile and trading classes at 12.1 per thousand, and clerical and official at 13.5. Thus labourers have a death-rate sixty-six per cent. higher than that of business men, and farmers forty-five per cent. higher. Overwork and overcrowding are alike responsible for the frightful tribute paid by these same classes to the Great White Plague. The improvement that occurs in most of our hospitals in patients of the labouring classes, who are not suffering from some injury or acute disease, simply from being put at rest in a well-ventilated room and given a moderate amount of nourishing food, is really astonishing. It is an open secret that in most of the chronic diseases brought to our hospitals in the large cities it makes little or no difference what medicine is given during the first week or ten days; the patients will improve on any medicine, or on none at all.

Of course a proper amount of work is not only necessary to existence, but highly beneficial both physically, mentally, and morally, yet this should never exceed

certain well-defined limits. The communal conscience has now agreed to the eight-hour day, and I venture to prophesy that within twenty years' time it will be reduced to six, and that this will be found to be the limit of bodily labour consistent both with health and profit.

It might simply be mentioned in passing that it has been abundantly proven that this change is not merely healthful for the worker, but profitable for the employer. Not only is more work done in the month, but a far better quality. There are less waste, less sickness, less drinking, fewer absences from work. The United States, which pays the highest wages and has the shortest average hours, has the lowest labour cost per article produced of any country in the world. At the other end of the scale, Italy, with the longest day and the lowest wages, has the highest per cent. of labour cost.

I merely wish to raise a note of warning against the impression which seems to prevail in sociologic circles that work at reasonable wages is the complete solution of the labour problem, and that there is little danger of any one getting too much of it, unless he be actually diseased or defective. From the voluntary nature of his toil the civilised labouring man works harder and longer than any known beast of burden or any serf can be made to do. An intelligent conservation of his energies will abundantly repay both the labourer and employer.

It has been long known to sanitarians that the highest average longevity is not among farmers, but

among professional and business men. The finest physical specimens of humanity that are to be found in America are not among farmers or day-laborers of any description, but among the children or grandchildren of these classes, who have been brought up in smaller towns or in the suburbs of larger cities. While it is true that the strain and pressure and crowding of city life have been an injurious factor in our racial development, this is only, so to speak, at the lower end of the scale, among the slum and day-labouring classes. The classes of higher intelligence and reasonably comfortable circumstances, including skilled artisans, municipal business employees, and those engaged in "personal services," have been improved instead of injured by it. This can be seen at a glance when the records of our champion athletic performances are examined. The majority of our football and baseball teams and two-thirds of the winners in athletic contests will be found to come from this relatively small class of comfortably situated city and town dwellers. The well-marked tendency in recent years for city people to make their homes in the country, rendered possible by electric cars, automobiles, and other forms of rapid transit, is both a sign of increasing hygienic intelligence and an admirable factor in the betterment of the racial health. The country is the best place for children, but the finest adult development, physical as well as intellectual, will be secured in the city.

In fact, we have been, both popularly and professionally, under the same delusion with regard to the

contrast between country and city dwellers as to that between the savage and civilised man. The general impression is that the savage is a perfect animal, almost free from diseases, and living to a great age. As a matter of fact, civilised man is a far superior animal to any known tribe of savages; he lives longer, is healthier and happier. He has, it is true, more diseases, but he resists them infinitely better. The reason in both cases is not far to seek. The savage is so desperately afraid of night-prowlers and night-demons that he makes his hut about as near like a prison or an iron safe as he can. Civilised man sleeps in comfortable, well-ventilated bedrooms. The savage never knows what his supply of food is going to be. It is always either a feast or a famine with him—more commonly the latter. The exercise of the savage consists in violent and furious bouts of either fighting, or escaping from or chasing his prey or his enemy, followed by long periods of idleness and torpor. His water-supply is often bad. He is unable to protect himself from the weather. He has infinitely less control over his environment than has civilised man.

The same comparison may be made step by step between the farmer and the average city dweller. Farmers' bedrooms are usually built chiefly for warmth and are close and stuffy. As some one has said, "The air in the country is always good, for the farmers keep all the bad air shut up in their bedrooms." Their food too often consists of that which they cannot sell. It takes them all winter to recover from the work-debauch of each summer. The city man, with

his well-ventilated house, good supply of water, good drainage, regular hours, moderate muscular exercise and good food-supply, is under more favourable conditions physically. And his lessened amount of enforced exercise is not the least beneficial of his changes. Those city dwellers who work hardest and longest with their muscles have invariably the highest death-rate.

To sum up very briefly, about one-half of the enforced muscular exercise imposed upon civilised man is beneficial; the other half is either neutral or injurious.

Now as to the voluntary muscular exercise which is indulged in under the name of physical culture, athletics, or some similar title. The chief dangers in this are a lack of proper appreciation of what tissues should be developed by exercise, and failure to recognise the great fact that the value of exercise depends not so much upon its quantity as upon its quality. The general impression of the majority of athletic trainers, physical-culturists, "strong men," and of most gymnasium teachers (until within the past ten years), is that the chief thing is to develop huge and misshapen masses of muscle. The ideal man in their scheme is he who can stand in front of a camera and contort the muscles of his back until they writhe out like a basket of snakes, or can split his coat-sleeve by contracting the overgrown biceps, or lift six hundred pounds clear of the floor. Such an individual may have a vigorous constitution, but he is as abnormal and as unsymmetrically developed as the string-

muscled, flat-chested bookkeeper, and may be a much poorer life risk. As a matter of fact, that type of human ox, the "strong man," is not only not a better animal than the average man, but a poorer. The fact of his being able to get such a muscular development is proof of abnormality. Now that athletic records have been carefully investigated by the medical profession, we find that the champion professional athlete is short-lived and highly subject to disease not only of the heart, but also of the lungs. If he marries, he has few children, and they are seldom above the average physically. In fact, he compares with the average man about as a Clydesdale draught-horse compares with a Morgan or an English thoroughbred.

Nor is this state of affairs confined to the professional athlete. Every physician who has practised in or near a university town can point to a dozen athletic young men who have been seriously injured by muscular exercise. Particularly is this true of overstraining and hypertrophic disease of the heart muscle. A recent study of the boys "in training" at a Western academy, by the school physician, showed that over sixty per cent. had cardiac murmurs.

Prolonged and fatiguing exercises, taken not for any enjoyment in them, but as a matter of conscience, "to build muscle," are distinctly dangerous. In fact, the medical profession is coming generally to regard college and high-school athletics, as now practised, as a menace to the health of the community. This was not true in earlier days, when college men took their sport like gentlemen, and the later life-records made

by the Oxford and Cambridge 'varsity crews and our earlier Yale and Harvard crews are still quoted by health journals. Nowadays, however, the results are widely different; and sufficient data have accumulated in proof thereof. Take, for instance, the data collected by Dr. Robert Coughlin[1] upon the causes of the deaths among athletes for the year 1905. First, of all of the 128 athletes who died during the year, 78 died from injuries received, and only 50 from disease—a huge inherent mortality to begin with. But the nature of the diseases which caused the fifty natural deaths is even more significant; for, contrary to popular impression, the death-rate from infectious diseases among these picked specimens, these prides of their clubs and colleges, was nearly double that of the other adult males of the community. For comparison Dr. Coughlin selected the deaths that year among the policyholders in one of our large insurance companies, who were all adult males of about the same social condition as the athletes. The contrast is so striking that I shall put the figures in parallel columns.

DEATHS IN 1905 DUE TO INFECTIOUS DISEASES

	Policy-holders	Athletes
Pneumonia	10.4	14
Tuberculosis	13	14
Typhoid fever	6	8
Cerebro-spinal meningitis	0	18
	29.4	54

[1]The Medical Record, New York, June 2, 1906

In non-infectious diseases likely to be due to strain the contrast is even more striking, especially when we recall the probable higher average age of the policy-holders, in connection with the fact that these diseases are far more frequent in later life.

DEATHS IN 1905 DUE TO NON-INFECTIOUS DISEASES

	Policy-holders	Athletes
Heart-diseases	6	16
Kidney "	6	10

In short, athletes are, according to these figures, two and one-half times as liable to cardiac diseases, sixty per cent. more liable to diseases of the kidney, and twenty-five per cent. more liable to die of the three main infectious diseases of adult life—pneumonia, consumption, and typhoid—than the average of their fellows. Instead of increasing their power of resistance to disease, their boasted training has apparently reduced it.

It may be justly objected that this conclusion does not necessarily follow, because this list includes a considerable percentage of professional athletes, who are often of low physical type, and bad life-risks to begin with. But a list of certain champion college athletes for fifty years, 761 in number, prepared in defence of athletics, shows that tuberculosis was the highest cause of death, with pneumonia second. While only seven per cent. of the deaths among the policy-holders were from accidents and injuries, sixty-one per cent. of the athletes died from these causes—an enormous preponderance, even after allowing liberally for the

greater probability of public report of deaths due to accidental causes over those due to natural causes. Furthermore, Dr. Coughlin finds, what my own investigations had also led me to believe, that "the average age at death of athletes is far below that of the average person in the ordinary walks of life." The actual average age at death of this series was only 26.2 years, as against an average of 57.2 years in all persons dying after fifteen years of age, according to the last United States census. These figures will be supported by the experience of a majority of intelligent college physicians. I might, perhaps, be permitted to say, to forestall any criticisms based upon a supposed "book-knowledge" only of these matters, that for two years during my medical-student days I was one of the executive committee of the University Athletic Association and a member of the football team; for three years medical director of a gymnasium, and for eighteen years connected with the faculties of colleges and universities in the Middle West, the East, in England, and on the Pacific coast, with students under my professional care almost constantly.

In my judgment, the champion athlete, so far from being an ideal type, a standard to aim at, is rather a necessary evil, apparently inseparable from the competitive system of athletics now in vogue. To reduce his "bad eminence," to distribute the benefits of training over a larger number is the principal aim of the new "coöperative" athletics where groups compete by their averages in place of individuals. This is

not to condemn athletics by any means; only their abuse. The whole trouble lies in false ideals and ignorance of the real aim of bodily training. The real tissues to be developed in athletic training are not the muscles, but the heart and the nervous system. This is clearly recognised and eagerly urged by intelligent, scientific gymnasium trainers, like Sargent of Harvard, Seaver of Yale, and Gulick of New York; but their leaven has reached but little of the mass of undergraduates and members of athletic clubs as yet.

The heaviest strain of exercise is thrown not on the muscles, but on the heart and blood-vessels. This has always been recognised by the profession and admitted by the more intelligent trainers. In an athlete under training, the heart is markedly increased not merely in vigour, but even in size—hypertrophied, as we call it. A certain amount of this hypertrophy is healthful and normal; a deer, for instance, has more than twice as large a heart in proportion to its body weight as a cow, and a race-horse nearly twenty-five per cent. larger than a dray-horse, proportionally. But we are finding out, first, that this hypertrophy may be easily driven beyond normal limits, and that the large heart of the athlete often contains inflammatory exudate—is swollen from congestion, to put it roughly. Second, that this large heart, whether normal or diseased, after the contest is over and training is relaxed, begins to shrink again. This shrinking is brought about by a fatty degeneration and absorption of both the inflammatory exudate and the surplus

muscle-fibres, and if it goes a step too far, may become one of our most insidious and dangerous cardiac diseases—fatty degeneration of the heart. Whatever the mechanism of its production, all authorities are agreed that heart-disease is peculiarly common among athletes, soldiers, lumber-jacks, miners, and men whose occupations involve severe muscular effort. The entire system of blood-vessels shares in this liability, and arteriosclerosis is unusually prevalent among these classes. Let the heart, then, be carefully watched in training, and at the least permanent quickening of the pulse, the slightest cardiac nervousness, the first appreciable outward swing of the apex beat, showing hypertrophy, let the amount of exercise be cut down.

The next organ to be trained is the stomach. Naturally the more work our body-engine does, the more fuel must be shovelled under its boilers. Many athletes in training "go stale," lose their appetite, begin to sleep badly, get cross, nervous, hysterical. These again are danger-signals, and call for cutting down the exercise ration. You can't get ten horse-power work out of a five horse-power furnace and boiler. (A man's capacity for development is limited by his stomach.)

Last but not least, training should be aimed at the nervous system. It is astonishing how long we have ignored this, when, as a matter of fact, fully one-third if not one-half even of pure athletic training is training of the nervous system. The mere increase in strength of a particular muscle is the smallest part.

It is the rapid, accurate, purposeful combination of a dozen muscles with the eye, the ear, the sense of touch and resistance, that forms two-thirds of training. And this is done solely through the nervous system.

The man who trains his muscles, trains and builds his brain. Indeed, this is the only physical method of brain-building that we know of. Of course he can't build up what isn't there, and all we can do is to develop to the highest possibilities such potentialities of cerebral power as we were born with. Even the champion athlete has probably a better brain for his training than he would have had without it. Most of us, however, have sufficient possibilities to profitably occupy all our pre-adult life in developing them.

This brings us to the final consideration, that it is quality of muscular effort that counts rather than quantity. So long as muscular effort is strengthening the heart and developing the nervous system and increasing the appetite, it is doing good; beyond this it is physiologically valueless, often harmful, however great economic or sporting value it may have.

It is not difficult to determine where the dividing line falls. In fact, we have an instinct for the purpose. So long as exercise gives us pleasure, exhilaration, it is doing us good. When we cease to enjoy it, it is either neutral or harmful physically. The athlete will, and the day-labourer must, persist far beyond this line—and die early in consequence. A reasonable amount of non-enjoyable exercise is, of course, perfectly consistent with health, but of no advantage to it.

All men in vigorous health enjoy exercise in some

form; and most labourers, within certain limits, enjoy their work, taking a pleasure and a pride in it. Whether it be the exhilaration of the four-mile-an-hour swing, up hill and down dale; the dash and smash of the tennis-court; the clatter and whistle of the broadswords; the swing and bite of the axe; the swish of the scythe, the crunch of the spade under the foot, the heave and swing of the pitchfork—there is a positive pleasure in vigorous exertion. In fact, in the last analysis, pleasure consists in responding to stimuli, doing things, easily, with a sense of reserve force, of power to spare. In other words, physically profitable exercise must partake of the nature of play. Nature nowhere shows a subtler wisdom than in the play instinct. The baby, like the fabled bear-cub, is born a shapeless lump mentally and played into shape.

There is no conflict whatever between bodily training and mental. They are part of one single scheme of development. Keep children growing physically, and answer their questions, and their minds will take care of themselves. The chief duty of the schoolroom is to keep out of the way of Nature's University, the open air.

In fine, development to be healthful must be symmetrical. You cannot profitably develop the body apart from the mind, or the mind apart from the body, or either apart from "the sense in us for conduct, the sense in us for beauty." The training which will develop the most vigorous, the most highly resisting physique, will also develop the clearest mind and the most beautiful body. Yes, and the highest

sense of courtesy and chivalry. Bring to mind the Greeks and the Knights of the Round Table.

One of the chief requisites for the ideal athlete is to be a gentleman. By training like a gentleman, and treating his opponent as a gentleman, the athlete will avoid all the physical dangers and reap all the possible benefits of athletics. Practised properly, athletics is one of the finest schools of courage, of clean living, of high courtesy and chivalry; of clear thinking, of beauty and symmetry of both mind and body.

CHAPTER V

SLEEP AND ITS SIGNIFICANCE

"Blest be the man who first invented sleep,
But cursed be he with curses loud and deep,
Who first invented and went round advising
That artificial cut-off, early rising."

—*Saxe.*

SLEEP, after thirty centuries of study and thirty thousand of experience, is still a mystery. We know all about it, but nothing of it. The results of our most laborious researches, our most painstaking studies, are mainly negative.

One great positive fact, however, emerges from the negations of all theories: sleep is not a *negative* process, but a *positive* one, not a mere cessation of activity, but a substitution of constructive bodily activity for destructive. The "anabolic" or up-building processes are in excess of the "katabolic" or down-breaking processes during sleep. During the working hours the balance is reversed. Sleep is a recharging of the body-battery.

It is the positive, constructive character of sleep which explains why babies at the period of their most rapid growth and development sleep from sixteen to eighteen hours out of the twenty-four, a capacity which steadily diminishes until adult life is reached,

when it becomes constant, in the neighbourhood of nine hours. At the other end of the scale of life, the well-known light sleeping and early awaking, characteristic of old age, is due to a loss of this reconstructive power. It is not that an old man does not need so much sleep as the child or adult, but that he can't get it—has lost, to a degree, the capacity, and the reconstructive processes involved in it. The dozings and drowsings of old people during the day are mild torpors from exhaustion, not true sleep—forerunners of the final ending of consciousness.

It is the positive reconstructive quality which accounts for the differences in the quality of sleep which we have all experienced. A nap of an hour when conditions are favourable will often rest and refresh us as much as a whole night's restless, dream-ridden slumber at other times. It is also the basis of the well-known ability of vigorous, healthy men to get along with exceedingly small amounts of sleep. Some exceptional individuals have been able to do immense amounts of work with only four hours' sleep out of the twenty-four, and keep this up for years without apparent harm.

So generally has this positive factor been overlooked in popular literature that it has given rise to a whole series of misleading analogies. Confusion has been allowed to creep into popular and even scientific literature between the drowsiness and coma of fever, and other morbid conditions, and true sleep. These conditions are abnormal, as a rule injurious, and in no sense tend to reconstruction. A typhoid-fever patient

who has apparently slept two-thirds of the time for two weeks will wake up with a loss of twenty or thirty pounds' weight, weak as a kitten, emaciated, wretched. The vast majority of these drowsy, so-called sleepy, comatose conditions—the unconsciousness of fever, of exhaustion, etc.—are totally different from and in opposition to true sleep.

The most dangerous of all counterfeits of sleep are induced by drugs. It goes without saying that there is no drug that can produce sleep any more than growth, appetite or strength. There are many which produce a state of unconsciousness resembling sleep, and some of these are unfortunately much resorted to for this purpose. Though permissible in skilled hands their habitual use is dangerous, both because they are all poisons—weak ones, it is true, but true poisons, and because they smother the symptom, suppress a danger signal, without doing anything to relieve the diseased condition which caused it. The man who cannot sleep is sick, and should reform his habits.

"How much sleep shall I take in the twenty-four hours?" This can be answered unhesitatingly in five words, "As much as you can." Here no competent authority would question the absolute safety of instinct as a guide. As the period of sleep represents the time necessary to restore the oxygen balance of the tissues, to recharge the battery, then obviously it must last until that process has been completed, as attested by the familiar sense of "restedness" and refreshment. "Go to sleep when you're tired, get up

when you wake feeling rested," contains the philosophy of the whole problem.

Obviously no hard and fast rule as to the number of hours required can be laid down. Just as individuals differ in the colour of their hair and eyes, the vigour of their appetites, their tendency to be fat, or lean, so they differ in the rapidity of their recuperation during sleep. As has been already mentioned, a few vigorous, energetic individuals seem able to recuperate with such rapidity that as little as four hours' sleep suffices them. To mention a few notable instances, Frederick the Great, Napoleon, and his conqueror the Duke of Wellington, John Wesley, and in recent years, Edison, the inventor, were able to refresh themselves completely within this time. On the other hand, anemic and nervous individuals may recuperate with such extreme slowness that they require ten, twelve, or thirteen hours of sleep properly to redress the balance.

At a rough working average it may be stated that the majority of vigorous adults require an average of about nine hours. Women require from half an hour to an hour more than men of their age. Any attempt to shorten this necessary period, whatever it may be, which can readily be ascertained by each individual for himself by a brief period of intelligent experimentation, is not only irrational but suicidal.

As a matter of fact, the average amount of sleep taken by most individuals is in the neighbourhood of nine hours. The proverbs are, as usual, at sea, and have about the usual amount of influence over actual

practice. "Seven hours for a man, eight for a woman, and nine for a fool," has been their dictum for centuries, but the average human being cheerfully plunks himself into the "fool" class, much to his benefit. I believe that the usual eight-hour average laid down in the text-books errs on the side of brevity, and the majority of men in active work take more than this or else suffer for it. The average labouring man goes to bed at between 8.30 and 9.30, or if he does not, often falls asleep in his chair about 7.30 or 8.00 and sleeps until 6.00. The average business or professional man goes to bed about 10.00 and rises about 7.00. Each class getting on an average nine and ten hours respectively. How the superstition ever grew up that there is such a thing as weakening yourself by oversleeping I cannot imagine. Whatever may have been the source of the delusion it is utterly without basis in physiology. No one ever got too much healthy, natural sleep, or injured himself physically by staying in bed until he felt rested. It must, of course, be remembered that sleep in stuffy, ill-ventilated rooms may never produce this sense of being rested, no matter how long it is prolonged. But, again, it is not the length of sleep, but the quality which is at fault. More than this, a great majority of men and all women would be benefited by a nap of from twenty minutes to an hour after the midday meal. In the case of women, who are able to control their time, this should be insisted upon as a daily rule. Many men are unfortunately so situated that for business reasons this rest cannot be obtained, but

they should make an effort to obtain it even if they do not fall asleep in the time.

This average of nine hours, of course, applies only to adults. For children it is impossible to lay down any fixed rule whatever. In the earliest days of infancy, fifteen to eighteen hours are required for the recuperative process. So astoundingly somnolent are young babies that I was once consulted by an anxious father, who expressed great uneasiness lest his baby's brain should not develop properly because it slept so much of the time. Needless to say it was his first. From this the period gradually falls until by the third year it has reached the neighbourhood of twelve hours, and by the fifth year, ten. But these again are to be taken only as the crudest of averages, as individual children differ enormously, according to their vigour, rate of growth, time of year, etc. A baby or young child should have *absolutely every minute of sleep that it can be induced to take,* and sleeplessness is even more emphatically a sign of disease in children than in adults. This necessity and capacity for large amounts of refreshing sleep persists up to adult life, and the amount required seldom falls below ten hours before the eighteenth or twentieth year.

To make children or rapidly growing young adults get up before they have had their sleep out and feel thoroughly rested, is not merely irrational but cruel, and when it is done as a routine practice at boarding schools or other institutions by those who pretend to be fitted to have the care of children, it is little short of criminal.

When is this sleep to be taken? For choice, and as a matter of convenience on various grounds, some time within the hours of darkness, just when makes no difference. There is no adequate foundation for the popular belief that the "beauty sleep" is that which is taken before midnight, still less that one hour of sleep before midnight is worth two after. This impression has grown up upon economic and moral grounds connected with the early-rising fetish, and has no basis in physiology except in so far as it is involved in retiring sufficiently early to enable one to secure the requisite sleep-period before the hour of compulsory rising. It has been demonstrated by numerous experiments that the depth of sleep rapidly increases from its beginning to about the beginning of the second hour, then almost as rapidly diminishes until the middle of the third, after which it remains at practically the same level until the hour of waking. Some observers have reported a second increase in the depth of slumber about the second hour before waking, but this does not seem constant. Although as tested by the loudness of the noise required to awaken the sleeper the depth of sleep is greater during the first three hours, it does not appear that the process of recuperation is going on any more rapidly during this part of the sleep period. Indeed all experiments which have been made and practical experience as well indicate that the last two hours of sleep give fully as much recuperation as the first two. It is by no means infrequent that individuals will wake, from various causes, at the end of the sixth or seventh hour,

with a distinct sensation of being unrefreshed, with perhaps a slight headache, which will have completely disappeared after two hours more sleep.

Strange as it seems, there does not appear to be any necessary physiological connection between sleep and the hours of darkness. As a matter of convenience most tribes and races have fallen into the habit of taking their period of rest at night, because the occupations necessary for securing food and a living are more advantageously carried out during the daylight. It is, however, perfectly practicable to reverse this completely, working during the hours of darkness and sleeping during the day for considerable periods of time without any apparent injury. That this habit, if persisted in for months, as in the case of night-watchmen, firemen, railroad men, etc., is apt to cause anæmia and neurasthenia is due to the loss of sunlight involved. Animals, of course, are perfectly indifferent, often habitually turning night into day. Most species simply utilise for sleep such part or parts of the twenty-four hours as are not needed for securing food.

To that most acutely personal question, "How early shall we get up in the morning?" physiology has little to say in answer. If under the stern stress of work-a-day life it is obligatory for any individual to arise at an early hour, all it can advise is to go to bed at such an hour as will enable him to get his nine hours' sleep before that time.

But that there is any advantage in early rising as such there seems little ground for believing. By the way its praises have been sung in proverb and homily

one would think that it was the chief of the virtues, but its claims have little basis in physiology. Its virtues are purely economical, commercial, and its rank among the virtues is a survival from hard-fisted agricultural ancestors, whose work had to be done in daylight. Naturally it became a principle with them to get as much of this as possible. It also appealed to their commercial instinct in another sense, as it was regarded as the highest and most praiseworthy economy to "burn daylight instead of candles." These influences have combined to elevate to a pinnacle of virtue a habit which is merely a money-making one.

One of the principal arguments in its favour, that it is natural to rise with the sun and go to bed with the same, is so absolutely irrelevant that it needs no discussion. We have neither the endurance of that distinguished traveller, nor is his appearance in any way the signal for the beginning of our activities or his disappearance for their close. Nor can the "good example" of animals and birds be quoted with any reason. Many of them don't set it at all, but retire with the sunrise. Those that do—are simply where our ancestors were a million years ago. The longest step toward humanisation was the discovery of fire, and consequent ability to sit up late at night and consider things. Civilisation and late hours always go hand in hand.

Nor is there any adequate support for the impression that the early morning hours are in any way more wholesome or healthy than later periods of the day. Except in summer time they are apt to be damp,

foggy, chilly, and among the least desirable hours of daylight. It is quite true that during the summer there is a sense of exhilaration about being abroad in these early morning hours, but this evaporates with the dew and is apt to be succeeded by a corresponding depression and loss of working power later in the day. I have been observing my friends and patients for the past twenty years in this respect, and am inclined to the opinion that not a little of the depression and nervousness which so commonly develop in hot weather is due to excessive exposure to light, from habits of early rising, inherited from agricultural ancestors, not counteracted by three to four hours' rest in darkened rooms in the middle of the day.

Secondly, that the exhilaration experienced during the early morning hours is an expensive luxury, which has to be paid for later in the day. In fact, I have found that as a general rule, to put it very roughly, the business or professional man who rises an hour before half-past seven or eight, goes to bed, or loses his working power, an hour and a half earlier in the evening. Each individual has in the beginning of his day about so much working power stored up in his brain and muscle cells. If he uses this up with great rapidity in the early morning hours he naturally exhausts his stock the sooner in the afternoon or evening.

It is largely a matter of when a man wishes to be at his best. If his occupation is of such a character that he can clear off the brunt of his work in the early morning hours, then let him rise early. If on the

other hand he requires full vigour and readiness of mind and body in the latter part of the day or at night, then he must rise later to get it. Even in pure muscle-work it is false economy to work too long hours. The eight-hour-a-day factory-hand invariably turns out more work and of a better quality than the twelve-hour-a-day man. Much more so in intellectual work. A few hours at high tension and pitch accomplish more than a day's "slogging." It need, of course, hardly be pointed out that the stage of intellectual development of any community is in direct ratio to the lateness of the hours it keeps. All the activities, social, literary, convivial, philosophic, that bring out what is best in man are at their highest tide after eight in the evening.

As we know of no drug or procedure which can produce sleep, it is obviously absurd to expect any "sure cure" for sleeplessness. This is invariably a sign of disturbance of balance or of incipient disease, and should be treated only by careful investigation and removal of its cause, when found. And there will be nearly as many causes as there are sufferers. We cannot even say what particular bad physical habit is most frequently to blame. So that the number of "good things to do for sleeplessness" which have any wide application is very limited.

The one procedure which most universally disposes to sound sleep is one which is within the reach of all, and that is getting well tired. To work hard enough every day to get comfortably tired, particularly muscularly, is the best cure for insomnia. Excessive

fatigue may, of course, produce it. Sleep is not solely or even chiefly a matter of the brain, but of all the active tissues of the body and especially the muscles. We must be symmetrically fatigued or, as we say, "tired all over" in order to sleep well. While there are many exceptions, labouring men and all those engaged in active out-door occupations usually sleep well. Most of our "insomniacs" are men and women of sedentary habits. In fact I have been sometimes inclined to suspect that sleep is even more a matter of the muscles than of the brain. Certainly the soundness of sleep of many professional and business men is directly related to the amount of muscular exercise in the open air which they have taken during the day. A brisk daily walk of from two to four miles is the most universally effective hypnotic. But even this rule has many exceptions.

Diet has little influence on sleep, except in so far as it may produce disturbances of digestion and through these of the general balance of health. The hypnotic effects of certain foods, such as onions, lettuce, milk, etc., are chiefly imaginary. Even the time of the last meal of the day is of relatively little importance, except that it is well to let this be at least two or three hours before retiring. But even this rule has many exceptions, as many healthy labouring men habitually fall asleep over their pipes directly after supper, and children, after poking the spoon into their little eyes, nod off over the tea-table with the bread and butter still clutched in their chubby fists.

The processes of digestion probably go on more

slowly during sleep, but they are perfectly carried out, as is illustrated by the almost invariable habit among animals of going to sleep directly after a meal.

Indeed a moderate amount of food in the stomach or intestines seems to promote slumber. Many night-workers, for instance, sleep much better for taking a light or even full supper just before retiring.

It goes without saying that the bedroom should be well ventilated, especially in view of the heavy storing up of oxygen in the tissues which goes on during sleep. All windows should be open from the top at least one, and better two to three feet, so that a gentle current of air can be felt blowing across the face. "Night air," as Florence Nightingale pithily remarked, "is all the air there is to breathe at night." It is just as pure and as wholesome as day air. Night fogs and rain are only injurious in so far as they frighten you into shutting your windows. No air that ever blew out doors is so dangerous or poisonous as that inside a bedroom with closed windows.

The temperature of the room should be about 55° to 60° F., if possible. If markedly below this the amount of covering required is apt to become so great as to interfere with the respiration of the skin. The clothing should be as light as is consistent with warmth, the mattress elastic but firm, the pillow as high as the breadth of the shoulder, so as to keep the neck and head horizontal or slightly above when lying on the side. The good, hard common sense of humanity has solved all these problems, and the modern hair-mattress or its equivalent, single pillow

and blankets, or cheese-cloth-covered "comfort," which can be cleaned and aerated by turning the hose on it, can hardly be much improved on. Beyond these there is no virtue whatever in hard beds, flat or no pillows, and cold bedrooms. Just another instance of the deification of the disagreeable. The boggy feather bed, collector of the perspirations and diseases of successive generations, the bolster, the eider-down quilt, the hard sail-cloth-like counterpane, both air-tight and the latter heavy as a board, have gone to the attic or the ash heap, where they belong, along with the four-poster and its curtains, the night cap and the warming pan—relics all of a barbarism which was either too stupid or too stingy to warm its bedrooms. The colder the bedroom in winter, the less the windows are opened and the fouler the air.

As to dreams, the less said the better, partly because we know so precious little about them, and partly because they are no part of normal sleep. It would also take a great many words to explain how little we know about them. All we can say of them is that they appear to be due, to put it crudely, to different areas of the brain or tissues and parts of the body, varying in the degree of their fatigue and consequently soundness of their sleep. Either those functions or regions of the brain and body which have not been sufficiently exercised during the day, or on the other hand those which have been overtaxed and unduly fatigued, may "stay awake" and make vague impressions on our consciousness. So far as dreams can be said to follow any law

whatever, they seem inclined to be often either continuous or revulsive, "like" or "contrary." Either weird and improbable continuations of our thoughts and occupations during the day, or more often wild rebounds into opposite or widely different fields. The merchant dreams of going to war, the miser of making love, the professor of making money, the gilded youth of thinking. Thus there is a faint physiologic basis for the belief that dreams "go by contraries." They certainly "go" or "come true" by that rule as often as by any other.

The troubled or horrid dreams which occur during sickness are probably due to the torturing of the brain-areas, in which the images conjured up are stored by the toxins with which the blood is loaded. Similarly the gruesome visions and nightmares which embitter the slumbers of those under the stress of violent emotions and mental suffering are due to similar action by the fatigue-poisons produced by these states. While perfectly normal sleep is dreamless, yet a moderate amount of dreaming, especially if the images evoked are of a pleasing or indifferent character, is quite compatible with good and refreshing slumber. The sleep which is accompanied by "good" dreams is usually restful, as is illustrated by the universal good-night wish of "Sweet dreams." The sleep attended by "bad" dreams is apt to be disturbed and unrefreshing, which simply means that mild and harmless stimulations of the brain-areas during sleep produce pleasing images, while stronger stimulations or injurious irritation by toxins evoke distressing or

painful images. A well-known illustration of the latter fact is the notorious connection between "gobberlins with glass-green eyes" and cold mince-pie for supper.

Persistent or frequent bad dreams are, like insomnia, a sign of ill-health, and should be regarded and treated as such.

One thing more can fairly safely be said about average or healthy dreams, and that is that they are largely due to the condition of the skin, whether external or internal. Our alimentary canal or food tube is, of course, only a long roll of the skin, tucked into the interior of the body for digestive purposes, our brain and spinal-cord another and solider fold, sunk in for telegraphic uses.

Slight changes in or irritations of the surface of the body or the lining of the alimentary canal are probably the starting points of most of our milder dreams. This faint impulse wakes up either the brain-area, with which it is directly connected, or the one which happens to be most nearly awake, and we are off.

Some of our common dreams seem to be directly traceable. Slipping down of the blankets is followed by dreams of Arctic relief expeditions or falling into snowdrifts. A gas-distended stomach, pushing up the diaphragm and compressing the lungs, produces dreams of "something sitting on your chest" or dramatic struggles against other forms of suffocation.

The common single dream, that of falling, falling, falling from a great height, to wake with a gasp of

relief just as you are about to strike and be dashed to pieces, is probably due to the general muscular relaxation and falling of the head, arms, and limbs which accompanies settling down to sleep. Careful studies have shown that it almost invariably occurs during the first forty-five seconds of sleep. A slip or change of position of a sixteenth of an inch is enough to suggest the idea of falling to the brain. It "does the rest," and provides out of its swarming storehouse of images the precipices, flights of stairs, giddy mastheads, and other scenic effects. If the impression is not vivid enough to wake you, you "strike bottom" with a delicious sensation of restful warmth and repose, just such as your tired body is getting from its "downy couch."

The next common dream, which we have all had scores of times, which, as Dickens quaintly said, he was sure even Queen Victoria, with all her royal wardrobes full of clothes, must have also had, that of suddenly finding yourself in public half-dressed, seems almost equally traceable.

The dream, and we can all recall its mortifying vividness, is usually associated with insufficient or displaced bedclothes. This gives our drowsy brain-cortex the idea that we haven't sufficient clothes on. Our arms and shoulders being completely covered by the close-fitting upper half of the nightgown, the impression of unprotectedness comes most vividly from our unencased lower limbs, and the hint is enough. Our well-trained modesty takes furious fright and *hinc illæ lacrimæ,* "hence these weeps."

We don't know much about dreams, but we know enough to feel fairly sure that they have no relation to anything in the heavens above or in the earth beneath, which is more than a hand's-breadth outside of the sleeper's skin.

Any beliefs or deductions based upon their assumed relation to things outside of this area are, from a biologic point of view, the purest and pearliest of moonshine.

CHAPTER VI

THE MYSTERIES AND THE CURIOSITIES OF SLEEP

THE first and chiefest curiosity of sleep is sleep itself. All theories and explanations of it, however carefully worded, have proved inadequate. We do not even know what we at one time thought we did about it. Experts are frankly in the Socratic attitude, "I know nothing except that I know nothing. Others do not even know that."

We are still in the dark as to why we sleep, the mechanism of the process, and why we wake. After centuries of study, all we can say is that we sleep when and because we are tired, and wake when we are rested. "Others," as Socrates gently hints, have not been so modest. Poets have apostrophised it as akin to death, when it is intensely alive; ascetics have denounced it as one of the lusts of the flesh; moralists have bewailed it as a sinful waste of God-given hours which might be spent in prayer; the village wiseacre and that interesting type of *idiot-savant,* the money-getter, have made proverbs advising its curtailment. But fortunately, little as we know, it is enough for practical purposes. Nature has taken care of that. Poets, moralists, scientists, ascetics, alike find themselves at the end of their speculations utterly in the dark; and being in the dark and tired, they do the

instinctive, the right, thing—and go to sleep. So end all our puzzlings.

Fortunately, its mysteriousness is only equalled by its beneficence; it is one of the few things that never do harm. Sleep and fresh air few ever get too much of.

The denunciation of the sluggard who cries, "A little more sleep, a little more slumber," is simply an unusually choice bit among those gems of senility known as proverbs. The sluggard is really far wiser than the ant, as any competent entomologist will tell you.

As a rule, to gloat over mysteries is not a particularly profitable occupation. That way superstition lies. But in this instance it is wholesome. It makes us wisely shy of interfering with the process and nature's superb system of automatic regulation thereof. Had it been proven, for instance, that according to a former physiological theory sleep was due to accumulation of waste products in the brain-tissues, some scientist would almost certainly have devised a process of washing these out with normal saline solution, and thus avoid this disgraceful wasting of eight hours out of the twenty-four. This theory was found inadequate years ago, but there is nothing invidious about its collapse, for every other which has yet been suggested is in similar case. Take, for instance, the long and widely accepted view which even to-day stands highest in the estimation of physiologists as most nearly approaching an explanation of the phenomenon, that sleep is due to cerebral anæmia or a lowered

supply of blood to the brain. That the amount of blood in the brain is distinctly diminished during sleep, is abundantly proven both by observations upon the brains of animals through trephine openings made for the purpose, and upon human brains exposed by fractures of the skull, or openings made for the purpose of removing tumours. A less gruesome illustration is afforded by the slight sinking in of the fontanelle, or "soft spot" on the top of a baby's head, during sleep. Drowsiness and loss of consciousness may also be produced by pressure upon the carotid arteries supplying the brain.

We also know that part of the blood withdrawn from the brain goes to the skin, causing the characteristic rosy flush, and part to the muscles, causing slight but appreciable enlargement of the arms, limbs, hands, and feet. This is why our shoes and gloves sometimes feel tight for us when dressing. This rush of blood to the skin accounts for that most annoying aggravation of itching or painful sensations in diseases of the skin which so often occurs at bedtime. As one of our leading dermatologists whimsically puts it, "The skin wakes up as the brain goes to sleep." But this fact is far from forming an explanation, since it simply raises the questions:

What is the cause of the anæmia? How is it brought about before falling asleep, and how overcome before waking?

Moreover, it is an open question whether this anæmia is not simply a sign of lessened activity on the part of the brain, an effect, instead of a cause of sleep.

Other tissues of the body and glands get the blood-supply they need for active operations by calling for it, so to speak, and not by waiting passively to be fed. The blood vessels were made for the brain, not the brain for the blood vessels. These observations have, however, completely disproved an earlier theory, that sleep was due to engorgement of the brain with blood, or cerebral plethora, a condition supposed to be proven by the flushed face of many sleepers, so that it has performed valuable negative service.

Still less satisfactory is the theory of Preyer, that sleep is due to the accumulation of waste products, chiefly of acid reaction (lactic and sarcolactic acid), which depresses the activity of the brain cells until unconsciousness supervenes. As Foster pithily remarks, "If this be true, what security have we of ever waking again?" While it is true that the injection of lactic acid and lactates into the blood produces symptoms of fatigue and finally unconsciousness, this is as far as the poles from true refreshing sleep; and many diseased conditions produce enormous accumulations of waste products in the blood without producing sleep—often, on the contrary, acute sleeplessness. The accumulation of fatigue poisons in the blood unquestionably predisposes to sleep, but can hardly be said to cause or produce it.

The most modern and up-to-date theory of sleep is the *neuron* one of Duval and Cajal. This is based upon the interesting fact which Cajal was largely instrumental in demonstrating, that the nervous system, instead of being one continuous tissue, is made

up of a series of distinct and separate cells, whose means of communication is by "touching fingers" with the tips of their delicate, twig-like processes (arborisations, dendrites), and that these "fingers" have the power of movement, can retract and thus break the connection or circuit. When the cells of the brain become fatigued, they are supposed to draw in these processes. This shuts off messages from the sense organs, and unconsciousness, or sleep, results. When rested, they yawn and stretch out their arms, so to speak, communication is again restored, and we wake up.

Unfortunately, the numerous attempts to demonstrate this retraction of the dendrites by examination of the brains of animals killed instantaneously during sleep have not carried conviction to the majority of observers, though a similar process is generally regarded as proved, to take place in the deep sleep induced by chloroform and other narcotics. And of course, even granting this mechanism of sleep, it advances our knowledge but little to prove that the brain cells curl up and go to sleep, in place of the identical procedure on the part of the whole body, which can be demonstrated in any kitten.

Then there is Pflüge's attractive theory that the brain cells during the day use up oxygen more rapidly than it can be supplied to them from the lungs via the blood; and when this oxygen starvation reaches a certain degree, the cells sink below the level of activity necessary to consciousness. During sleep expenditure falls below the intake, and thus the balance necessary

to consciousness is restored. This, like the cerebral anæmia theory, has a solid basis in fact, viz., that of the total intake and outgo of oxygen during the twenty-four hours, only about forty per cent. is taken in while sixty per cent. is given off—in the form of carbon dioxid—during the twelve hours of daylight; and, on the contrary, during the twelve hours of the night, nearly sixty per cent. of the total oxygen is taken in and only about forty per cent. given off. In other words, the body during the day spends or gives off from twenty to forty per cent. more oxygen than it takes in; during the night it takes in twenty to forty per cent. more than it gives off. Thus balmy sleep is literally "tired nature's sweet restorer" of the oxygen balance. Good poetry is often very close to good science. In support of this view may be cited the well-known drowsiness, deepening into unconsciousness, which comes on in atmospheres overcharged with carbon dioxid, ranging all the way from that of a stuffy room to the "choke damp" of the coal mines or the "foul air" at the bottom of a well. But it can equally be seen that these states are not true sleep, but slow poisonings, narcoses, tending not to refreshment and awakening, but to increasing sluggishness, and finally death.

This, in fact, brings us to the crux of the entire problem, the one great positive fact which emerges from the negatives of all these theories, and to develop which alone was the purpose of their discussion here; that sleep is not a negative process, but a positive one, not a mere cessation of activity, but a substi-

tution of constructive bodily activity for destructive ones. The anabolic or upbuilding processes are in excess of the katabolic or downbreaking processes during sleep. During the waking hours the balance is reversed. It is not sleep that leads to death, but waking. Men have been known to sleep for weeks and even months at a stretch with but little injury. Persistent wakefulness kills in from five to ten days. It is credibly reported, that with Oriental refinement of cruelty, death by sleeplessness is one of the methods of execution for certain higher class criminals in China. The wretched victim is forcibly prevented from going to sleep until death from exhaustion closes the scene, which is said to be seldom later than the fifth or sixth day.

It should of course be explained that absolute sleeplessness is a very different thing from the *insomnia* of our nervous patients who "don't sleep a wink all night," which usually means that they were awake from three to five times during the hours of darkness.

One of the most unexplainable mysteries of sleep which confronts us, as soon as we extend our study beyond the human species, is that we are utterly in the dark as to the stage in the development of life at which the habit of true sleep begins. Surprising as it may seem, we have no adequate proof of the existence of the habit of periodic daily sleep in any animal below the warm-blooded mammals and birds. In fact, it would almost appear to be an accomplishment of these two higher classes alone. Here again, we cannot speak positively, inasmuch as the greatest

practical difficulty in determining the occurrence and hours of sleep in cold-blooded animals like fishes, snakes, tortoises, etc., is that they possess either no eyelids at all, or none that are movable; and hence the readiest superficial sign or proof of sleep, that of the eyes being shut, cannot be elicited in them. (Fishes have no eyelids at all, snakes and reptiles have eyelids, but they are fused together, and have become transparent, forming an additional "glass" or protection to the eye.)

Fishes in aquaria have been studied by scores of different observers, and while they unquestionably drop into conditions of apparent lethargy, and remain utterly motionless for hours or even days at a stretch, these states do not seem to be definitely periodic, or associated with any particular hour of the day, and they will apparently avoid danger, or move toward food if hungry, as promptly in this condition as when apparently awake. Many fishes, of course, and nearly all reptiles fall into that curious sleep-like condition known as "hibernation" at some period during the year. But this, as we shall later see, is in no way akin to true sleep. Many fishermen, both deep-sea and fresh-water, firmly believe that fishes, especially in sunny weather, come up to the surface of the water and fall asleep, and that in this condition they can be more readily approached. But the question is still an open one, and one which careful investigation, in conditions where fishes are under observation day and night for a considerable period, as in aquaria, has yet to settle.

If we could venture any suggestions as to the real nature of sleep in warm-blooded animals, it would be the broad one, that the degree of activity and height of temperature which marks their waking hours is something new and in a sense abnormal in the animal kingdom, and hence can only be maintained for from half to two-thirds of the twenty-four hours, resulting in such exhaustion and accumulation of waste products in the tissues as would require a sinking down into a state resembling the old primeval lethargy of their cold-blooded and invertebrate ancestors, in order to permit the upbuilding processes of life to catch up with the downbreaking ones.

Another of the curiosities of sleep is the singular difference in its quality in different individuals. Some fortunate men are able to get as much rest out of four or six hours' sleep as the average man does out of eight or nine; just as some men will get enormously fat on a slender diet, while others with a huge appetite and intake are walking skeletons. This fortunate power of rapid recuperation may almost be said to be one of the characteristics of greatness. At all events it has occurred with sufficient frequency in great and successful men to have done great harm among average individuals. By one of those ludicrously infantile processes of human logic, which make us smile gently when we hear man described as a rational being, many of our self-constituted guides to success have assured the young idea that this man became great simply because, by dint of his determination to work eighteen or twenty hours out of the

twenty-four, therefore: "Go thou and do likewise, and like success shall be thine." The hugeness of the *non sequitur* is obvious, but this is far from being the only instance. Men of huge muscles, who happen to be born "brothers to the ox," write books and publish journals telling the average youth how to get strong by imitating their little peculiarities and bad habits. Doddering old centenarians who happened to be born with the smouldering vitality (and usually the brilliant intellect) of the mud-turtle, prate fatuously of the onions and sour milk, frugal diet, moral habits or regular hours which they allege have brought them to this enviable degree of profitless persistence upon the planet. As well might the elephant endeavour to explain the secret of how to weigh three tons, or the boa constrictor write a pamphlet on how to grow forty feet long.

Of course the majority of great men require as much sleep as the average individual, and many of them more. Some of the greatest, so far from taking three or four hours' sleep a day, have been able to work only two or three hours out of the twenty-four. Two successive hours of work was often a day's work for Darwin, four for Spencer, and three hours a week at times for Descartes. The last, like the famous Dr. Johnson, was a notorious lie-abed, often not rising till two or three in the afternoon; and his untimely death at fifty-four was attributed by his friends to his being compelled to rise at five in the morning, by the enthusiasm of his royal pupil, Queen Christina, who chose this hour for her lesson. But enough of them

have had this singular quality of getting as much rest in four or five hours as other men do in eight, to enable the moralist and proverb-maker to find texts for sermons with their usual intelligence.

Another curiosity of sleep is the many misleading analogies which have been drawn between it and other states. First among them is the beautiful poetic comparison which has almost become an article of faith, embodied in the phrase, "Sleep and his brother, Death;" and, "We are such stuff as dreams are made of, and our little life is rounded with a sleep." From a physiological point of view, sleep and death are as far apart as the poles. The only similarity between them is that they are both accompanied by unconsciousness. The one is a positive, reconstructive, intensely vital process, self-limited and tending inevitably to an awakening. The other is negative, destructive, utterly lifeless, tending to dissolution and decay, with no possibility of any physical awakening. The analogy is such a beautiful and soothing one, that one regrets to lay sacrilegious hands upon it; but it is unfortunately without physiological basis. I am, of course, not in any way discussing the possibility of a spiritual awakening, that lies in another province altogether.

Nor is there any similarity between the drowsy, sleepy, comatose conditions of fevers and fatal illnesses. They are all narcoses, or poisonings of the brain, by toxins, either of germ origin, or manufactured by the abnormal processes of the body tissues themselves. They are not self-limited, but end only

when the tissues of the body have succeeded in producing a sufficient amount of antitoxin to neutralise the poisons which cause them. If the body fails to do this, they deepen to coma, and finally death.

This opposition between death and sleep does not, however, destroy one consoling analogy which has been drawn between them, and that is they are both painless, and cause neither fear nor anxiety by their approach. It is one of the most merciful things in nature that the overwhelming majority of the poisons which destroy life, whether they be those of infectious diseases or those which are elaborated from its own waste products, act as narcotics and abolish consciousness long before the end comes. While death is not in any sense analogous to sleep, it resembles it to the extent that it is in the vast majority of instances not only not painful, but welcome. Pain-racked and fever-scorched patients long for death as the wearied toiler longs for sleep. The fear of death which has been so enormously exploited in dramatic literature, sacred and otherwise, is almost without existence in sickness. Most of our patients have lost it completely by the time they become seriously ill.

"While many of the processes which lead to death are painful, death itself is painless, natural, like the fading of a flower or the falling of a leaf. Our dear ones drift out on the ebbing tide of life without fear, without pain, without regret, save for those they leave behind. When death comes close enough so that we can see the eyes behind the mask, his face becomes as welcome as that of his 'twin brother,' sleep."[1]

[1] "The Gospel according to Darwin."

Nor is there a much better basis for the generally accepted analogy between true sleep and that curious "winter sleep," known as hibernation. The subject of hibernation is such an enormous one, and there is such a lack of definite information—and consequent difference of opinion—as to its true character, that only the merest outline of the drift of scientific opinion in regard to it can be given here. To put it very crudely, it appears to be a dropping from the animal almost to the vegetable stage of vitality. Every vital process is reduced to the lowest ebb consistent with its continuance. All voluntary muscular movements, of course, cease absolutely, the eyes are closed, the animal, which has usually retired to some sheltered and protected spot, becomes unconscious, the respirations become so shallow that the closest observation fails to detect them. The temperature of warm-blooded hibernators falls toward the cold-blooded level. The heart is slowed down to the lowest possible rate and vigour consistent with life. Even the muscles of the alimentary canal cease to contract rythmically, its glands cease to secrete, and its terminal opening becomes closed with a plug of dried mucus. Later observations seem to indicate that by cutting off the intake of oxygen, carbon dioxid accumulates in the blood and tissues until it produces a light permanent narcosis, or anæsthesia, and this condition continues for periods varying from weeks to months, until either change of temperature or the exhaustion of fat or other food material stored up in the body beforehand causes the animal to waken and come

forth in search of food. In the majority of cases, the animal goes into this state just at the close of the season of plenty, with his tissues well loaded with fat, and emerges in the spring thin and gaunt, having presumably supported such low grade of life as existed by consumption of the energy stored up in his fat. It must, however, be admitted that there are a number of exceptions to this rule at both ends, so to speak, some animals going into their winter sleep in very moderate flesh, or even thin, and emerging apparently little changed in the spring; others going to sleep plump and fat, and awakening in apparently the same condition. So that the fat-burning hypothesis, plausible as it sounds, cannot be accepted without reservation.

On the other hand, it is only fair to say that in the last-mentioned instance animals emerging within a few pounds of the same weight which they went to sleep at, lose flesh with great rapidity after resuming their activities, and are ravenously hungry, thus raising the suspicion that the maintenance of weight has been due to an accumulation of water in the tissues in place of the fat, which has been burned up and utilised.

Another interesting fact about this process is that it is not caused by cold, as was at one time universally supposed. This was first brought to our attention by the fact that fishes, amphibia, reptiles, and some of the mammals living in hot climates go into this trance-like condition during the season of heat and drought. In fact, a new word has had to be coined covering

this form of the habit, "estivate" (literally, "summerate") contrasting with hibernate. Secondly, it was found that only a small percentage of animals ever hibernate at all, and they of the class whose food supply is absolutely cut off in the winter, such as squirrels, mice, rats, bears, marmots, etc. These animals, if kept in captivity and supplied with plenty of food, will, after a time, lose the hibernating habit. So that it appears to be literally an economy on the part of nature, a going down to avoid punishment in the form of starvation, whenever an adequate supply of energy through food is cut off. The change is exceedingly widespread through the animal kingdom, being habitual in nearly all terrestrial invertebrates, and in most cold-blooded vertebrates, especially fishes, amphibia, reptiles, and occurring in a number of mammals, but in no birds, the latter for the reason that they can solve the food problem in another way by migration either north or south, as the season demands. In fact, it may almost be said that most land invertebrates, amphibia, reptiles and fishes possess the power of going into this curious carbon-dioxid narcosis at will, if one can imagine these creatures having a will at all. So lethargic are they then, and so completely indifferent to their surroundings, that they may be exposed to extraordinary extremes of heat and cold without apparent injury. They may be dried almost to mumification, frozen or submerged in water for long periods without apparent injury. Even warm-blooded animals, like dormice and woodchucks, when asleep for the winter, may be put under water for

hours at a stretch without apparent injury, so completely is respiration suspended.

Fascinating and mysterious as is the subject of hibernation, enough is known of it to make it perfectly clear that it has nothing in common with true sleep. Instead of the oxygen intake being increased, it is diminished to the lowest possible level; instead of the animal waking refreshed and invigorated, he is weak and emaciated. Instead of being a recuperative process, it is a trial of endurance on the part of the tissues—a test of how long they can possibly last without further supply of energy. Although so widely spread among his ancestry, there is no adequate proof of its occurrence in man. It is one of the "lost arts." What a blessing we would find it in this nerve-racked age if we had only retained it! Some of the trance-like conditions into which individuals fall and lie for days or weeks may possibly involve some trace of the survival of this ancient habit. But the vast majority of these conditions occur in semi-civilised, excitable men or hysterical women, so that there is always a possible question of simulation; and all cases which have been carefully studied by competent observers have been found to be frauds, being surreptitiously supplied with food and drink by their attendants or family. The same is true of the alleged power possessed by Hindu fakirs and ascetics of all ages of going into states of trance in which they will allow themselves to be buried alive and dug up again and revived after several months have elapsed. One instance on record in which an individual of this class

allowed himself to be buried alive and his grave watched by a guard of English soldiers, was dug up at the end of the time exceedingly dead. In another the fakir is said to have been dug up alive at the end of three days. The whole subject is involved in such an atmosphere of mystery and "fakery" (a word most appropriately derived from the title of its devotees themselves) that it is impossible to attach much serious weight to the claims made. Most of the claims, both Occidental and Oriental, to the power of existing for indefinite periods in this trance-like sleep seem to rest simply upon the well-known power possessed by many weak-minded individuals of throwing themselves by auto-suggestion into a hypnotic sleep. In this condition, or awake, life can of course be easily supported for many days or even weeks without food, as has been often illustrated by the prolonged fasts of Succi, Tanner and others, who easily reach forty and even sixty days. It is, however, a significant fact that none of these sleeps can be carried on in a hospital where the patient is under the observation of competent and unsympathetic nurses. For although food can be done without, water cannot, and these sleepers will invariably be found resorting to the water bottle and responding to the calls of nature within twenty-four hours. In their own homes, where they can help themselves surreptitiously to the water on the wash-stand, they may keep up the farce for weeks without detection. Most of the "sleepers" so frequently reported in the newspapers, though they lie without ap-

parently waking for weeks and even months at a stretch, make no pretence of fasting, but take food and drink regularly. Though they still terrify their families, they no longer puzzle their doctors, as they are most of them clear cases of hysteria in young girls or women.

It might be incidentally mentioned for the relief of anxious souls that the risk of any individual passing into a trance and remaining in it long enough to be buried alive is exceedingly slight indeed. There is no authentic instance of this having ever occurred. I took occasion to investigate this question some years ago, and communicated with a number of leading undertakers, and they all unanimously denounced it as one of the myths of the nineteenth century. One of them, at the time president of the National Funeral Directors' Association, informed me that he had carefully investigated every instance of "burial alive" reported in the newspapers for fifteen years past and found every one of them to be, in his own disgusted language, "a pure fake." However, I cannot fight that battle to a finish here, tempting as the field is.

The last remaining counterfeit of sleep, the hypnotic trance, is so obviously different in character that its discrepancies hardly need to be mentioned. Every one who has seen it will be struck with the difference. It has no relation to fatigue, but may be induced at any time and at any stage of vigour, though most commonly and easily in individuals whose mental processes are at such a low ebb that there really is not much difference between their sleeping and wak-

ing stages so far as any practical results are concerned. It is not recuperative, but rather depressing, and the patient feels, as he says, "queer and dizzy" when he wakes up. Instead of the brain being anæmic, it is congested, the skin is pale instead of flushed, and there is no increase in the relative oxygen intake. In fact, the condition is an auto-narcosis, or perversion of consciousness, and does little but harm, instead of good. It may, of course, be used in expert hands as a method of treatment, but its field of usefulness in this regard is becoming more and more limited every year, and the tremendous claims made for it by Bernheim and the Nancy School have dwindled already to a surprising extent.

The chief question which has always confronted us in our efforts to utilise it, "How can a weak mind be made stronger by becoming absolutely dependent upon another?" still faces us unanswered.

Nor are the sleeps produced by hypnotics much more nearly akin to true sleep in either nature or effect. The more powerful of these, like opium and its derivatives (morphine, codeine, heroin, etc.), chloroform and ether, are so obviously pure narcotic poisons that they are seldom resorted to for this purpose excepting in "Baby's Friends" and "Soothing Syrups." The apparent slumber produced by them is a toxic narcosis like that due to the toxins of fever already discussed. They have, of course, a certain field of usefulness in expert hands, in a limited class of conditions, such as after severe and painful accidents, or surgical operations where the tissues are ready and anxious for nor-

mal sleep, but are prevented from getting it by acute pain. In these conditions an opiate administered by a competent physician may relieve the intense pain and allow the patient to sleep naturally and with refreshing results. It is, of course, obvious that they should not be used to make sleep possible in this way in chronic painful diseases, or where the pain is likely to recur, on account of the danger of forming a habit.

There is a group, however, of weaker drugs, such as chloral, sulphonal, trional, veronal, etc., which being much less poisonous and producing few or none of the unpleasant after-effects and discomforts of the stronger drugs, are extensively used by both the profession and the laity for this purpose. They nearly all belong, however, to the methane group, of which chloroform and ether are the leading members; they are narcotic in their action, benumbing the brain-tissues in order to produce sleep, and are poisonous if taken in considerable amounts. Just as we find out the dangers of one of them, a new one is brought in by the pharmacists with a great flourish of trumpets, and announced as equally effective in producing sleep, and absolutely non-poisonous or harmless to the most delicate constitution; and it is eagerly pounced upon by the sleepless among the public and profession, and sells extensively for several months. Then reports of death from its use begin to come in, and its users and prescribers take fright, and it drops back into the ruck with the others.

Now, there is this to be said about these sleep imitators: that under certain conditions they, like the

opiate, may succeed in removing the touch of discomfort or restlessness which prevents sleep, and thus allow natural sleep to follow. Under the care of a competent physician, their use is admissible in a certain limited class of cases, and some of them are so feebly poisonous as to present comparatively little danger from this source, even in large doses. But they all belong to the great class of "symptom-smotherers."

The man who works all day in an ill-ventilated room and takes little or no exercise, or the woman who slaves over her housework or her silly embroidery and almost forgets that there is such a thing as open air, the business man who is driving himself too hard and keeps up on stimulants, the individual who is in an early stage of pulmonary consumption or Bright's disease, when they find that they cannot sleep, instead of regarding it as nature's danger signal, demanding investigation and change of habits, swallow some sleeping draught and persist in their suicidal course until a breakdown results, that they can no longer shut their eyes to. *There is no such thing as uncaused sleeplessness* any more than there is uncaused loss of appetite, of strength, or weight. All of them are signals of trouble and should be promptly regarded and investigated as such. Hypnotics have their place in medicine like other poisonous drugs, but that place is becoming steadily smaller as cases are more painstakingly and intelligently studied.

One of the strangest curiosities of sleep is the widely prevalent idea that it is possible to get too much of

it. There are, of course, a number of drowsy and unconscious states resembling sleep, which, as we have seen, occur during illness, and these may possibly have given rise to the popular belief that it is possible to "sleep yourself weak," or, as I have heard it expressed, to "sleep so hard that it tires you." Toxic narcoses of this sort are possibly responsible for the "horrible examples" which are held up to the young in ignorant country neighbourhoods, of lost individuals who let the habit of sleeping late in the morning grow upon them until they finally slept all day as well as all night, and ultimately "slept themselves to death."

Then there is, of course, that weird, tropical disease, the Sleeping sickness, in which the victim after being feverish and uncomfortable for several weeks, gradually begins to grow drowsy, and drowsier as the disease deepens, and finally cannot be awakened. The sleeper wastes and emaciates rapidly. Swellings occur in the arm-pits and groins, ulcers develop on the skin, and he dies, a human wreck, in from six to twelve weeks' time from the beginning of constant "sleep." But this is a perfectly definite disease, due to infection by a parasite known as a *Trypanosoma,* introduced by the bite of the *Tsetse* fly *(Glossina palpalis),* similar to the species which carries the dreaded disease of horses whose name it bears in South and Central Africa. This is spreading with such rapidity through Central Africa as to awaken the greatest uneasiness, and is beginning to attack the white population.

The last curiosity of sleep is the extreme irregularity among animals as to the time of day at which they take it. Nearly all the carnivorous animals, of course, sleep in the day and carry on their hunting operations at night. The same is true of a large number of rodents, as evidenced in our involuntary household "pets," rats and mice. Even herbivorous animals, like the deer, the antelope, and wild cattle, habitually turn night into day, both in the tropics and during the heated seasons of the Temperate Zone. As every hunter knows, the time when deer steal abroad in the summer is in the cool darkness of the night, and the sneaking, cowardly trick of lying in wait for them at licks and springs or shooting them by the light of a lantern in the bow of a canoe as they browse along the margins of the streams used to be considered sport.

Go into any zoological garden a little after nightfall and you will find most of the tropical animals just waking up. Even among the domestic animals, when day and night are both alike periods of safety and abundant food supply, the dog and the cat still keep their choicest activities for the night, and horses, cattle and sheep will graze all night long whenever the heat in the middle of the day begins to be oppressive, and take the daylight for slumber in the densest shade they can find. So that as far as the animal kingdom generally is concerned there can be little question of any necessary connection between the hours of darkness and sleep. This latter is usually taken in whatever time is left over, so to speak, from the portion

of the twenty-four hours during which food can be most safely and conveniently secured.

Nor do they even invariably prefer the light as such for their active period; in fact, as has been pointed out by Hough and other biologists engaged in the study of the flora and fauna of the deserts of Arizona and the great Southwest, many of the animals choose the night for their period of activity in order to escape from the injurious effects of the intense glare of light. And many of the adaptations of the desert vegetation, its spines and scales and dull green pigmentation verging upon brown and even black, are as much protectives against light as against heat or drought.

Not only is this indifference to the time of sleep general throughout the animal kingdom, but it is also well marked in the probable ancestral line of our own species. Many of the marsupials are nocturnal in their habits. The generalised insectivora, probably next in line, are almost universally nocturnal. The next link, the lemurs, are so strongly addicted to night hours that their eyes show a peculiar and special adaptation to this form of life. Many of the monkeys, both Old World and New World, are notorious night-birds, rollicking and chattering through the tree-tops all night long in the tropical moonlight. Fully one-third of the anthropoid apes, including among them those closest to the probable line of human descent, the gibbon and the chimpanzee, are great night roamers, resting in the heat of the day in the darkest undergrowth, but making the earlier

and the later hours of darkness hideous with their howls.

The nocturnal tendencies in our pre-human ancestry are so well marked that one can scarcely resist the temptation to idly speculate why man has become so strictly diurnal in his habits. Of course, by the time he has reached the stage of tilling the soil, or even that of possessing flocks and herds, the mere question of convenience in carrying out his necessary labour and operations would require him to be abroad during the day and to sleep at night.

But this was a comparatively late accomplishment and the question remains unanswered, why during the hunting stage, through which every race, of course, has passed, he should not prowl at night and sleep during the day, like the rest of the carnivora? To follow the speculation a little farther, the one thing which seems adequate to explain it, was that he began to develop an imagination, and the first use he made of it was to become afraid of the dark. This again was closely connected with the subject of sleep, as in all probability it was his dreams that made him afraid of the dark.

Dreams are the physiological basis of savage theology. Scarcely an aboriginal tribe is known which does not people the night with ghosts and demons of which the spooks and bogies of the nursery are lineal survivors. As soon as man rises to the conception of unseen forces—demons and spirits—night is invariably the time of their dominion. Indeed, to this day one of the principal titles of the only surviving demon wor-

shipped among us is the "Prince of Darkness." So vividly afraid are almost all savages of those demons of their own invention that many of them absolutely refuse to stir beyond the circle of their own flickering fires after night and are afraid even to make night-attacks in warfare, a little foible which has been an enormous comfort to the nerves of white men in many an expedition.

It is an amusingly suggestive fact that as soon as man begins to crowd into the great cities, where by light, noise, and company night is literally turned into day and the terror of darkness removed, he promptly reverts to the nocturnal habits of his ancestors. Can it be that the tumult of emotions stirred up in his bosom by a bright moonlight night has an ancestral element about it? That it may lead to anything, from making love or poetry to robbing a hen-roost, is certainly suggestive of its primitiveness.

Ever since the agricultural stage, or indeed the latter part of the pastoral, was reached, and still more so since the development of the commercial stage of civilisation in which we now live, considerations of convenience have overwhelmingly decided us in favour of working during the day and sleeping at night. In the cloudy northern climates of the Temperate zone, which are the home of the present-day civilisation, another factor has come in and that is the desirability of getting as much as possible of the sunlight which struggles through the fog and the rain-cloud.

Sunlight is the true secret of life. It is the Great

Spirit whose conjuring up by the emerald and crimson wizards, chlorophyll and hemoglobin, created all wonderful forms of life in both vegetable and animal kingdoms. Embodied sunlight is all we are—clouds of watery vapour in human shape, shot through with golden light like the crimson glories of the sunset. But granting all this, it is also true that sunlight, like fire, though a good servant, is a bad master. We may get too much of it for the best interests of our physical vigour, and it is well to remember that while in the cloudy northern clime, which was the home of our modern civilisation, it was almost impossible to get too much sunlight or daylight, this is by no means true in the tropics or even in the brilliantly sunlit regions into which many of us have migrated on this side of the Atlantic.

Part of the sun's rays at both ends of the spectrum, the ultra-violet and the red, are now known to be not only non-beneficial but in excess irritating and destructive to living tissues. It is upon this power of destroying freshly grown tissues that their effect in the treatment of new growths, like cancer and lupus, depends. The whole subject is still in its infancy and has been so little investigated as yet that we cannot do more than simply sound a note of warning against excesses of enthusiasm for either sunshine or violet light. This much we know already, that these rays in excess are injurious to living tissues and, as has been stated, the adaptations of many of our tropical plants and animals in the way of colouring and nocturnal habits are in the nature of protections against exces-

sive light. And by recent experiments it has been found that prolonged exposure of healthy individuals to direct sunlight even in the Temperate Zone is accompanied with rise of temperature, increase of destructive processes in the body metabolism, headache and discomfort of varied degrees, according to the length of exposure. It was also long ago surmised, and the evidence for this belief has recently been collected in interesting and attractive form by Major Woodruff in his "Effects of Tropical Light on White Men," that the marked increase in the amount of pigment in the deeper layers of the human skin, resulting in the production of the so-called black and brown races of the tropics, is to be regarded as a protection against excess of light and the penetration of the violet rays.

To sum up, then, the habit of sleeping at night appears to be largely a matter of economic convenience, reinforced in cloudy northern climates by the desirability of getting as much of the scanty sunlight and daylight as possible. However, there are large regions in the newer homes of the race, for instance, the greater part of the American Continent south of New York and the Great Lakes, save the North Pacific Coast and the whole of Australia and South Africa, in which the latter consideration does not apply, especially during the summer months. And I am of the opinion that either a later hour of rising or a period of sleep in darkened rooms during the day will be found to be beneficial in these regions in summer. Excess of light in summer fatigues and ex-

hausts as well as excess of heat. It certainly was not just sheer tropical laziness which has led all races residing in the tropics to resort to this siesta habit. Nor possibly were our primitive ancestors or their contemporaries now residing in tropic and semi-tropic regions quite such utter fools as we at one time supposed, in living in caves and making their earliest houses resemble the latter as closely as possible.

CHAPTER VII

THE REAL ANGELS IN THE HOUSE—SUNSHINE AND FRESH AIR

It is one of the most curious paradoxes of human nature that while in most matters hygienic the instincts of the natural man are to be trusted, in the matter of house building and house habits we have to challenge them at almost every turn. We know very well that abundance of fresh air is the first vital necessity of all breathing creatures; and yet we shut and lock our windows, draw the double curtains, and pile on the coal. We know that the real place to live is in the open air, that at least half our waking hours should be spent in it, and yet we avoid it, as if it were a pestilence. Rushing from our cliff-dwellers' apartment closets into a tightly closed and heated car or trolley, by choice one running underground if it is within reach, we dash from this into our steam-heated offices provided with swinging doors and rubber-edged sashes to shut out that pestilence, fresh air. Business over, we again fly by the shortest possible route to another hermetically sealed room, where we dine, and for relaxation we repair to a packed and reeking den, called a theatre, as innocent of any attempts at ventilation as the Black Hole of Calcutta, where, crowded shoulder to shoulder with from 2,000

to 3,000 other human beings, we breathe and rebreathe the emanations from their lungs, skins, and teeth for three hours. Then home in a semi-asphyxiated condition by the nearest underground tube or box on wheels and so to bed.

Then we talk of the "terrible nervous strain" of modern city life! The worst strain of modern city life is not on the brain, but on the lungs. Apart from its foul air, city life is the easiest, happiest and practically the healthiest life yet invented.

Of course there is a reason for this singular state of affairs; we are not quite so senseless as all that would come to. Our bad house habits are the result of a choice between evils, a confusion and clash of purposes. The primitive house was never built either for good ventilation or for sunlight. For the matter of that, primarily it was never intended for a house or home in the modern sense of the term at all, but only for a temporary place of refuge during the night or in storms. It was originally a place of shelter from the elements, from wild beasts, from even fiercer and more dangerous human enemies.

Its first and most indispensable requisite was that it must be *safe,* no matter how dark and stuffy. If the Gothic cathedral was "a prayer in stone," the primitive house was emphatically a *fear* in stone! And the worst of stone is that it is so durable.

Though we have lain down at night and arisen in the morning in peace and safety now for hundreds of years, our houses still show in every line of them the deadly traces of this ancient obsession of fear. The

trouble was we got two dips of it. One at the very beginning of things, and the other comparatively recently in the Middle Ages.

The first permanent houses of the race were unquestionably caves, safe, but ventilation not exactly one of their strong points. It is not necessary to go to the Dordogne or Solutré for proof of this fact. Some of our modern dark bedrooms are quite sufficient proof, to say nothing of certain halls and churches which make one sympathise with Mr. A. Ward's plaintive remark when lecturing in the Egyptian Hall, Piccadilly: "I wish that when the Egyptians built this hall they had provided some means for its ventilation."

Witness also the extraordinary tendency observable to crawl into the darkest and stuffiest holes and corners we can find when sleepy, sick, or frightened, even if it be nothing more substantial than the darkest corner under the bedclothes at the foot of the bed. There is no need for us to jeer at the ostrich as the foolish bird.

When, however, we had invented the club and the spear, and walked upright long enough to use them, we threw off this monkey terror and mustered up courage enough to live boldly upon the face of the green earth in tents and bark huts or lean-tos, confident that our hands could keep our heads against even the biggest and the fiercest of our enemies. This period mercifully lasted a long time and is the one to which we are now harking back in our attempts, feeble and timorous at first with no other hope than that of cur-

ing a few consumptives, but which are now expanding into a great, hopeful, sun-lit world-movement toward the reconquest of our heritage, the open air.

But unfortunately with the passing of the hunting and pastoral ages came the age of feudalism, of the fortress, of the walled town, and the clouds of fear-obsession again gathered over the house. Walls were made thick to resist attack, windows were reduced to mere slits just big enough to shoot out of, but as small and tunnel-like as possible to keep out hostile arrows. Huts and houses were crowded together so that a wall could readily be thrown around for defense in case of sudden attack. In short, half the bad features of the cave architecture were revived and the traces of these last remain alas! even to the present day.

We cannot blame the Cave Man or our great-great-grandfather of the Middle Ages. They had no choice in the matter except between two evils. And of course between waking in the morning with a stuffy and aching head and having that important portion of your anatomy decorating the end of a pike or hanging from a saddle bow, he properly chose the former. It helps us greatly to understand and have patience with that extraordinary and abject dread of fresh air in the house, which is our most serious obstacle in our attempts at rational ventilation, to remember the genesis of it. It is not so much the fresh air itself, or the cold that we are in fear of, as it is the Terrible Things—snakes, panthers, arrows, bullets, hobgoblins and vampires, cats and burglars, which we have had dinned into us for hun-

dreds of centuries past—that might come in with it. That survival of the Dark Ages, the Burglar Dread alone, strongest in the most primitive half of humanity, is probably responsible for more tightly closed windows and foul bedrooms in better-class houses than almost any other single factor.

Incredible as it may seem at first sight, these vague ancestral fears and terrors, baseless and ludicrous as they may now appear, are one of the realest and most substantial obstacles to the spread of modern ideas of ventilation and healthy homes.

The first step for the admission of the Angels of Fresh Air and Sunshine into the home is the proper placing of the house. I am sadly aware that to many this statement will appear about as practical as Oliver Wendell Holmes's famous advice as to the prevention of disease: that it must begin with the grandparents. Now that we have succeeded in getting architects and builders to break away from the mere slavish and brainless imitation of the antique, the classic and the picturesque, and to utilise the superb new control of forms, of openings and of exposures which the toughness and plasticity first of wood and later of steel and concrete have given them, a veritable new world-field of architectural possibilities is opening. By exercising such choice as is permitted us, by choosing the good and refusing the bad, we can control the structure and position of our homes to a very considerable degree.

Moreover, builders are eager to follow the popular taste, and one of the most striking features of our

modern city development is the vast and gratifying improvement in both healthfulness, lightness, and beauty of modern city homes. Even the much-abused flat or tenement, when constructed intelligently and on scientific lines, is not only far more comfortable, but wholesomer and healthier in every way than the detached cottage or average farmhouse of fifty years ago. The model tenement is better lighted and ventilated than the brownstone front, while nothing as ideal for wholesome human comfort has ever been invented in any previous age as the better or even average class of suburban homes. If there be one tradition that makes me long for a hammer more eagerly and viciously than another, it is the absurd old delusion that our forefathers built better houses than we "of these degenerate days."

It is the exception that a house more than one hundred and fifty years old is fit to live in unless it has been, like *Mrs. Poyser's Craig,* "made over again and made different." The next most troublesome form of prejudice that we have to contend with in attempting to ventilate houses is the result of the dampness, the draughtiness, the darkness, the coldness and general abominableness of the old houses.

So inherently draughty were they, that it was absolutely necessary to keep every window and aperture shut and battened in winter time in order to maintain the lowest degree of livable warmth. The carpenters of the last century did not know how to hang a window so that it would be weather-tight and yet capable of being opened by any one except a trained athlete

or an expert burglar with a full kit of tools. If you don't believe it just try to open a window in the next bedroom that is assigned to you in one of these fine old colonial houses of three-quarters of a century or a century ago. This was the genesis of that bitter prejudice, which has almost crystallised into an instinct during successive ages, against an open window in winter time as a thing abhorred and deadly beyond description.

Barely fifty years ago Florence Nightingale found it necessary to head her crusade for breathable air even in hospitals with the terse remark:

"Windows were made to be opened."

It has never been practically accepted by more than five per cent. of even civilised communities, yet by one of those charming contrarieties of human nature, which leaves us hesitating between laughter and imprecations, the glory that ever gilds the past and places the Golden Age far behind us, has been allowed to transfigure these disagreeable facts and even to move us to declare that only in the time of our grandfathers and great-grandfathers did men know how to build houses. Modern structures are houses of cards by comparison, which is all of a piece with the delusion that more people lived to a good old age in the olden days than do so now, both resting upon the same broad and convincing fact that the people and the houses that belonged to that age and survived within the period of our own recollections were naturally old.

Only the houses which were extraordinarily massive and substantially built in the olden time have survived to be pointed out to us of these feebler days as examples of the age when men "knew how to build." What the sanitarian is most thankful for is that so few of them did survive.

Few things would do more to promote the health of the community than a law providing for the destruction of every house when it had reached its fiftieth year. Then our worst monstrosities in the way of cliff-dwellings and child-smotherers would never be built at all, and our architecture would remain plastic and responsive to our real needs instead of being a Frankenstein which perpetually crushes us with the burden of our past mistakes and stupidities.

The days when a man's house was not merely his castle figuratively, but built as nearly as possible like one actually, are past. And the days when houses were built as monuments to perpetuate the pride and conceit of individuals through successive generations ought to pass with them. Let each generation build for itself and not saddle the future with indestructible and permanent monuments of its mistakes and defects.

Most of these old structural difficulties and inheritances we are overcoming now through improved workmanship, weight-hung plate-glass windows, and modern systems of heating, which latter, defective as they are, are the first approach to anything that could be called adequate. But the last foe of fresh air in the house is still living and active, and that is the problem of heating.

A certain modicum of warmth in our habitations is a vital necessity and has been ever since we lost the faculty of hibernating and discarded our furry coating. We may as well practically admit that before this every other consideration must inevitably go down. If we cannot devise some means by which freshness of air in our living-rooms can be made consistent with a reasonable degree of warmth we may as well throw up the problem.

The inadequacy, yes futility, of the old systems of heating is the real hydra-head that faces us at every turn in the study of ventilation. The principal objection to-day to windows on two sides of every room and an abundance of light everywhere is not the expense of glass but that too much window space makes a room difficult to heat.

Ever since men began to shake off the senseless habit of crowding one house up against another in solid rows, born of the days of sheltering fortifications, they have begun to fall under the only less disastrous spell of clustering together and cutting down window space and outside wall for warmth and protection from cold in winter.

But even this difficulty can, with our improved methods of construction and our modern heating plants, be largely overcome with a little intelligent determination. Houses as well as men are becoming more independent, less afraid to stand alone, and

"With a frolic welcome, greet
The thunder and the sunshine."

Moreover, a larger percentage of the population are owning and building their own homes than ever before in any previous age. Man is master not merely of his fate, but of his house to a higher degree than ever before.

The first and one of the most important considerations in the building or choosing of the house is its aspect. This point has been wrathfully disputed and vigorously thrashed out, but fortunately most of the competent authorities are now about in the frame of mind of the director on the country school board when the question of repainting the schoolhouse was under discussion. The other members of the board were equally divided between white with green shutters, and slate with white trimmings, but he listened silently, contributing nothing. Finally noticing his silence and exhausted by their own eloquence, they turned to him and asked him for his opinion:

"Oh," he said, "I don't care a durn. Paint it any colour you like, s'long's it's red!"

And the residuum of all disputations on house aspects has now practically settled on southeast; any aspect, in fact, from east by south to south by east; but the nearer it falls to the central norm of southeast, or "sou'-sou' east" in nautical terms, the better. There was for a long time a preference for an eastern aspect. But this was largely of ceremonial and sentimental origin, partly a remnant of the old sun-worship days, coupled with the belief that all our civilisation came from the east, which still survives in the curious European expression: To *"Orientiren"* one's self, *i. e.,*

"turn toward the east," in the sense of getting one's bearings. Partly also from later and tenderer memories of the

"Little window where the sun peeped gladly in at morn."

On practical grounds, however, it is distinctly inferior to either southeast or south on account of the much fewer hours of daily sunshine in the winter time when all our sunshine is of value, and an excess of sunshine at an undesirable hour in the summer when we ought to be taking our real beauty sleep, *i. e.,* from four to seven in the morning.

The advantages of the southeast aspect are few but weighty, viz., the maximum of sunshine the year around, particularly in winter, when it is of greatest value, with the maximum of breeze and consequent coolness at night in the summer time. It is easy to cut off any excessive amount of sunshine by awnings, screens and blinds, besides which no one ought to be in the bedrooms or living rooms of the house in the daytime in summer, but out on the porches or under the trees.

But no device yet has been discovered to bring the sunshine in at a north window. While it may be frankly admitted that sunshine, like fire, is a bad master, and that too much of it in our American climate in the summer time may be, and often actually is, injurious, yet it is a splendid and matchless servant in the promoting of healthfulness of the house, for

which no substitute has yet been discovered. It is the foe alike of bacilli and "the blues"; the best tonic ever yet invented for the liver and for the scalp, and for everything between, the only real complexion restorer, and the deadliest foe of dirt and disease.

By all means build and arrange your house so that you can get all there is to be had of sunshine during ten months of the year. It is simple enough to shut it out during the fraction of the other two, when you don't need it all. "But why," will inquire at once some orthodox owner of a "desirable lot" on the north side of the street—"why not, if sunshine is what we want, have your house face due south, and thus get all the sunshine possible, southwest as well as southeast? At the same time, put yourself square with the street and the world?" There are few things more curious, and from many points of view more regrettable than this extraordinary American passion of ours for "squareness." It is second only in unfortunateness to our health-racking belief that "Satan finds some mischief still for idle hands to do." It is asserted by esoteric moralists to be mysteriously and basally related to "squareness" of conduct and uprightness of character. But it has done more than any other one thing to destroy the beauty of our otherwise attractive, park-like villages and country towns with almost as many trees as citizens, and more lawns than pavements and to render half of our rooms cold and sunless in winter, and the other half blazing hot in the summer months.

If we must choose a precise point of the compass for

our streets and plot everything in deadly monotonous checkerboard fashion, by all means let that fixed direction be a diagonal from the northwest to the southeast, and its corresponding right angle. A due south front means a due north back and a due west side. The first of these, while giving an abundance of winter sun, will get a perpetual blaze all through the summer. The second will practically never get any sun at any time of the year, except in the long summer afternoons; and the third, or west, will get a perpetual bombardment of the sun's rays at the hottest and most exhausting time of the day, so that when we attempt to retire to them at night, they are still baking and sizzling and fail to cool off properly until after midnight.

By facing the house southeast, every aspect will get a moderate amount of sun at every season of the year; and though the southwest side of the house will still get rather more of the westerly sun than is desirable, yet it will have the advantage of being tempered by a night breeze, which in the summer time is almost invariably from the south or southwest.

But living rooms and the most constantly used bedrooms, especially for the youngest and the oldest members of the family, should be placed by preference on the south and southeastern aspects, partly to avoid the glare of the westerly sun in summer time and partly because, for some curious reason which we do not understand, but which any gardener or flower lover can testify to the correctness of from practical experience, westerly sunlight is not as valuable for

growth as eastern. It has even expressed itself in the formula that one hour of morning sunshine is worth more to a plant than two of the afternoon. Plants that will flourish superbly upon the eastern or south-eastern side of a house will spindle and run to stalk or small and imperfect flowers on the western exposure.

We should also learn to be independent of this slavery to the points of the compass and to parade-like alignment with the street in the internal arrangements of the house. If for any reason the house be on the south side of the street, or the main approach to it from the north, then do not hesitate to simply reverse the interior arrangements of the house and make the most important living rooms and bedrooms face the south and the kitchen, dining-room and reception rooms toward the front, or north. Let your windows open toward, not Jerusalem, but the sun-god wherever you may dwell.

The next thing is to break away from that other squareness obsession, of outline. The basis of this is of course economy, trying to enclose just as much space as possible with as little expenditure of building material. Also to save expense by making all angles right angles and diminishing the number of corners or sloping jointures, and at the same time to give as little surface exposure to the exterior for the wasting of heat or the contact of cold winds as is possible. As a result, our country and small town houses have come to look like so many dry-goods boxes, a little longer or a little shorter. The "soul" of the average Ameri-

can house is of the artistic proportions and fascinating contour of a brick turned up on edge.

This is the basis for the universal complaint made by the visiting foreigner of the monotony of our architecture. It chiefly depends upon the fact that "a straight line is the shortest distance between two points," and that any "handy man with a hammer" can put together a square joint, but it takes a carpenter to make an angle or a bow or curve.

We must break up this deadly monotony of outline, not merely for the sake of artistic variety of contour, but for the fundamental principle that underlies all good architecture, that it subserves and expresses the purpose for which the house is built. The aim of modern houses from a hygienic point of view should be to make every room a corner room; that is to say, break the outline sufficiently to allow as far as possible every room in the house to have windows upon two aspects of it. Once this is done, the most difficult problems of both lighting and ventilation are solved in advance.

Something of the same effect may be produced by an intelligent use of the bay window, which practically adds another side or facet to the room, a new point of the compass from which air and sunlight can enter it. In spite of the sneers of the classicists and the formalists, the sanitarian has little but praise for the strong tendency to variety of outline and irregularity of forms, which is such a striking characteristic of our newer home building. To break up outlines of walls and roofs merely for the sake of

variety, or for quaintness, or to be "different," has perhaps become a fad, and like other fads has been carried at times to absurd extremes. But in the main the tendency is a sound one, like most popular instincts, and is distinctly beneficial in its results, giving not only an attractive exterior, but also rooms which are beautiful in their outlines, and in their light-openings, and can be made attractive with far less expense and complexity in the matter of colors, furniture, and hangings, which latter in the sanitary eye are an abomination.

The most beautiful pictures upon the walls of a room are those that can be seen through its windows.

Now that the race has just begun to throw off the shackles of the cave-fortress dread, and the almost equally repressive and injurious bondage to economy of building material and labour and saving of fuel, it has really at last begun to build houses which are proper places for human plants to flourish and bloom in. We are building greenhouses for ourselves instead of for our flowers. "Glass houses" may have certain defects from a catapultic point of view, but priceless vantages from a hygienic one. So do not be afraid of making your house even what your æsthetic friend may dub an "architectural crazy quilt."

Our ancestors of Queen Anne and Tudor times were excellent people in their way, the best perhaps that had been invented up to that date; but they were unspeakably filthy in their personal habits, hadn't the remotest conception of ventilation, let alone of drain-

age or sewerage; were as afraid of a bath as the devil is of holy water, and used strong perfumes, like musk and civet, to overpower the reek of packed and steaming humanity that occupied their most artistic but dark and unventilatable houses.

The business of your house is to express and serve *you,* not your dead and gone ancestors. And while preserving all that there may be of dignity and beauty and simplicity in the architectural past, the modern house should strike boldly out and subserve the needs of the present. With all its defects, inconsistencies and even absurdities, it eliminates to a greater degree than ever before the three deadliest disease breeders of all times—darkness, dampness and foul air.

Even if it does cost a little more to heat it in the winter time, if old ladies of both sexes object to some of its corner rooms and bay and oriel windows or comical turrets as drafty, and if it does not possess the dank and cellar-like coolness of the old thick-walled and small-windowed house in the few weeks of intolerable heat in the summer, these disadvantages are the mere dust of the balance in comparison. In fact, most of them are, from a sanitary point of view, advantages in disguise.

In those rooms in which windows on two aspects cannot be secured, an extra large transom can be used as a substitute. The transom is an advantage from a hygienic point of view over every door, especially where halls are properly ventilated and provided with at least one or more windows of their own opening directly to the outer air. A little intelligent planning

will usually be able to secure for those rooms which have windows only upon one side a possibility of cross ventilation through some hall window, allowing a free current through the transom, or through the transom and windows of a room on the opposite side of the hall. It is also a great protection against summer heat, a procurer of healthful sleep on hot nights, to have the doors of all rooms opening upon hallways provided with slat or Venetian three-quarter doors, so that cross ventilation can be secured through the doorways without interference with privacy.

Another of the emancipations of the modern house lies in its choice of a site. Up to a century and a half ago men were afraid to build upon hill-tops, partly from fear of exposure to the north winds, which they were utterly unable to guard against on account of draftiness and ludicrously inadequate methods of heating, partly from lack of water supply. Hence many of the best and even most imposing houses were built in "a sheltering hollow of the hills," which meant that water ran under, around and through their cellars after a heavy rainstorm, just as it does through the eaves-gutters of a roof. And if they were further screened by "a belt of woodland," this meant they were liable to be damp the greater part of the year. In fact, the greatest difficulty which we find in dealing with old houses in England or on the Continent of Europe lies in the awful holes and quagmires and dark, swampy hollows in which many of these houses were built. They must be near the water, both for their own supply and for their horses and cattle.

They had no pressure water systems, consequently built close by the side of or in some cases actually over springs and wells. The beautiful villages celebrated in song and story which dot the lovely English country are many of them little better than perpetual typhoid, ague, and diphtheria swamps, on account of this valley-seeking, water-loving habit of growth.

Nor have we altogether escaped from this water bondage on this side of the Atlantic. Ride out in any direction through our rich farming country and you will see dozens and scores of houses that are built in the worst possible place on the entire farm from a sanitary point of view in order to be near some well or spring and "convenient for the stock." Their surroundings are turned into a foul-smelling bog of animal excreta every winter, which doesn't dry up until late in the spring; while beautiful, breezy, well-drained knolls lie all around them, which a windmill or a gasolene engine or the utilisation of a well upon some higher part of the farm would enable them to occupy. The farmer's wife is often anxious to move up onto these; but the farmer declines to put himself too far away from his beloved hogs and cattle. Those who live like or too close to hogs are pretty likely to die like sheep. And this is one of the factors which now makes the death-rate of many healthy country districts higher than that of the great cities, even with the slums included.

The cynic has remarked that the bitter old jest of Vespasian, "It is safer to be Herod's pig than his son," might be applied to a certain percentage of our

farming population. The real pride and affection of the farmer is centred in his barns and his "feeding-lots." Such trivial affairs as the house and the garden may be left to the "women folks."

The cellar or ground-floor closet of the old-fashioned house or even of the average farmhouse of to-day in which mould will not form is the exception. Most of us who have happened to live in them will remember that we took special precautions against the moulding of shoes or other leather articles or garments when they had to be kept in such closets. When we remember that the vast majority of our disease germs are either moulds themselves or belong to the mould family, we can grasp something of the profound significance of this fact for health.

Though it has been said scores and hundreds of times, I may be pardoned for again repeating that *the one and only group of conditions under which disease germs can live and retain their malignancy until they can be transferred to another human victim* is that offered by these old-fashioned houses, viz., darkness, dampness, and absence of fresh air. Scarcely a disease has yet been discovered or developed so malignant that it can be communicated or caught in the open air save by direct personal contact. Nine-tenths of our disease germs are not transferred directly from one person to another, but lurk in the corners of rooms until they can spring upon the next victim.

The old-fashioned house is the very mother of infectious disease. A large percentage of the germs

of our deadliest diseases will die in from half an hour to two hours in well-lighted, well-ventilated rooms even, and nearly all of them perish quickly in direct sunlight and in the open air. Our forefathers were not so far wrong in believing that some of those old houses were haunted. They emphatically were, both by the memories of those who had died of their foul air and by the deadly germs which each successive generation of victims had left behind it. It was literally a sure sign of a death in the family within a year to undertake to live in one of them.

CHAPTER VIII

BATHS AND BATHERS

THE bath instinct goes deep and far back. Life originated under water. It has never got very far away from it since. To this day nine-tenths of our body cells are aquatic—yes, marine organisms; can only live immersed in a saline solution. Dry them and they die promptly.

That's why we love the sea. It's the water inside us responding to the surge of the Great Sea-Mother.

Cleanliness is only an incident of bathing. A certain degree of robust indifference to dirt is necessary to health, both bodily and mental. The sturdy savage didn't care a rap whether he was clean or dirty, but he bathed every chance he could get, for the exhilaration of it.

Only the valetudinarian and the model housekeeper are in agony if not spotlessly clean. It's a disease of the imagination in both cases.

Therefore: *Don't scrub. Seldom use soap. Use as cold water as you can enjoy.*

The chief value of bathing lies in its exhilaration. Don't make a penance of it. If you don't enjoy it, it's doing you harm. The good of the morning bath is in the reaction, the glow that follows it, not in the cold plunge itself. Cold in general, and cold water in

particular, are a superb tonic. First to the nervous system, through its branches in the skin, second to the heart and blood-vessels as shown in the glow, and third to the muscles and digestive glands. It's the best appetiser known, worth all the tonics, bitters and cocktails in existence.

But like any other tonic, while a small dose stimulates, a large one depresses. And the size of the dose depends *entirely on the bather.*

For a strong, vigorous man or woman in the prime of life, nothing is better than the cold plunge. It exhilarates, it clears the brain of the cobwebs of the night, it sends the blood humming through the veins as nothing else in the wide world can.

But it takes a vigorous constitution to *react* to it thus. Children, rapidly growing boys and girls, especially the latter, the aged and invalids of all descriptions are often incapable of this response.

I repeat again, it is the response, the reaction that we should aim at. If we fail to get this the bath is a failure, if not an injury.

Particularly is this the case with those who are below par from any cause, the overworked, the underfed, the incipient invalids of every sort, who with heroic zeal, keep plunging their shrinking bodies into the icy tub, to emerge shivering, with chattering teeth, blue finger-nails and red and running nose. With pathetic conscientiousness, they cling to their idol, in a blind belief that what makes an athlete better will make them well if they only stick to it.

Much as we have profited by adopting the English-

man's religion, Muscular Christianity, we have made a fetich of the cold tub and worshipped it to our hurt. Many a one who is hurt by it and hates it, endues it with a sort of moral virtue on account of its disagreeableness, and blames himself for the unpleasant effects.

Use then only such a temperature as you can enjoy either in the stinging shock or the prompt reaction. Even Sampson should temper the frigidity of his tub to that degree which enables him to lie in it for at least half a minute with comfort, for the shock of sudden cold, like that of muscular overstrain, has its dangers, especially after fifty, when the arteries are losing their elasticity. Delilah should take hers less Arctic yet, and so on down the line to the invalid and the aged, for whom only a few degrees below blood heat is cold enough. One simple rule for all: The best temperature is the one that gives the best reaction, and consequently most pleasure.

The tub is better than any splash or shower, because it alone gives that peculiar alteration of the basis of support of the body which is the charm of swimming. While we stand, all our internal organs hang as it were vertically from our backbones, when we lie down they rest upon the backbone or hang laterally from it toward either side according to our position. When we are under water all this is changed, the pressure is practically the same on all surfaces, the liver, lungs, spleen, intestines float in a water-bath and entirely alter their relations to one another. Pressure on heart and blood vessels is equalised or relieved, kinks floated

out and a general replacement and gravity-massage of the great viscera takes place.

Few cannot stand the full tub in some form, if properly modified, and taken *as all baths should be,* in a reasonably warm room. But for those who cannot, or have not the facilities for it, the cold or cool splash is an excellent substitute. For this only a basinful of water is required. Plunge the hands into it and splash or "pat" it rapidly over the body. To begin with, the neck and arms, and gradually extend it day after day until the whole upper half of the body is splashed, is a convenient rule.

Nearly any one, even the most delicate, can stand this splash-bath in a warm room, and it is a splendid "cold preventive," tonic and appetiser and the best catarrh cure on the market. The vigorous can extend it to the entire body, or finish off by pouring a pitcher of water over the head and down the back and chest while standing in a large dish-pan or portable tub. This latter, by the way, was the original form of the sacred tub of the Englishman and is perfectly satisfactory for every purpose of both exhilaration and cleanliness.

The shower-bath has its advantages, but they are chiefly economic. It is cheaper to install, takes up less room and in public baths, requires far less water per capita and less expense in keeping the tubs clean. It is very little superior to the hand splash, if not properly handled may give a more dangerous shock than the tub and is distinctly inferior to the latter in comfort, exhilaration and "liver floating" effects.

The routine use of soap in a full bath is an insult to the skin and a severe reflection upon the efficiency of this great protective covering of ours. The human skin is the most wonderful, most beautiful fabric in the world, and we don't half appreciate its marvellousness. Flexible as silk, resistant as steel, colour-tinted like the petal of a flower, but tough as leather, almost translucent to light, but the most superb non-conductor of heat and electrical currents known.

Its vitality is unconquerable, its power of repair almost unlimited, with a vascular mesh capable of containing half the blood in the body, it can adjust itself to almost any extreme of temperature. With nearly three millions of flushing sweat-glands, it is absolutely self-cleaning. No contamination of any sort can cling to it for long, because its surface is constantly changing by the dying of the flattened and superficial cells and their falling off in daily showers. Shut an arm or a limb in a plaster of Paris cast, as in a fracture, for instance, let it remain in position for three weeks, then take it off, and you will find merely a handful of human bran which has accumulated in its interior. This branny powder is made up of thousands of almost invisible delicate epithelial scales, which under normal conditions are continually shed and rubbed from the surface of the body, carrying with them all the impurities that may have attached to them.

Little can get through the skin, even the medicines which are rubbed in and supposed to be absorbed, are chiefly volatilised by the heat of the body and inhaled

by the lungs, or else act on the imagination by their colour or odour.

All this, however, only when let alone. It has its own water-proof coating of delicate, fatty substances, brought up to and spread upon its surface by the sweat glands. The alkali of soap promptly unites with this and removes it, leaving the surface dry and harsh. Tiny cracks form, dirt works into these, which requires "scrubbing out," often with stronger soap. This deepens the cracks still more and so the silly drama proceeds. Only the best and mildest of soaps should be used on the human skin, and these restricted to the hands, face and occasionally, feet.

Even here they should only be used for known contaminations and visible dirt. Strong soaps and scrubbing defeat the very purpose for which they are used and work the dirt in, except on the toughest skins.

Even hot water for hands and face should be avoided as far as possible, as it also dissolves nature's skin-lubricant and leaves the surface dry. Never wash off more than will come with mild soap and cold water. Wait till nature brings the rest up to the surface. The sweat glands are continually bubbling up a mildly alkaline flood which floats and washes any impurity out of "the pores" and deposits it upon the free surface. You couldn't, by the way, "clog" these "pores" with ordinary dirt any more than you could an artesian well. Then the cells, which coat this surface like shingles on a roof, are constantly dying and falling off in literal showers, carrying all the impurities with them. Under modern civilised conditions, it is

hard to get enough dirt to accumulate on the skin to damage it.

It is easy to injure it by scrubbing and strong soaps. Pimples, "blackheads," and a bad complexion generally have nothing to do with "dirtiness" or failure to wash, and are often made worse by scrubbing and borax. In the treatment of the skin and complexion, a masterly inactivity is the safest guide. Let the skin alone, and treat other organs of the body. But that is another story.

Now, as to hot baths, these also have their uses and their drawbacks. They have two distinct fields of utility, the one purely mechanical or cleansing, as in the popular weekly hot bath; the other, for just the opposite function of the cold bath, soothing and relaxing instead of toning up and invigorating. As to their use for purely sanitary and cleansing purposes, little needs to be said, excepting to point out that as a means of constant and continual cleanliness, they are far inferior to the daily cold or cool bath.

Cool water, without soap, used daily, will keep the skin both cleaner and healthier and in a more comfortable condition than hot water and soap once a week, and if the former be regularly used, there is no real necessity whatever for the latter. As has been pointed out in the discussion of soap, the great thing to be avoided in bathing is taking too much of the natural lubricant out of the skin. Almost any one who is of at all thin and delicate epidermis, will have noted that the morning after a typical hot scrub the skin is inclined to feel dry and harsh and to respond to any irritation

that may be offered to it by flannels or underwear with unusual asperity. This degree of dryness and harshness, however, produced once or twice a week, is of no special seriousness.

Stiff scrubbing brushes of all sorts and descriptions are usually not only of no advantage, but are often distinctly injurious to the greater part of the surface of the body, and their use should be confined to the nails and the tough leathery surfaces like the palms and the soles. The popularity of the weekly hot bath as an institution is of course very largely due to the fact that many houses are not provided with a supply of city water, or water under pressure, and that consequently bathing has to be carried out in water which is heated upon the back of the stove and then carried into the bath-room, or more commonly yet, dumped into a wash tub by the side of the kitchen stove. Under these circumstances, it is an admirable and necessary institution. But from a cleansing point of view, it may be almost dispensed with in those houses blessed with a modern bath-room.

This is the bath *par excellence* of the Japanese, and is one of the secrets of their remarkable personal cleanliness. No matter how poor the hut may be, it is sure to contain some apparatus for heating water and a large sized wash-tub or boiler which can be used for bathing purposes. Every coolie even regards his evening bath as both a religious duty and the greatest luxury of the day. It is really an amusing sight to see the Japanese coolies upon one of our California orange ranches taking their family tub.

About an hour before the end of the day the good wife begins to get her fire up and a couple of large kettles or boilers of water on to simmer. By the time the head of the family comes back from the field this has reached almost the boiling point. A large tub is placed in front of the cottage in the open air. The workman assists his wife to carry out the water and pour it into the tub. Then off comes his scanty clothing, and into the tub he goes, where his wife stands over him, and scrubs and souses until he is clean to the joint satisfaction of both of them. Then the head of the family gets out of the tub and his wife promptly takes his place and goes through the same performance. After this the children in order of age. And then the whole family arrayed in clean garments goes in to supper. The panorama presented by a dozen cottages in line going through this duty of ablution about sunset is really a most entertaining one.

This brings us, however, to the other use of the hot bath, and that is its relaxing and soothing effects. These are very real, and, under proper circumstances, of great value. Partly by virtue of its heat, partly by the steam which is inhaled in the course of it, and partly by its stimulating effect upon the excretory glands of the skin, the hot bath has a remarkable effect in removing aches and pains, or "taking the soreness out of" tired muscles, and in early disease conditions "break up a cold," etc. For these purposes it should obviously be taken at or near bedtime, when the day's work is over and the skin may safely remain

relaxed for at least one to three hours afterward. For the average man or woman a bath of this description taken in the evening without soap about once or under certain conditions even twice a week, is perfectly legitimate, and indeed a beneficial procedure. It has also usually the desirable effect of inducing sleep in those who are disposed to insomnia.

However, it may become a source of danger by its very attractiveness. It is so soothing, so enjoyable, that it is easy to carry it to an extreme as to relax the skin and produce a more or less permanently depressing effect on the nervous system by its overuse. Roughly speaking, few individuals should take a hot bath oftener than twice a week, except on the advice of their physician. In certain diseased conditions it is of course of simply priceless value, especially in the later stages of chronic diseases of the kidneys and of the heart; and in the aged its skilful use will, so to speak, make the skin do duty for the kidneys for months and even years. But this of course is a matter requiring the most careful adjustment by expert skill, and should only be undertaken, like all other remedial agencies or drugs, under the watchful care of a physician. There is, however, a good deal of exaggeration in the popular impression of the extent to which a hot bath opens the pores and renders the bather liable to catch cold. If the water be as hot as the bather can comfortably bear, the immersion be not too prolonged and the skin rapidly and promptly dried in a warm room, the skin will be left so reddened and full of blood that instead of being more liable to the

evil effect of a chill, it will be even less so; so that, after a moderate period of adjustment, say a half hour or an hour, the bather can go out in the open air, properly clothed, with perfect safety, although, of course, it would not be advisable to take a long ride in cold weather or stand or sit exposed to the cold until chilled in this condition.

Indeed, the hot bath can be used not only as a relaxer, but as a tonic, and taken in the morning instead of at night. It is now quite extensively recommended by experts as a substitute for the morning cold bath where the individual is in such a lowered condition of health as to be unable to respond to the cold. About two or three inches of hot, not warm, water is allowed to run into the tub. The bather first steps into it, then sits down and rapidly and vigorously splashes himself from head to foot, either with his hands or with the assistance of a bath sponge, with the hot water. As soon as he feels in a glow he steps out of the tub and dries himself quickly, dresses and goes down to breakfast with almost the same sense of exhilaration as would be experienced by his stronger and more vigorous brother from the cold tub.

One particular form of the hot bath, the Turkish or Russian, has become such an institution in the land as to call for a few words of mention. While it has certain utilities, its name or names are fairly significant. It is an excellent bath for the man who never takes any more exercise than he can help and who seldom washes otherwise. In other words, it is a

kind of attempted short cut and vicarious atonement for laziness and dirtiness. It is used largely as a substitute for exercise; and while, if a man cannot be induced to take any exercise at all, it is better that he should take a Turkish bath than do nothing, yet it is an exceedingly poor substitute for exercise in the open air and nature's best method of blood purifying, a healthy sweat. As a means of eliminating through the skin in one round, as it were, the poisonous *excreta* which should have been gotten rid of by daily vigorous exercise it has, of course, its uses. But it is, upon the whole, to be classed with those drugs now so much reprobated by the profession, which are now tersely described as "symptom smotherers." That it is an excellent eliminant is clearly shown by its extensive use by heavy drinkers to rapidly get rid of the effects of a debauch.

No man ought to so situate himself with regard to his work that he cannot at least get two hours' exercise daily in the open air. This sounds like a mere counsel of perfection, but it is one which would be found, if followed, to pay abundantly in the long run. Practically, of course, many men that cannot or will not or fancy they cannot get this amount of exercise will find that the Turkish bath has its uses. It is also much relied upon as a popular method of breaking up a cold, and if properly applied is most effective. On the other hand, it is a singular and unexpected source of danger, even here. The very fact that it is so resorted to, and that the temperature is kept at a pitch equal to or above that of the body,

that the ventilation of the room is bad, and that plenty of moisture is in the air, renders it a superb breeding ground for the germs which we now know cause two-thirds of our so-called "colds." Some of the worst colds that I have ever seen have been contracted in a Turkish bath from the "bugs" that were left there by the last man that was cured, and not, as is popularly supposed, from getting chilled afterward. As a matter of fact, it doesn't hurt a reasonably healthy man a particle to be chilled. It is, indeed, a valuable bracer and tonic to him. From a hygienic point of view the Turkish bath is little better than a mild form of debauch, an attempt to get out of the system by mechanical means what should never have been allowed to accumulate there, or, in the case of the "booze-fighters," should never have been put into it.

This, of course, is nothing against it or its congeners, as a remedial measure in definitely diseased conditions. There it has a wide field of usefulness, but like every other remedy, may cut both ways, and should only be used by skilled hands.

But for popular use it is best adapted to the peoples who invented it and whose names it bears, the lazy Turk and the seldom-washed Russian.

Sea-bathing, as a special form of the cold bath, is to be judged by much the same standards. Partly by the salt contained in the sea water and partly by the surge and splash of the surf, it is intensely stimulating to the nerve endings of the skin and through them to the entire system. Moreover, it is a return to primi-

tive ancestral conditions, and sets the nerves vibrating as almost no other influence can.

The principal element to be considered is the temperature of the water. If this be warm, while a dip in the surf will be a superb tonic for the strong and vigorous individual, it will be of doubtful value, and if not carefully guarded, positively dangerous to the young, the weakly, or the aged. It may be judged by the same rule as that applied to the cold plunge, viz., whether it is succeeded by a prompt feeling of warmth and exhilaration. But it is so much bother, so much trouble, to get undressed, to put on one's bathing suit and get ready for a swim, and so disappointing to have to turn around and relinquish all the fun that one had anticipated at the end of two or three minutes if the water happens to be too cold, that here, as nowhere else in cold bathing, one is strongly tempted to overdo the matter, and remain in until disagreeably and even injuriously chilled. In fact, to lay down a rule of being guided by the results in sea-bathing is a little too much like the attitude of the monthly nurse who was asked whether she used a thermometer to learn the temperature of the baby's bath.

"Why no," she said, "what's the use? I just puts the baby right in, and if it's too cold it turns blue; and if it's too hot it turns red. I never bother with a thermometer!"

One of course never knows actually what the temperature of the water is until he actually plunges into it, and the assurances of its warmth by preceding vic-

tims are of course proverbially unveracious. Perhaps the best practical rule that can be devised is to use the more venturesome bathers who have preceded you as a kind of living thermometer. If their cordial asseverations that the water is "just as warm as anything" are hissed through chattering teeth, and their noses are red and their lips and finger-nails blue, then *"caveat emptor."*

Either don't go in at all, if you are feeling below par, or make a quick dash and get right out again. Never stay in until you feel uncomfortably chilly. Of course there will be often a momentary chill, from which you will react under vigorous thrashing and splashing, and as long as you feel warm and comfortable the bath is doing you no harm. The moment, however, you begin to have a sensation of permanent chilliness, or if you see the little curved part at the root of the finger nails *(lunula)* beginning to turn blue or dark, then get out at once, no matter what your friends may think.

You can of course react more promptly after somewhat greater degree of chill in sea water than in fresh, on account partly of the slap and tingle of the waves, and partly on account of the delicate film of salt which the sea water leaves upon your skin in drying. But this is at best a broken reed to depend upon, and it is far better to come out two or three minutes sooner than you could possibly have stood it and reacted promptly, than to stay in a minute beyond that period. Wherever you see individuals mooning about with blue lips and sniffling noses, yawning and stretching

and slapping themselves to try to restore a sensation of warmth to their bones, you may be certain that their surf bath has done them harm instead of good.

As in the cold bath, there is no benefit whatever in heroically enduring chilliness, shivering, and acute discomfort in sea water, under the impression that because it is disagreeable, it is manly and bracing, and will in the long run do you good. Sea bathing should be regarded solely as an enjoyment, and practised as such. The strong and rugged and red-blooded find it a bracing and exhilarating sport, and may indulge in it freely, not only without harm, but with great benefit. The weak and relaxed and undervitalised, and especially all who know themselves to be below par in any respect, heart, lungs, kidneys or what not, must indulge in it most sparingly.

As usually practised, except to a few most vigorous and hardy individuals, it probably does at least as much harm as good. I have known many instances of neurasthenic women, of rapidly growing girls, of incipient invalids of all sorts, who have gone down to the sea coast and improved superbly until in an evil moment they yielded to the banter and jeers of their companions and went in for a swim.

One dip in the cold waters of our Northern coast may undo all the good of weeks or months of careful rest and upbuilding. It is of course a great temptation, especially to the young, to do what all their companions are seen to be doing; and the average attitude of the thick-skinned, red-blooded animal that enjoys it, of jeering at those who do not as cowards, and

molly-coddles and "Miss Nancys," is one that has been productive of an enormous amount of harm. It should be severely discouraged and soundly repressed by all who have the welfare of children at heart. Young people should be taught to determine their own conduct quietly and unobtrusively, without regard to the example or clamour of others.

As a rule, if bathers only went into the surf when they felt like it and stayed in only as long as they enjoyed it, sea bathing would be almost robbed of its powers for harm, which, as it is at present practised, are quite extensive.

CHAPTER IX

CLOTHES AND THE WOMAN

THE obvious does not always happen to be true. Few things could appear more self-evident, on but the merest glance at the fearful and wonderful garments which envelop us, than that clothing was originally designed to protect us from the weather, had its basis in utility, in fact. And yet few things could be farther from the truth. Nothing could have been farther from the mind of our supposititious ancestor, the noble savage, "when naked through the woods he ran," than that such scraps and fragments of garments as he wore were to protect him from the weather.

Instead of putting on clothing to protect himself against the weather, primitive man's first step was, as a matter of fact, to denude himself of such natural clothing as he already possessed in the shape of his hairy coating, which, in the tropical climate in which he originated, was not only unnecessary but a source of perpetual annoyance in the days before insect powder was invented. The first step toward dressing was to undress—a tendency which still survives on state occasions. The face, emerging first, was pronounced good, and the process was enthusiastically extended to the remainder of the body. The old theory that the skin of man became denuded by the friction of cloth-

ing and that the hairy coating disappeared because it was no longer necessary is utterly unsupported by the facts.

When man had succeeded in clearing himself, with the energy and enthusiasm displayed by our American pioneers in the backwoods, his artistic genius, which was just developing after the fashion of the small boy's, discovered that here was a superb background for the display of its triumphs. With the aid of charcoal and pieces of coloured stone and sticky paints, lines and patterns and figures were gleefully painted upon the surface, and so delighted was he with the effect, that he proceeded to etch them in with sharks' teeth, splinters of bone, and thorns. That this stage actually occurred in our ancestry we furnish amusingly conclusive proofs in our own time, by the delight that nearly every boy takes at a certain stage of his development in having blue hearts and pink anchors tattooed on his arms.

A little later, it occurred to some savage genius that the general effect might be pleasingly heightened by hanging fringes and pendants of various sorts around the neck, the waist, and the wrists and ankles. These, of course, were of the scantiest at first, but they gradually expanded and grew, fringes were hung from the necklace, feathers were stuck into it, bits of bark were worked in to make it stand out better, the more expensive skins of rare animals were combined with it, and finally it became a cloak. By a similar process of expansion the ornamental belt combined with the loincloth to form the short skirt or kilt.

That was about as far as the process got in the tropics. But when the more enterprising members of the race began to push farther and farther away from the equator in search of game or berries or for cooler places to make their summer camps, they began to find that these cumbrous and exceedingly expensive ceremonial cloaks and kilts were of value as protection from the weather. The cloak was therefore lengthened into the blanket, and the kilt was brought below the knees. But this so obviously interfered with the use of the arms in fighting and of the legs in running, that a further development was necessary, and another genius stepped into the gap and split the kilt to form the loose trousers and divided the cloak to make sleeves. This, however, was a comparatively late development. Indeed, a large part of the species has not yet been more than half emancipated by it. It naturally did not occur in the tropics, because there the only time that cold was experienced was at night, when it could be met by the throwing on of blankets or wraps. Even as a protection against rain, garments were of little use, because the ordinary tropical rain is a drenching water-spout-like downpour, which will penetrate everything except a mackintosh within a few minutes.

One of the big-game hunters gives a most amusing account of the way in which his native bearers and hunters in Central Equatorial Africa prepared for a rain, namely, by stripping off every shred of clothing, rolling it into tight bundles, which they put inside their packs, and going naked. He had the openness

of mind to follow their example and found it a great relief, as instead of feeling drenched and clammy and sticky through the rain from the clinging of his soaked garments and chilly the moment it ceased from their evaporation, he kept cool and lithe and comfortable like a trout in a pool, and the moment the rain ceased, he was dry. The one drawback was his shoes, which the epidermis of his soles was not thick enough to allow him to take off in the forest trails. These got full of water and "squashed" and gurgled most abominably.

Loose, flowing garments which do not come close enough to the body either to interfere with ventilation or absorb perspiration and can be readily thrown off in the privacy of one's own quarters have remained the standard of wearing apparel throughout the tropics and subtropics. Hence hygienic-costume problems are there totally different from ours, and, indeed, most reformers urge us to hark back to the picturesque and sweeping voluminousness of the dress of those regions. It is when tailors begin to make things that cling closely to the body and hamper its movements that trouble begins.

Contrary, perhaps, to popular impression, we have less quarrel from a hygienic point of view with the ornamental aspects of clothing than with its utilitarian ones and those growing out of false ideas of modesty. We have been accustomed to lay more stress upon the former because they seem so absurd and so unnecessary. Mere ideas of beauty or of ornament certainly ought to give way to considera-

tions of health. We have, therefore, declaimed without mercy against the diaphragm-cramping, liver-displacing corset, the tight shoe, and the pneumonia-breeding exposure of full dress, or rather undress. All that can be said on these subjects, and more than can be supported, has been said so many times that it is superfluous even to refer to them here. It might simply be said in passing that most of the hepatic, pelvic, and other displacements that are laid at the door of the corset are to be found in abundance in women who never heard the name of the instrument; and that the death-rate from pneumonia and tuberculosis in the classes that never wear what, with delicate irony, is termed full dress, is at least thirty per cent. higher than in the classes that do indulge in this alleged absurdity.

The chief quarrel which hygiene has with clothing is that there is too much of it; that garments come down too far, are too tight, too heavy, too hot. We do easily four times as much harm to our health by overloading ourselves with clothing and by over-indulging ourselves in the luxury of warmth (cramping the movements of the body, interfering with the respiration, depriving the skin of its most inalienable right, the right to fresh air, soaking up the perspiration, and making a refrigerating cold-pack for the body after exercise), as we do by simply pressing the body at some single point like the waist line or the ball of the foot.

At bottom the corset is but a device for enabling us to wear and retain the voluminous clothing which

modesty and comfort demand without totally losing all semblance of figure. Get rid of the absurd superfluity of skirts and petticoats, and the corset will disappear of itself.

Here again we have to contend against, not an idea of beauty, not even a false one, but a ridiculous form of that exceedingly doubtful virtue, modesty, which makes it a capital offence for the gentler sex to show that they are bipeds. Mrs. Grundy demands that from a conventional point of view they shall be regarded as all in one piece, like the figures in Noah's arks. And there you are. Not merely the doctor—he doesn't count for much anyway—but the artist, the sculptor, the intelligent modiste, have all alike inveighed against this idiocy for three-quarters of a century, with just about the same amount of effect as Burdette says good advice has upon the mind of a young man, namely, "In proportion to the square of the contents of the hole that is left in the centre of a bowl of water after you take your finger out of it."

The influence of modesty, that curious virtue which begins just where innocence and purity leave off, would require a whole chapter, but it would be both humiliating and—hopeless. Suffice it to say that the story of the fig-leaves in the Garden of Eden is both typical and significant. It never occurred to our first parents that they needed them until after the episode of the apple.

In fact, beauty and health go hand in hand here as almost everywhere else. A loosely draped toga or

other upper garment with short or no sleeves, a loose divided lower garment reaching but little below the knees, with a cloak, mantilla, serape, or what not for rain or cold, is the ideal costume alike of the classicist, the sculptor, the painter, who puts all his favourite subjects into it wherever freedom of choice is permitted, the high-class costume artist, and the physician and physical instructor. The late M. Worth, master dressmaker of the world, kept hanging for years in his consultation chambers a costume of this description closely resembling that worn by the upper-class Persian women, which he pointed out to every one of his customers who asked him for an ideal costume.

The trouble is not so much with our false ideas of beauty as of morals. In fact, although ideas of beauty have led us into certain dangers in dress, they have protected us from others, or would have done so if they had been given reasonable consideration. The chest-protector and the everlasting flannels are just as repugnant to an intelligent hygienic sense as they are to "the sense in us for beauty," and have done almost as much harm to the health of the species as any two beauty-born absurdities that can be mentioned.

From the most matter-of-fact physiologic, yes, even chemical, point of view, we are ready frankly to concede that it is perfectly legitimate to require of a garment that it be beautiful, or as nearly so as may be, considering what wears it. If it is "uglifying," it is pretty safe to be unhygienic. You may apply

this touchstone to the creations of the dress-reformers as freely as you please.

Biologic morality recognises pride as one of the chief of the virtues, in spite of its occasional excesses. And there are few more wholesome forms of it than pride of appearance. The individual who is fastidious as to the external form and appearance of his or her clothing is exceedingly likely to extend that fastidiousness and high sense of cleanliness to the body under the clothes. To be "well groomed," in our expressive modern vernacular, is to have made a long step toward keeping in good health, especially when the care is extended, as it usually is, to those most important organs, the teeth, as well as the hair and the nails.

Even horse trainers have discovered that thorough and vigorous grooming will take a couple of seconds off a racer's record. And the stodgy and unimaginative steer can actually be made to gain weight by the procedure. A good coat, a satin finish, is not only the chief sign of health in animals, but a means of its continuance. Men and women who take pride in their personal appearance are at least twenty per cent. more likely to avoid dangers from infection and from filth of all sorts and to resist successfully such illnesses as they may encounter than are those who are slovenly or indifferent.

Proverbs to the contrary are, of course, abundant, but these, as usual, are little more than the attempts of mediocrity and cowardice to console themselves for their lack of success. Fine feathers do not always

make fine birds, but you will find the latter inside of the former eight times out of ten. And while all that glitters is not gold, as that sage philosopher, the Hon. Isaac Epstein, remarks, "But if id does glidder, you can bet id aind't mud." Appearances are occasionally deceitful, but not half so often as proverbs or moralists.

The chief and commonest objection to a garment, from a hygienic point of view, is that there is too much of it, that it covers in one piece too many joints in succession. The dangers from this offence are, of course, obvious. What makes us warm-blooded animals is our muscles, and if the play of the muscles is interfered with persistently through all our waking hours, the effect is deadening and devitalising. The best way to degrade people into dolls is to dress them like dolls. Not only so, but this fault takes away one of the perfectly legitimate and most important incentives to acquiring a good muscular development, and that is the opportunity to display it visibly. The minute a man begins to get good biceps or a well-rounded forearm, he wants to roll up his sleeves. And when he has a shank that is something better than gas-piping he has no particular objection to knickerbockers and golf-stockings. At first thought this may seem a comparatively trifling influence, but the more it is considered the more far-reaching it will be seen to be.

So far from the exposure of the arms and chest, which the conventional evening dress demands of women, being injurious, it is rather beneficial physi-

cally. In the first place, colds are *not* caught by direct exposure of the upper part of the lungs to even chilly air. That childish fallacy was exploded long ago. And again, the necessity of displaying well-moulded arms and well-rounded shoulders has acted as a powerful stimulus to the development of these parts of the figure in the women of the leisure class, in whom otherwise they would have tended to atrophy from disuse.

The harm done both by the exposure to possible chill from the baring of the neck and arms in evening dress and by the wearing of those charming but diaphanous creations through which every wind of heaven can blow, and which the really sterner sex yet wears with smiling face when the weaker one is going about with its coat collar turned up, has been enormously exaggerated. The colds and the "declines" that are developed by fair young creatures on account of going to parties when the doctor told them not to are due either to the foul infected air of the ball-rooms or the absurdly late hours kept. As long as they feel warm and have a good colour and a good circulation, women and girls may go as thinly dressed as they please with comparative safety. And really the habit is self-regulating, for the minute a girl's nose turns red or her lips blue, she is a fright, and she knows it.

The next most objectionable feature is that a garment clings closely to the figure. This is undesirable for two reasons. The first is that it is apt to repeat the offence that we have already been discussing,

namely, cramping the necessary movements. No garment can be as elastic as the skin, and, however thin or loosely woven, if it fits at all closely over a joint or even over the swell of a muscle, it is sure to cramp free movement, and the amount of interference with muscular efficiency which will actually be effected by the gentle pressure of even a silken garment which fits closely to every joint and every muscle-body is something incredibly great. Just try playing tennis some day with a close-fitting sleeve and a cuff that draws closely round your wrist; your arm will be useless inside of a dozen games.

But the greatest defect of the close-fitting garment is that it interferes with the natural ventilation of the skin. This, it is true, is only a small per cent. of the total ventilation of the body, carried on chiefly through the lungs, but it is an exceedingly important part. The amount of excreta given off by the skin is small, but these excreta appear peculiarly poisonous.

Pflüger has recently obtained some most curious results in experiments upon skin ventilation. He put his subject in an ordinary pneumatic cabinet which he closed tightly, and timed him to see how soon he began to show signs of distress from fouling of the air. He then opened the cabinet, filled it with fresh air, and put the subject back into it with his head protruding through an opening in the door, which was closed by a rubber washer or apron fitting closely round his neck. He was thus getting a full supply of fresh air through the lungs, while his skin was breathing in the confined space of the cabinet. Much

to Pflüger's surprise, after a somewhat longer interval than before the patient began to show symptoms of distress, to gasp for breath, and to complain of dizziness and a sense of oppression. Just as soon as the water vapours and extractives in the air-chamber had reached a certain density, and the air a certain degree of heat, no more could be given off from the skin, and the sensations of skin-suffocation appeared.

This throws an interesting light upon the remarkable relief given in hot, close rooms by a current of air from an electric fan, even though that be placed in a closed corner of the room and merely stirs up the air which is already present. By giving a constant change of air to the surface of our bodies, it cools them and prevents them from surrounding themselves with this jacket of warm, foul air. It also throws an interesting light upon the value of the open-air treatment in consumption, a treatment which, by the way, is now being extended to pneumonia, typhoid and other fevers. So that it is exceedingly important that a garment should either hang loosely or be sufficiently porous to permit of free interchange of air, vapour, and heat between the skin and the external air.

Here again a true sense of the artistic comes to our aid by pointing out that clothing beautifies the figure, not by revealing the actual anatomical details, but by suggesting outlines and permitting graceful attitudes and poses. The beauty of the human figure consists chiefly in its lithe and graceful movements. In repose there is little particularly attractive about it. It

is certainly a far-wandered sense of beauty which would insist upon garments fitting closely to the figure at more than a very few points. While the proportions of the athlete or of the Venus de Milo are a thing of beauty and a joy to look upon, those of the average human form divine are not exactly in that class. From the point of view of the bathing-beach or the gymnasium we must admit that it was a fortunate day for most of us when clothing was invented and became *de rigueur*.

The next defect of clothing is that it is too thick. This is injurious in two ways: first, by interfering with the free ventilation of the skin, and second, by keeping the body surface at an abnormally high temperature, and as a consequence of this promoting excessive perspiration.

The one thing for which we have been striving with our houses, our heating appliances and our clothing, is to surround our bodies with an air of as nearly uniform temperature, day and night, winter and summer, as possible. This aim, while perfectly legitimate and necessary within certain limits, can easily be and habitually is carried to an extreme. We are now beginning to discover that not a uniform, equable temperature, but frequent and rather vigorous variations of temperature form the ideal *milieu*. That climate is the most healthful, not merely to vigorous individuals, but also to a majority of invalids, which has well-marked contrasts both between the seasons and between day and night. Heat stimulates one kind of metabolic activity, cold another, an equable

temperature neither. When to its interference with skin respiration, its prevention of the wholesome and necessary stimuli of variations of temperature, we add its effect in both promoting excessive perspiration and keeping itself clinging like a wet blanket to the body, we can see how distinctly undesirable overthickness of clothing is.

The last defect of clothing is in being too impervious. This may be brought about, of course, by mere thickness alone, but also by material which is deficient in porousness. The most frequent offenders in this respect are rubber, leather, and furs. Leather is, of course, less objectionable than rubber, because in its natural condition it is somewhat porous, but most of this porousness has been destroyed by the tanning and the finishing applied to it. Neither leather nor rubber should be worn except as an emergency protection, and this statement, of course, applies to furs. As a temporary protection against the penetration of icy wind furs are of great value; but when worn habitually, and especially during any sort of muscular exercise, they are about the worst clothing ever devised, stopping ventilation, retaining perspiration and heat, and cramping movements.

This brings us to the question of the materials out of which garments may be made. This problem the age-long experiences of the race have solved fairly rationally, in that the vast majority of garments for human use are made of some form of woven web, wool, cotton, grass, or silk. The advantages of the woven web are, of course, purely mechanical; namely,

that except in a few of the very tightest of cloths, like duck, openings are necessarily left, through which both air and moisture can pass. Secondly, that by this same accident of construction they contain much air, which is the most important single substance in a garment. Thirdly, most of them are somewhat elastic—at all events, much more so than skins or hides.

The factors which have raised flannels and other woollen fabrics to such an extraordinary pinnacle of sacredness in pseudo-hygienic circles are that, in addition to being porous and elastic, they "feel warm," a sensation due to the pricking of the skin by the broken ends of the woollen fibres, and, weightiest of all, retain the shape of their mesh and consequent porousness to a certain degree when moist. This last can, however, be almost perfectly imitated in both cotton and linen by special weaves and meshes. As is well known, if you get wet through with flannels on, it does not chill you as it would if you wore ordinary cotton. The ordinary cotton fabric collapses when wet and becomes nearly impervious and a rapid conductor of heat. The woollen fabric retains to a considerable degree its form, is still porous, though, of course, less so than when dry, and does not permit the escape of the body heat. When this has been said, however, all has been said, and the grovelling worship of flannels as the Word of Power in problems of clothing is almost as absurd as anything that the slaves of fashion have been guilty of.

While woollen fabrics deserve the highest place for

all round wear, especially for exterior garments, yet for underwear they have certain grave defects. In the first place, that mild scratchiness which makes them feel warm to the majority of skins, to a large minority is intolerably irritating, especially in the case of the delicate skins of children. Many and many a case of obstinate "heat rash" in an unfortunate infant will be found to be limited to the area covered by his life-saving flannel bandage.

In the second place, while this stimulating quality is beneficial in cold or cool weather, it is distinctly injurious in hot weather. Thirdly, while capable of absorbing perspiration and remaining non-conducting to a high degree, they unquestionably promote the flow of the secretion very distinctly; in fact, it is almost an open question whether they do not produce as much perspiration as they absorb.

Most vigorous individuals in moderate health will find that they can carry out a given amount of exercise with less clamminess and less discomfort from both heat and perspiration in cotton or linen underwear than in woollen. Flannels are both more difficult to wash than cotton and much more expensive, so that they are not likely to be changed so frequently. Moreover, in the process of washing, they have a deadly habit of shrinking, with results that are not exclusively comical, inasmuch as the more they shrink and the more board-like they become, the more do they lose the good quality of porousness with which they were originally endowed.

Put not your trust in flannels or in clothing of any

sort. They will break in your hand like a wooden sword. Live vigorously and joyously in the open air, sleep in a draft, put plenty of good coal under your boiler, and you will keep warm and healthy in almost any kind of clothing, providing there is not too much of it.

CHAPTER X

THE COMPLEXITIES OF THE COMPLEXION OR THE MEANING OF A GOOD COLOUR

FEW things are more irrational than our hygienic, moral and official attitude generally toward beauty. It is officially decried as the most evanescent of life's fleeting shows, as vanishing as Burns's "Snow-flake on the River":

"A moment white, then gone forever."

Besides, it is deceitful above all things—the lure to lead us into all sorts of trouble—a thing that as a name or a consideration that should influence us in the serious affairs of life should not be considered for a moment.

And yet—and yet it drags everybody at its chariot wheels, including even the moralist and the practical man themselves. We can readily understand the denunciations of beauty. They are the desperate attempts of the rational and the prosaic sides of our nature to protect themselves from being utterly overwhelmed and overriden by this conquering daughter of the gods. But why, when we can see that it is so often a mere matter of surface tints and know that it is fleeting, are we so irresistibly attracted by it? Biology has an answer ready. That practically eight

times out of ten beauty is nature's seal of approval of wholesomeness and of purity. Our ideas of beauty have been built by age-long experiences of the race upon the crude old matter-of-fact principle, "Handsome is as handsome does." To put it very crudely, yellow is beautiful because it is the colour of the sunshine, of warmth and light and growth. Blue is beautiful because it is the colour of the clear sky. Red, because it is the colour of the crimson life-blood, the mark and the sign of healthy vigour. A particular type and contour of face are beautiful because they are usually found associated with health, cheerfulness, and efficiency in our own particular race. This is why the white races have one type of feminine beauty, the yellow races another and widely different one, and the black yet another. Though as all these belong to the human species and are more alike than unlike, their ideals would agree in many particulars.

In short, the very fact that a face strikes us as beautiful is, though by no means conclusive, good presumptive evidence that it is an index of balance, of vigour and cheerfulness, in other words, of the best qualities of the race. Curious proof of this may be found in the fact that a composite photograph of say one hundred individuals is always "better looking" than what we would regard as an average member of the group. The normal or racial features stand out prominently, while the abnormal, or defective, neutralise one another.

This brings us to the heart and crux of our subject.

First of all, that it is perfectly legitimate for an individual—man or woman—to desire, and by all reasonable means to attempt to obtain, beauty. But, secondly, and even more fundamental, that beauty must be, in nine cases out of ten, the surface reflection of vigour, wholesomeness, and purity, an index and a product of the deepest and most fundamental facts of bodily structure.

Few things could be falser than the oft-quoted old proverb, "Beauty is only skin deep, while ugliness goes to the bone." Easily two-thirds of human beauty is beauty of face, and a large share of this dominant element consists in that curious complex, built from a variety of influences, which is not inaptly from this point of view termed "a good complexion." For a more complex phenomenon would be hard to discover in the whole realm of nature.

First of all, every particle of colour that the complexion has is borrowed—borrowed from the blood and from the heart, and the only terms upon which the loan will be continued is the prompt, regular payment of interest, not annually or semi-annually, but daily. Said interest to be paid in coin or bills of four denominations, drawn upon the banks of the universe, viz., fire, water, air, and water. Fire in the form of that embodied sunlight we call food. Air and water in the form of a continual bath of one and frequent ones of the other. The earth, by exercise upon or in it with foot, spade, or racket. All the changes in the colour of the complexion are due solely to the amount of blood flowing through the blood-

vessels of the face and the quality of that blood. The condition of the skin of the face has practically no more to do with it than the glass in the florist's window has with the flowers displayed behind it. Its whole duty, its utmost effect, is achieved when it keeps itself clean. It is simply a living, elastic, ground-glass or celluloid plate through which the rosy blood, alike the life essence and the product of the entire body, can glow. We talk of the hero or the saint "with his soul shining through his face." Every one of us literally shows his heart through his or her complexion.

It is as idle to attempt to change in any lasting way the colour of the complexion by local manipulations or applications of any sort as it would be to make the petals of a rose redder by massaging them. When a gardener wishes to improve the size and colour of a rose, he knows exactly what to do. He plants it where it will get the morning sun and yet be sheltered from the northeast winds. He enriches the soil about its roots with a lavish hand, shelters it from the glare of the mid-day sun, so that its sleep is not disturbed; he cleanses and cools its leaves and stalks by sprayings and sprinklings with pure water. And he gets his results. Just so must we go about it to improve that choicest rose of earth's garden, the human face.

The only way to have a beautiful complexion, is to observe the rules of nature's universal beauty game, or to inherit one from ancestors who have played the game. And even this choicest gift of the gods can

only be retained by complying with the conditions, paying the interest on the loan.

A good complexion is like happiness. The best way to miss it is to aim at it directly. It cannot exist either of itself nor for itself alone any more than "art for art's sake." Its colour is simply a flag flown at one of the outposts of the blood army. The only way in which it can be kept floating is by having a strong central force and plenty of patrolling parties, to keep the lines of communication open and maintain a sufficient guard at the outposts. And the guard is changed every fraction of a second. There is no such thing as a permanent "good colour." The outpost is not even held by a permanent garrison, but its ruddy patch of vigour is due to a continuous stream of red corpuscles hurrying by at a double-quick day and night. Stop them for two seconds and you get black in the face.

Let the knife of the rosiest, ruddiest fisher-boy that ever handled an oar slip and gash his femoral artery and his face will become the colour of marble or of old ivory in a handful of minutes if the flow is not checked.

One of the many "complexities" of this subject is the exceptions that have to be made to every rule or statement. And here is one of them. That some girls and a few women will have perfectly ideal complexions, from the "June rose" to the "peaches and cream" varieties, and yet defy every known rule of health or of common sense.

But even for this biology has ready one of its cold-

blooded explanations. A good complexion, a fine colour, is not merely an index of health and vigour, but an advertisement; and as the flower develops the glowing colours of its petals to attract the bee or the butterfly with his load of fertilising pollen, so wise old Mother Nature in the kindness of her heart has permitted our human buds and blossoms in the springtime to show the rose in the cheek as a charm to all observers. That is why we were all beautiful (or much more nearly so than at present) when we were young. Far the greater part of this happy faculty of the springtime of life is due to the greater wholesomeness, freshness, and happiness of our whole body and mind in this rose-coloured period. But not infrequently we find some daughter of Eve who has the charmed power of keeping half her life-blood coursing through her cheeks and glowing in her eyes. Like all hot-house flowers, these are usually the first to fade. But while they last they work havoc, both among hearts and hygienic laws. These are the cases that destroy all the authority of the doctors in matters cosmetic, that reduce to a mockery our rules of health, and make us throw up our arms in despair whenever the question of complexions is mentioned. It is simply one of the exasperating mysteries of the sex, which make it so utterly unmanageable, so impossible to generalise about—and so charming. It is these exceptional women who are beautiful in spite of themselves, no matter what they may do which they should not do or leave undone which they ought to do, that are the basis for the denunciations of

the moralists, of "Favour as deceitful and beauty as vain." They are the despair of the hygienist, because, with a logic that is the privilege of their sex, they usually choose to regard this inborn and unescapable gift of theirs as due largely, if not chiefly, to the silly, fluffy, little canary-bird things that they do to their faces, from lemon juice and buttermilk to cold creams and face masks—all of which combined have as much to do with the case as the proverbial "flowers that bloom in the spring." And two-thirds of their less fortunate sisters imitate their logicality and imagine that by pathetically infantile pattings and splashings of this sort they can reproduce in themselves these inborn, age-inherited charms.

"Mrs. So-and-So has a complexion like a peach, and *she* says she owes it to bathing her face in lemon-juice every night and sleeping on a violet pillow." "Doctor So-and-So tells me to sleep with my windows open, take more exercise and cold baths—and I just *hate* 'em—and *he's* got a skin like a nutmeg-grater, and a nose like a beet."

It is easy to guess whose advice will be followed.

Nevertheless the fact remains that these women who are beautiful in spite of themselves are an exception and a small one—not more than two or three out of every one hundred. And for the vast majority of us, men and women, the best hope of beauty or attractiveness lies in playing the age-long rules of the game. You may have good red blood in your body, and not have it show in your face as much as you could de-

sire. But unless you have it in your body, it can't show in your face at all.

When your blood is thin—in the popular phrase "watery"—deficient in red colouring matter and fat, your complexion will be poor and anæmic no matter to what desperate local measures you may subject the unfortunate skin of your face. Good blood and plenty of it is the only sure recipe for good colour for the vast majority of us.

The next element in the "complexity" of this complexion phenomenon is the element of outline, of plumpness and softness and graceful curves. This again is in part due to the amount of blood circulating through the tissues, for the skin of the face is wonderfully well supplied with blood vessels, and will swell like a sponge or shrivel like a dried fig when these are distended or emptied. But the most important element in plumpness and roundness of outline and softness of skin is a most matter-of-fact and unexpectedly prosaic one, and that is plain fat. Every inch of our skin is padded and underlaid by a layer of semi-liquid fat, which thickens in the depressions into positive cushions. Not only is it necessary as a lubricant to allow the skin to glide smoothly over the interlining muscles and bones, but it is absolutely essential in a most vital way to its nutrition. When once the layer of fat that underlies our skin has been absorbed, as in starvation or illness, the skin becomes harsh, dry, and rough, and is apt to crack and fissure. And there is no absolutely known method as yet discovered by the wit of man for fattening one part of the body

and leaving the remainder of it thin. If you want to give a graceful plumpness and roundness of outline to your face the only way to do it is to feed the entire body. There is a homely Western equivalent for an invitation to dinner, to "draw up yer cheer and set down an' feed yer face," but it remains the only known method of accomplishing this latter feat.

A "skin food" is as utter an absurdity as a brain food, a foot food, or a nose food. The only possible way of feeding the skin is from the inside.

The next element in contour, the lines of the face, the expression, the possibility of wrinkles, is due to another vital activity beneath, and to a considerable degree outside, the skin itself. And this is the muscles of the face. Here alas! we have yet another division of this complex subject, which is itself "complexity worse confounded." Suffice it to say that the whole skin of the face is underlaid with a sheet of muscle, broken up into larger and smaller bands and fibres, each attaching themselves at their deeper ends to the underlying bones of cheek, jaw, brow, etc., and at their surface ends to the deeper layer of the skin. Their purpose, very briefly, is to open and close the different orifices, eyes, nose, and mouth, which have made the face the face. It might appear at first sight that here was an apparatus which, as the muscles are voluntary, we could control by exercise of our will, and hence determine our own attractiveness of expression. But unfortunately—or rather fortunately—the matter goes far deeper than this, and if there be anything which is beyond our control, it

is the expression of our countenances, for the brief biological reason that the contractions and relaxations of these muscles are governed by the needs and conditions of the canals or openings which they close. The muscles of the lower half of the face, roughly speaking, are controlled by and reflect the condition of our digestions, and respond to impulses from every inch of our thirty odd feet of food tube. The muscles of the middle third, surrounding the nostrils, are controlled entirely beyond our power of interference by the conditions of our lungs and body tissues in regard to their oxygen supply, while those of the upper third of the face respond to the impressions made upon our optic nerves and sense of smell, and as these are the foundation of our brain, in a general way upon our whole minds and intelligence. It is little wonder that our shrewd old ancestors for hundreds of generations past have attached great importance to the expression of a man's countenance as an indication both of his efficiency and his disposition. Not what we would like to be, but what we are, is written upon our faces. If we want to have a cheerful and pleasing expression, we can't get it by repeating patent formulæ like, "Papa, potatoes, prisms, prunes and plums!" but by living the life, and playing the game hard but fair. If you want to keep unpleasant lines from appearing at the corners of your mouth, do not skimp on your butchers' and grocers' bills, in order to spend on veils and skin foods.

If you wish to keep the crows' feet away from the

corners of your eyes, live a wholesome, cheerful, natural life, as much as possible in the open air and the sunshine, instead of trying to rub them out after they have happened with anybody's massage cream. Old Omar must have had in mind these deadly lines and marks upon the human countenance when he sang:

> "The moving finger writes, and having writ,
> Moves on, nor all your piety nor wit
> Shall lure it back to rub out half a line,
> Nor all your tears wash out a word of it."

The only real way of exercising your face is to exercise the entire body and mind. These little strands of muscle beneath the skin are in constant and incessant play during all our waking hours. They give the skin its only real and effective massage, again from the inside. If you want to exercise and develop it to its highest possibility of vigour, elasticity, and beauty, you must live and enjoy things with every inch of your body. And twenty-six pairs of these tireless little workmen, pushing and pulling and twitching it all day long, will do infinitely more, if you will only give them a fair chance and head them in the right direction, to improve your complexion and smooth out your wrinkles than the most elaborate pattings and rubbings and massagings ever thought of, which at best can cover a mere fraction of an hour in the twenty-four.

It is true that various of these methods, like massaging, steaming, bathing in very hot water, and the application of alcohol, camphor, acids and irritants of

various sorts, will draw the blood to the surface, and temporarily increase the amount of blood circulating in the face, thus giving an artificial glow or imitation "complexion." But they never can produce the real thing or more than a mere temporary effect. Moreover, like everything else in the world, action is followed by reaction. And the complexion that is perpetually fussed with in this way, and steamed and parboiled, or half skinned and scrubbed, is very apt in a short time to get a distinctly second-hand, or "5th of July," sort of appearance. In fact, it is nearly sure to do so unless it happens to be one of those hereditary and indestructibly good ones to begin with.

Last of all, there is the nature and structure of the skin itself to be considered. This is simply a great water-proof, air-proof, cold-proof, electricity-resisting sheet, which is spread over the entire body, for the purpose of shutting out injurious external influences. Its business is passive resistance, not active participation of any sort. Its duty is to shut things out, not take them in. It has glands, but they are for the purpose of pouring forth excretions, the sweat glands, and the so-called sebaceous glands for the lubrication of the hair. It has little or no more power of absorption than a mackintosh coat. Nothing save a few of the very strongest drugs can be driven through it except under pressure of a powerful electric current. Most of the drugs that we formerly believed were absorbed through it, like mercury, iodine, and carbolic acid, are now known to be volatilised by the heat of the body and inhaled through the nose and mouth,

while they scarcely penetrate the skin at all. Still less can any nutriment of any sort be made to pass through it. Milk baths, wine baths, and oil baths are pure relics of barbarism and superstition. They are practically never used nowadays except as an advertising dodge by clever actresses.

Its very structure is significant, its outermost layer made up of from three to five successive layers of cells, the deepest of which are comparatively round, the next cuboidal, and the next flattened or tile-shaped, from which they take their name, "epithelial," and the most superficial ones flat and scale-like. They are in continual process of growth and formation, forming in the deeper layers and progressing outward toward the surface, flattening and drying as they go. When finally they reach the surface, which they coat like the shingles on a roof, they are half dead and rapidly shrivel up, die and fall off. We are thus continually discharging a shower of scales of dead skin from every inch of our surface day and night. Supposing even that we saturate the surface meshes of these with some powerful mordant like iodine or paint them with a caustic like nitrate of silver or nitric acid, it is only the question of a few days or hours when the cells thus impregnated are shed and thrown off from the body. Everything that attempts to enter through the skin must run counter to this constant outward current of living cells. When by heat, friction, scrubbings, or even acids and caustics you peel off this surface layer of cells all you do is to increase the rapidity of their rate of dy-

ing a little and produce no effect whatever upon the deeper cells.

In fact, the skin is one magnificent mechanism for cleaning itself. As to cosmetics in general there is little to be said and that little, like themselves, probably useless. The worst fault of most of them is that they are utterly ineffective and that they delude those who use them into the idea that by these superficial and artificial tricks they can escape the penalties of neglecting their general health. Comparatively few of them are actively harmful. Those who have naturally good complexions will get good results. Those who have poor ones, poor results from them. Such ones as give artificial tints are of course frank confessions of failure and usually deceive few beside their wearer. Those that have to be rubbed in are useful to the amount of muscular exercise involved in said "rubbing in." If you really want to get the best result from a face cream, buy it by the quart, go out into the yard and rub it with both hands into the trunk of your favourite tree for an hour each day. It won't hurt the tree, and it will do your complexion far more good than if directly applied.

Real blemishes and defects of the skin, like pimples, pustules, blotches, roughness, chapping, scaly patches, birthmarks, are the results of disease, and, like other diseases, can be treated and cured by competent physicians. Diseases of the skin, or dermatology, form a large and important special field in scientific medicine and are no longer left to charlatans and adventurers.

Wash the face as if it were a window-pane—not a

kitchen floor. Nature's own face-cream is a delicate oil, poured out by the sweat-glands. Too hot water and too strong soaps remove this, leaving the delicate surface unprotected, to roughen, crack and chap.

The only known "skin tonic" that works is cold, in the form of cold air in liberal doses. This works partly by direct effect, partly by the exercise it spurs you to to keep warm, but chiefly by the appetite it gives you.

The best colours to apply to your face—through the opening provided for that purpose—are red meats, green vegetables, purple fruits, golden butter, white bread and sugar.

Take care of the body and the complexion will take care of itself. If you want to *look* beautiful, *be* it through and through and you'll achieve your ambition in some measure. "Hansum does" soon becomes "hansum is."

CHAPTER XI

THE SINS OF THE SHOEMAKER

EXTREMES produce extremes even in the human body. And it is a *proprium humani ingenii* to go to extremes about them. At one extremity of our bodily form is a structure almost unique in the animal kingdom, the lordly head with the illustrious brain that it shelters. At the other, another structure, the foot, almost equally unique in the animal world, and of most exquisite adaptability and mechanical beauty. It was the latter that made the former possible, and yet since the dawn of history we have flocked with one accord to admire and bow down before and render delighted honour to the expanded brain bulk at our upper extremity, while with equal unanimity we have thought little of, attempted to ignore, or even treated with open contempt and ridicule the equally necessary and almost equally valuable and beautiful development at our lower or pedal extreme. We have almost paralleled the fabled attitude of the peacock, who, it was alleged, would die of pride if it were not for his feet.

Certainly we are almost as unanimously inclined to be ashamed of our feet as to be proud of our brains. Yet in no small percentage of cases, I will not say how large, our pride would be more justly expended upon our lower than upon our upper extremities.

We seldom appreciate the exquisite adaptations and mechanical perfection and beauty of the human foot. Indeed, it is only sober and most painful truth to say that one of the most frequent fads of fashion or custom—even of morality—has been to endeavour to hide it from view, either by shutting it in tight leather boxes or concealing it with skirts and drapery. In many a savage tribe, in many a barbarous—nay, semi-civilised—court it has been considered the height of impoliteness to refer to the existence of the foot at all, to even imply that our high serenity is encumbered with such a lowly, plebeian and discreditable organ. We fondly endeavoured to keep up the delusion, in public, at least, that, like the fabled bird of paradise, we had no feet.

Even in this enlightened age we ruthlessly deprive our feet, though not of life, of liberty and the pursuit of happiness as regards expansion, fresh air, and sunlight. And then we wonder that they so frequently give trouble. Like every other "submerged tenth" of servile class in a community, they take their revenge upon their oppressors, and a bitter one it often is. Civilised man too often has reason to be ashamed of his feet as a result of the way in which he has maltreated and deformed them.

The first requisite for the intelligent understanding of a structure and mechanism is to know its problem, the uses which it has to subserve. The problem of the human foot is a new and exceedingly difficult one in the animal world. The support and propulsion of the quadruped is a comparatively simple affair. He

has simply a prop "at each corner," upon which he can stand at rest, with almost the mechanical stolidity of a table on its legs. Like the table, three legs will support him perfectly, and he always has, so to speak, one leg left for other purposes, such as rest, repair, attack, etc. When he wishes to move, all he has to do is to propel himself upward and forward in a rising curve with his powerful hind legs, swing his stick-like fore legs forward, and catch himself on them, gather up his hind legs and repeat the process indefinitely. Or, if slower movements are required, he can swing forward any pair of his legs, either on the same side or diagonally, resting meanwhile on the other pair. Consequently, he has been able to modify his limbs in a score of different ways, solely for speed purposes, and to alter his feet from the primitive five-toed pad into every conceivable shape and number of claws and hoofs, reaching even the extreme of resting his entire weight upon a single toe-nail, expanded into a box-like hoof, like the horse.

In man, with his erect position, the problem, though more similar than might appear at first sight, is markedly altered, and that in the direction of difficulty.

In the first place, instead of being able to have two kinds of feet, one to lift and throw him forward, the other to catch and support him, he has to make one kind of foot perform both functions. This means that a sufficient length of foot must be laid flat upon the ground in order to serve as a lever to lift and throw forward the body. As this lever must have

an arm, this makes necessary the spur-like projection of the posterior arm, or heel, behind, as well as the anterior projection or lever proper in front of the weight-bearing joint or ankle.

In the second place, as the body is obliged to balance itself fairly securely in walking or running upon one foot, it is necessary that the foot-sole should be broad as well as long. In other words, the human foot, to fulfil the new demands imposed upon it by the erect position, must be of generous length for leverage, and of liberal breadth for balance and support.

Against both of these requirements Fashion has persistently fought, with her usual inspired idiocy. Why she should have chosen to do it, is a mystery, except that everywhere we turn, in our attacks upon the shape and outline of our bodily members, feet, hands, waist, teeth, even head and nose, we seem to have been inspired by a firm determination just to make them "look different." None of them are as beautiful as they were before, few of them as efficient. And yet from earliest savagery it has been the inveterate habit of the race to cramp and pinch its feet, to amputate one or more of its fingers, to knock out, discolour, or file to a sharp point its front teeth, to flatten its head by tight bandaging in infancy, or to compress its waist to a wasp-like slenderness. The study of the whims of "beauty" makers will go farther to make one doubt whether man can be truthfully described as a rational animal than almost anything else. The most puzzling thing about the prob-

lem is, that not only are none of these improved or beautified feet, hands, eyes, teeth, waists, etc., as efficient or as healthful as in their natural or unspoiled condition, but that though their distortion has been committed in the name of "beauty," they are as inferior in beauty and gracefulness as they are in efficiency. The physiologist is ready to exclaim with Mme. de Staël:

"O *Beauty!* what crimes are committed in thy name!" The only consistent impulse that appears to have inspired them has been the desire to look different, to produce some change in our appearance which shall be recognised as a work of art, and admired accordingly.

Nowhere is this absurdity more strikingly illustrated than in the earlier idea of what constitutes a beautiful foot, particularly in the gentler sex. The popular demand in a feminine foot is that it shall be a narrow, pointed, elongated body, curved, or, more accurately, humped into a nearly horseshoe-shaped arch, the pillars of which are within a few inches of each other and consist of the compressed tips of the inner toes and a high, narrow heel brought forward almost directly under the centre of gravity. Its functions as an organ of support and locomotion are ruthlessly disregarded, and instead of a series of long, low, graceful arches, it is distorted into the resemblance of a link of sausage pointed at one end, or a banana in a convulsion.

The physician, the skilled pedestrian, denounce it as deformed, useless, painful, and almost disabled,

and the artist cordially unites in their attack and demands the very same outlines that they do.

The plan of the healthy, natural foot is an exquisite combination of arches, one long and low from the heel to the balls of the toes, the other short and high, crossing this at right angles a little in front of the ankle joint. These arches are built mainly of a number of wedge-shaped bones, but there is little that is "bony" or rigid about them, as their form is mainly preserved by the tension of three muscles of the leg, whose tendons attach themselves to both the upper and under surface of their keystones in a most ingenious manner. Thus the weight of the body is naturally supported upon the intersection of two graceful, yielding, living suspension arches, hung upon elastic cables of muscle, which by their expansion and contraction give a beautiful, springy elasticity to the gait. But in order to do this, they must, like all other springs, expand so that the foot ought to become both longer and wider when weight is placed upon it. For this change in form, the modern "pretty" shoe makes absolutely no adequate provision, and not only this, but by throwing a ridiculous peg-shaped heel far forward to give an appearance of shortness to the foot, the longitudinal arch is completely broken, the weight thrown directly upon the sensitive instep, and the centre of gravity of the whole body disturbed. The elasticity of the gait is destroyed, just as if a block of wood had been wedged between the flanges of a carriage spring.

The physiologist demands a long, low, gently arch-

ing slope from heel to toes, with a broad, graceful, fan-like expansion across the ball of the foot, and this is precisely the form which has been immortalised by Du Maurier in *"les beaux pieds de Trilby."* Mechanically the human foot is one of the most exquisitely adjusted, effective, and enduring instruments in the world; it will run down and tire out any hoof, pad, or paw that moves. Artistically, for beauty of outline, harmony of curves, dimples, and grace of movement, it is equally unsurpassed. Here beauty and strength go hand in hand, and fashionable deformity and feebleness.

Would that a poet would arise who in lofty measuses would sing not "Arms and the Man," but "Feet and the Man!" Pride is currently reputed to be a sin. But if there be one sentiment which I would like to implant in the human bosom, it is pride in our feet. They are among the most wonderful mechanisms in the world. And yet we cramp them into tight leather cases, carefully planned to diminish their size, and hide, or even alter their shape, as if they were something that we were ashamed to expose to the light of heaven. As they are now, as we have made them, perhaps we ought to be. But as we are born, there is nothing under heaven that we have a better right to be proud of, and to exhibit on every possible occasion. It may at first sight seem almost absurd for a physiologist and hygienist to seek to alter codes of etiquette or traditions of minor morals. But the sober fact of the matter is that there are few things that do more to prevent the proper development and

promote the diseases and deformities of the human foot, with the serious bodily disabilities and discomforts to which these give rise, than our present mental —and I had almost said moral attitude toward bare feet. After the years of innocence to be caught barefooted in public would probably fill most of us with a livelier and more irrepressible sense of shame and embarrassment than almost any other condition of *déshabille* that could be conceived. Indeed, our sense of disgrace and mortification at being seen barefooted anywhere except on the seashore would more nearly resemble that which we should feel when detected in a petty crime or gross impropriety than anything else. Like many of the more senseless of our pruderies and prejudices, this dread of displaying the foot is a part of that extraordinary feeling, half vice and half virtue, called modesty. But the puzzle still remains how it ever came to be included even under that capacious heading, except upon its usual ostrich-like tendency, of insisting upon hiding every portion of the human body, and declaring the exposure of even the face, hand, the hair of the head, the foot, to be immodest. Although, as we shall see, there are many serious practical objections, especially in our Northern climates, to going barefoot, as well as the purely etiquette ones, yet there is very little question that we shall never learn to admire and appreciate as they deserve the beauties of the natural and healthful human foot, until we get free of this morbid prejudice against its display in public at all ages. And until we do come to admire and recognise the natural beauty

of the human foot, we shall never accept or more than tolerate the gracefulness of the proportions of the shoes or other covering which would allow it to retain and develop this shape.

While there are practical difficulties in the way, and wide differences of opinion among those who have carefully studied the question, there is fairly substantial agreement that the adoption of some form of footwear, at least indoors and upon ceremonial occasions, resembling in its looseness, its free access of air, and its liberty for expansion and movement of the foot—resembling the classic sandals of the Greeks and the Romans—would be an immense help in our attempt to secure healthy, vigorous, and beautiful feet for civilised man.

The most effective way to get rid of corns, for instance, is to make us ashamed of them, as we certainly should be if we had to exhibit them in public upon state occasions. We will gladly continue to pay the penalty of the most exquisite tortures from them so long as we can hide them from public view, and console ourselves with the thought that they are the price which we pay for our ability to wear small and "beautiful" shoes.

However necessary practical considerations of comfort and of protection and efficiency may make the wearing of heavy shoes upon the street and across country, I cannot see any possible objection, and much advantage every way, in releasing our feet from their bondage indoors and during sports which, like tennis, golf, cricket, etc., are played upon smooth surfaces,

free from stumps, thorns, stones, and other sources of danger to the feet. Certainly children under ten years of age and women during the greater part of the time that they spend indoors and are not actually working or standing upon their feet should be encouraged to go barefooted as much as possible.

Just as a counsel of perfection, it is pretty generally agreed that the ideal footwear, except in stormy or most inclement weather, would be in the nature of a soft, porous, and elastic moccasin of cotton, silk, or linen in the summer, and of woollen cloth, felt, or buckskin during the winter, which should be worn constantly indoors, with well-ventilated sandals fastened by some simple clasp, which could be readily slipped off and on at the threshold of the building, for outdoor wear. But this, like the divided skirt, the Grecian waist-line, the soft, flexible hat with a real brim, and the other details of a rational costume, appear about coeval with the millennium.

Were such footwear adopted, and the feet permitted to develop in their full natural beauty, we might even come to spend half as much time upon whitening, manicuring, polishing, and otherwise beautifying our feet as we do now upon our hands, for the purpose of displaying them upon state occasions. It would be quite as reasonable from either an æsthetic or a hygienic point of view, and would do infinitely more to promote our comfort and our efficiency. As it is, we load our hands with gold and diamonds, and our feet with iron and sole leather, and then wonder that we

have corns and bunions upon the latter and never upon the former.

One of the gravest difficulties of this subject is that we do not half appreciate its importance. Even when our attention is called to the fact that our celestial intelligence must touch the earth at some point, and that the nature of that contact is of some importance, we dismiss it airily with some such time-worn pleasantry as importance of a "good understanding," and continue placidly to hug our fashionable shoes and our corns. As a matter of cold and uncompromising fact, until we either develop wings or our intellects become sufficiently powerful to walk alone and carry their bodies with them, our only means of a *που στω*, of a leverage and connection with Mother Earth, is through our despised feet. And the breadth and balance of that contact is a factor of greatest importance in not merely our efficiency but our comfort. Kipling has put one of his most penetrating flashes of wisdom in the mouth of the ever-delightful "Mulvaney," who advises a new recruit on his first night in camp:

"For remimber, me son, a soldier on the marrch is no betther than his feet!"

An aphorism that is fit to take rank with that of Napoleon, when half reproached for spending time upon such insignificant details as bread and bacon for one of his campaigns:

"An army, sir, is like a serpent—it travels on its belly."

It will apply to many a soldier in the march of life who has never smelled gunpowder.

The vital importance and necessity of strong, elastic, healthy feet as a means of movement and progress in all outdoor occupations, and of indoor ones that have to be carried out standing, is of course obvious to the dullest. Two-thirds of the breadwinners of the world are absolutely and directly dependent upon the efficiency of their feet for their ability to continue their labour. And when they are "off their feet," as the phrase goes, they are practically disabled.

But what we do not properly appreciate is the immense importance of firm, strong, well-expanded, pain-free feet as a basis for the entire carriage and balance of the body. So little muscular effort is required to support a quadruped that some of them habitually take the major part of their sleep day and night, standing. In man, on the other hand, every instant of maintenance of the erect position of the body, whether sitting or standing, is at the expense of powerful muscular effort. The most powerful and incessant part of this effort is expended where the greatest mass of muscles lie in the body, viz., the small of the back. They are like a great bowstring, subtending the forward curve of the lower half of the spinal column. Pitch the plane of support of the body forward even a few degrees, as is done by a high heel, and you instantly disturb all the delicate relations and counterplay of these great balancing muscles of the back and abdomen.

The pains and penalties attending bad shoes and

weak feet are not confined to the extremities, but punish *every other muscle in the body which is concerned with the maintenance of the balance.* No small percentage of the backaches from which we are so apt to suffer, especially among the gentler sex, whenever fatigued, are due to the disturbance of balance by high heels or bad shoes. Backache is the second commonest pain from which the human body suffers, because the great muscles in which it occurs are upon the most constant and unrelievable strain all during our waking hours. Everything that disturbs the plane, the expansion, or even the comfort of the feet adds markedly to the already enormous difficulty of maintaining the erect position, and causes probably from twenty to thirty per cent. of this frightfully common and disabling pain in the back, and aggravates fifty per cent. more of it.

One of the most striking illustrations of the disturbance of the body-balance caused by high heels is that ridiculous marsupial-like carriage which, under the names of the "Grecian Bend" or the "Kangaroo Droop," appears upon our streets about once in twenty years, whenever one of the periodic attacks of this form of *folie circulaire* is at its height. And really, if high heels must be worn, it is much better from a hygienic point of view to frankly abandon the erect position and resume this semi-quadrupedal one until the periodic insanity has subsided. For the last five years we have been in the inactive phase of this recurrent delusion, and many of us had even been lay-

ing the flattering unction to our souls that the short bicycle skirt and the low heel and long last were really signs of an increasing intelligence and rationality in the human species. But, alas! There are signs already that the curve is again mounting toward the positive phase. The short skirt is almost gone already, and the high heel is reappearing.

The most serious aspect of the sins of the shoemaker is the degree to which they turn what should be the most enjoyable and exhilarating of all exercises, walking, into a labour and a punishment. Fully half the difficulty which physicians have in getting their patients to take a rational and healthful amount of exercise in the open air depends upon the disabling and punishing effects of tight, narrow, wedge-shaped shoes, of shiny air-proof and water-proof material, with or without high heels, that not merely etiquette, but even decency and decorum, have inexorably prescribed for formal wear during business hours and in public.

This is of course doubly effective in women, although it must divide the honours of percentages of crippling with the undivided skirt. When it comes to the point that you have to go home and change your shoes before you can take any real exercise with comfort, you may be certain that your muscles are going to be permanently unexercised and your tissues unventilated.

It must be frankly recognised at the start that the shoe, though an evil, is a necessary one. Great as is the damage which it can inflict if unintelligently and

irrationally applied—great as are the abuses to which it not merely is subject but has almost constantly led —it on the whole protects us from more dangers than it renders us liable to. All demands for a "return to nature," and the sweet, primitive simplicity of going barefoot constantly, are faced at once by grave practical difficulties. Not only is there the obvious difficulty of snow and frost and slushy mud, but there is the more serious question of first, damage to the comparatively delicate tissues of the feet from rough ground, rocks, thorns, etc., but the further possibilities of infections of different sorts through these wounds or injuries. The human foot, unfortunately, from this point of view, was born in the tree-tops, and had a soft, prehensile, palm-like sole and opposable thumb until within comparatively recent years, geologically speaking. It had to retain this broad, expanded palm surface when it assumed the function of a hoof upon terra firma, and consequently has been unable to protect itself by hard hornlike boxes, by masses of fur, or even thick leather-like pads. It is true that in the earliest stages of savagery a considerable amount of this horny thickening and hardening goes on upon the soles of the feet, so that the savage will tramp unconcernedly over rock, jungle, and stubble that would make a barefooted white man cringe and flinch at every step. But even with this admitted compensation, it is doubtful whether the barefooted savage is ever as strong on his feet as the leather-shod white man.

One of the earliest uses that he makes of his dawn-

ing intelligence is to provide some kind of a moccasin, sandal, or other footwear, and as a matter of practical fact, well-shod civilised troops can wear out and run down in a long campaign barefooted or even moccasined savage bands almost as shod horses will run down unshod mustangs, simply by wearing their feet to the quick. Even dogs that are to travel much and long over rough surfaces or through ice and snow do better and last longer with boots on. A soft and properly fitting and reasonably constructed shoe is not only no disadvantage, but a great advantage in every way to the race.

Another aspect of the question is one which we are only just beginning to appreciate at its full value, and that is the danger and seriousness of the risk of infection through wounds upon the bare feet and legs. Army surgeons, medical missionaries and medical explorers find that when they extend their observations, that the savage or barbarous tribes which are in the habit of going barefoot or bare-legged are subject to a large number of serious and crippling diseases through the infection of their feet and legs from wounds, bruises, and scratches. Many of these, especially in the tropics, occur only in the barefooted peoples, and disappear when they come to use adequately protected footwear. In other cases, it is found that they are much more heavily subject to septic and other infectious diseases, like *septicæmia, tetanus* (lockjaw), boils and carbuncles of different sorts, while ulcers of the feet, especially of the deep or penetrating variety, are vastly more common

among the barefooted races than they are among the civilised shoe-wearers.

It is even believed that such a serious general infection as the Plague is more liable to spread among barefooted peoples, partly because the bare skin of the feet and legs is so much more exposed to the attack of flees, bed-bugs, chiggers and other insect parasites carrying the infection from the rat, and partly, possibly, from the direct entrance of the *Bacillus pestis* through scratches, cracks, and wounds upon the feet and legs. The great frequency of the earliest sign of the disease, the bubo, or inflamed and swollen gland in the groin, which has given this pestilence its name of the "Bubonic Plague," is believed to point to an infection through the feet, whose lymphatics empty into this chain of glands.

It was reported some years ago, in the losing fight which the British Government has been making for the past five years against the plague in India, with a net result of three and a half million deaths, that the English regiments detailed for sanitary duty to clean out the infected houses seldom or never contracted the disease. But when Indian regiments were put to work quite a number of them developed it. It was found on inquiry that the natives in order to save their polished shoes and precious leggings promptly reverted to first principles and stripped them off when sent into such dirty places. They were made to keep on their shoes and leggings and returned to this duty, with the result that there were no new cases of the plague developed among them.

Though we have no plague or "Delhi boil" or "Madura foot" or other tropical soil infections in the temperate belt, yet we have the Tetanus bacillis and a score of other milder septic organisms that are found in the soil, especially when this is well manured, either intentionally, as in our cultivated fields, or accidentally, as upon our city streets. So that probably, on the whole, an indiscriminate going barefoot, even upon the part of boys and children, would do more harm than good on account of the danger of injuries and infections to which it might give rise. Intelligently indulged in, as on the sea-beach or indoors, on the lawn or playground, it would do much to counteract the injurious effects of shoe-wearing.

The principal abuses of that double-edged gift of the gods, the shoe, consist in making it too tight, disturbing the proper balance and elasticity of the foot by thrusting blocks under it in the form of heels, making it of an unnatural shape, so as to interfere with the proper pushing movements of the foot in walking, and making it of too impervious, too rigid, or too thin materials. Of course every living human being will admit that shoes should not be too tight, as readily as that the whole is greater than a part, or any other of the fundamental axioms. But equally, of course, "I never wear *my* shoes tight; I have *lots* of room in them." Tight shoes are like unorthodox opinions. They always belong to somebody else. Why, in the first place, we should ever be ashamed of a large foot and proud of a small one is

from a dispassionate point of view one of those things which, in the language of Lord Dundreary, "no fellah evah can find out." We are immensely proud of a large head, of broad shoulders, a deep chest, or of six-foot stature. But of a No. 10 foot, which matches accurately with all the rest of these, and should accompany them, we are almost as acutely ashamed. A long, well-spread, well-arched, muscular foot is just as much a sign of vigour and efficiency and of endurance as a big head is of great brain power. Nor is our prejudice in favour of a small foot a whit less absurd from an artistic point of view. From the foot of the Apollo Belvedere and that of the Venus de Milo to *"les beaux pieds de Trilby,"* the pedal extremity which the sculptor and the artist have delighted to immortalise has been as generous in its proportions as it is graceful and vigorous in its outlines. And yet we can bring the blush of shame or the red hue of embarrassment to even the manliest cheek by jeering about the size of his feet if they happen to exceed the arbitrary limits of decency, No. 9. A big, well-grown body should have a big, well-grown foot if it is to be really vigorous and efficient.

Though every one will admit that shoes should be worn loose, the difficulty is in the degree of looseness. Practically, with most of us, if on putting on a new shoe we can force our feet into it without too much effort and without positive discomfort, we think it is loose enough, and proceed to "break it in." It would be much more accurate if we applied that term to the foot instead of the shoe. As Uncle 'Rastus re-

marked, after listening to the squalls of one of his recently arrived grandchildren who was supposed to be teething,

"Ah heah's lots of folks talk 'bout babies a-cuttin' their teeth, but it peahs to me dat it's a case ob de teeth cuttin' the baby!"

Another moiety of us will perhaps go as far as to demand that we should be able to put our foot to the floor in a new shoe and bear our weight upon it without positive pinching. Beyond this, however, few of us are *exigeant* enough to go.

Now, consider just for a moment precisely what the function of the foot is, and we can see at once how inadequate both of these standards are. In the first place, the foot is not flat, but arched, for a perfectly obvious mechanical reason—to give elasticity to the gait, and to lessen the jar to the body and head. The only way in which an arch can give elasticity is by expanding, as is illustrated in the familiar carriage spring. You might just as well put an ordinary carriage spring in a rigid frame which pressed upon it firmly, above, below, and at both ends, and then expect it to "give" or spring as to expect the foot to work properly in a shoe which doesn't give it at least three-quarters of an inch of leeway or expansion in length, and half an inch for expansion in width. In other words, your great toe when your foot is simply resting on the ground without any weight upon it ought to be at least three-quarters of an inch short of the tip of your shoe, and an inch is better.

Another way to test it is to throw the weight firmly forward upon the foot, as if in the act of stepping off, and see whether there is the slightest sensation of contact at the end of the toe. There should be at least a quarter and better a half inch of leeway when the foot is in this position.

This length requirement is not such a difficult matter to secure, either from yourself or from your shoe-dealer or shoemaker, for the reason that it has at last dawned upon the benighted intelligence of this latter class, that one of the best ways to make a foot look slim and pretty is to increase its length in proportion to its breadth. So that as a rule, you will not have to fight very vigorously in order to get a shoe which is adequate in point of length. When, however, it comes to the other expansion requirement of adequate width, then the battle is on in earnest. Not only will the average salesman insist upon selling you his idea of a pretty shoe for your particular form of pedal extremity, and warn you that corns and blisters of all sorts of trouble and things will chafe up on your feet if they slide about in the shoes. But the average shoemaker can hardly be induced to give you a shoe which has decent width, except at the point of a club, in the form of a curt refusal to accept the first pair of shoes which he makes for you which do not come up to your standard of comfort. It is not fair, however, to blame him or the salesman, for they know perfectly well that whatever you may say about comfort and common sense, in your heart of hearts you would like better than anything

else a shoe that will make your foot look pretty, according to fashionable standards. And that at least three-quarters of us—present company always excepted, of course—will come back and abuse them if our comfortable shoe settles into an ungraceful shape or shows wrinkles.

The desirability, nay, the vital necessity of a broad low heel, placed well back, is so obvious as to admit of no discussion. The only excuse for the existence of a heel at all is the desire to exaggerate and increase the apparent height of the natural arch of the foot, to give it a supposedly more graceful appearance, and at the same time to shorten its apparent length. The first of these processes is as unnecessary as painting the lily. And the second is injurious in direct proportion to its success.

As we have already seen, the shorter the foot, the weaker its leverage upon the ground, and the higher the heel, the more seriously and radically the balance of the entire body is disturbed. Nobody outside an institute for the feeble-minded, or ultra-fashionable circles, would for a moment defend the high heel on rational or hygienic grounds. Closely related with the height of the heel, and indeed as the only excuse for the existence even of a low one, is the question of maintaining the arch of the foot. This is, of course, important. But it should be done from above, not from below. The business of the arch of the foot is to "give." And no matter how high it is kept by curved pieces of wood, heavy leather, or metal plates in the sole or instep of the shoe, its usefulness is de-

stroyed if these resist in any marked degree its descent. As a matter of fact, the arch of the foot is best and most beautifully developed in children who have never worn shoes at all, or only flat or spring-heeled shoes, in sandal-wearing peoples and in savages.

Nature built the arch of the foot in the first place, and can be trusted to take care of it, if not interfered with too much. And it is supported naturally by the crosswise tension of a group of muscles on the front and the back of the leg proper (the shin muscles and deep muscles of the calf), and in addition from before backward, by the long and short flexors, or benders, of the toes which run across its under surface from heel to ball of foot, like a bowstring across the arch of the bow. Let alone, it is one of the most beautifully elastic, yielding, and resilient arches, in proportion to its strength, in the animal world. But every attempt to "support it" mechanically from below interferes with this bowstring and elastic suspension action. Even in the distressing and disabling condition known as "flat foot," or "broken arch," when this supporting curve is lowered or broken and the weight of the body thrown down upon the ground through the instep, while metal and other supports in the instep of the shoe are valuable as a temporary means, yet nowadays we do not dream of depending upon them for permanent results, but on the contrary, vigorously and systematically exercise the foot in outward rolling and other movements, to tone up these muscles and bring the arch into its normal condition

of elastic suspension once more. At the same time toning up the general muscular and systematic vigour of the patient and relieving the feet of any abnormal and excessive strain, particularly in the form of prolonged standing. Unless we can restore the muscular tone, we fail of a permanent cure.

Now comes the puzzling and long-debated question of the shape of the shoe. After much and wrathful debate, authorities are fairly well agreed that this should be as nearly as literally "foot-form" as possible with an additional three-quarters of an inch to an inch in length, and at least half an inch in breadth to allow for expansion under pressure. The chief point of disagreement is as to the shape of the toe. One school holding that it should continue forward the natural outward slope of the sides of the foot from instep to ball, ending in a broad, shovel-shaped, square toe. The other holding that after adequate and proper breadth has been attained across the ball of the foot, the outer border at least of the shoe may then be diverted to run parallel with the line of the toes in moderate expansion. The general balance of opinion is inclined more and more toward the latter position, for two reasons. First, that it is becoming recognised that our two feet are to be considered each as lateral ends of one transverse arch or support, and that we do not rest in either walking or standing upon the full breadth of the sole, but upon a broad curved line about two inches wide, extending from the heel behind along the outer side of the foot, and, slanting across the ball of the toes to that of the great

or inner toe. What we need then, for firm and graceful support in our shoes, is two broad, gently curving ing arcs, with their convexities toward each other and all the material of sole which extends out in front of the ends of the toes is pure waste material as far as actual utility is concerned. The other contention confirms this position even more strongly, inasmuch as it points out that when we walk naturally, we do not thrust each foot straight forward in the direct line in which we wish to go, after the fashion of the celebrated "goose-step" of the German army. But that we swing it first outward, then forward, then inward, rotating in fact our body around the hip joint of the leg that rests upon the ground. In other words, the natural mode of progress of the human body is a series of short, concentric, half-parallel curves, each of about a third of a circle in degree—the gait, in fact, which an extra width of the hips or an excessive amount of adipose or lack of muscular vigour converts by exaggeration into the ungainly waddle.

In spite of the fact that "pigeon-toed" has become a term of reproach, most outdoor living races "toe in" when they walk, as is almost ludicrously obvious in our native Indian tribes. If this then be the case, it is obvious that we do not push off directly from the point of our shoe, but from a point on the side of the sole opposite the ball of the foot on the outer side if we toe in, as most of us do if we are really trying to get anywhere, and on the inner or great-toe side if we assume our carefully acquired drill-sergeant gait and toe out.

So that the broad, shovel-shaped, flat-boat toe is not only an offence to the eye, but a hindrance to efficiency in rapid and enduring walking. It by no means necessarily follows that anything which is ugly is on that account hygienic. This intoeing, bent-legged gait, by the way, is not only being adopted in our gymnasia and schools of physical training, but also by army drill masters, particularly the French.

The point of the toe must, however, be whittled off only on one side, and that the outer. For anything which tends to make the inner side of the shoe other than perfectly straight and doubles the great toe outward is crippling and deforming to the last degree.

Last of all, a word as to the material of the shoe. Here, in the main, the hard, practical, common sense of humanity has triumphed over fashion. And we may agree that for practical purposes and under the majority of circumstances there is "nothing like leather." Tough and impervious to stones and thorns, yet flexible, and within moderate limits elastic, impervious to moderate amounts of moisture, yet fairly porous, and capable of being readily cleaned and dressed and resurfaced, it has won its high place in the regard of the shoemaker the world over on substantial grounds. Like every other good thing, however, it has its defects, and has been used for shoe purposes in far too exclusive, wholesale and unintelligent a manner. Its toughness and strength of fibre have been used to cramp the foot as no woven material, except grass or hemp fibre, could be made to do. Its power of taking a polish or high finish has been

abused by various forms of pastes, blackings, and enamels until we have almost destroyed the porousness which it naturally possesses, and which is one of its greatest virtues. In short, while recognising its most valuable and substantial qualities for something like one-half to two-thirds of human footwear, the more completely we can emancipate ourselves from an absolute bondage to it, the more nearly we can come to encasing our feet in some softer and more porous material at least one-third of the time, the better will be our prospects for healthy and comfortable feet. Certain enamelled leathers should be avoided altogether, although it is only fair to say that the majority of them correct their own defect of imperviousness within a few weeks of vigorous wear by cracking and opening at a dozen points. It is also a great pity that we cannot manage to disabuse our minds of the æsthetic prejudice in favour of the "high light" or other form of brilliant polish upon our pedal extremities. It has, of course, the great practical advantage that dust and even mud can be wiped or brushed off from it, as from any glazed surface. But it is artistically absurd, and the soft, velvety-looking surface of buckskin, suede, or other so-called "undressed" leathers is much more attractive to the unspoiled eye; while for comfort, elasticity, warmth in cold weather, and coolness in heat, on account of their porousness, they are far superior to the various hard-finished or glazed leather. Soft, Indian-tanned buckskin is probably as nearly the ideal material for footwear as can be devised.

We are no longer in such deadly fear of the penetration of moisture through the shoe, first, because we recognise that most colds, that were supposed to come from wet feet, are due to infection, and at most can only be precipitated by this form of chilling. Second, and even more fundamental, there is really no harm in getting the feet wet so long as they remain warm and we are not conscious of any chill. If we keep on walking and exercising with sufficient vigour after our feet are wet to maintain the circulation and keep them warm, or if our foot covering is sufficiently substantial and porous, as in the case of the medium-weight woollen sock covered by a felt, buckskin, or other porous leather, to remain non-conducting, even when wet, our feet will not be one-third as liable to chill when this has occurred. In fact, with this type of shoe, and even a cotton sock, it is quite possible to get your feet well moistened when walking in the rain and yet not know that they are wet, so entirely free are they from any sense of chill or penetration of moisture.

We should certainly utilise far more freely for the uppers of our shoes—nothing better than leather for the soles has yet been discovered—canvases, tightly woven woollen goods and felts than we now do. The chief objection to them is the æsthetic one that they lose their shape and look "sloppy." Other than that, except in bad weather and across very rough ground, they are more comfortable and more healthful. Certainly no material should be tolerated which will prevent the free perspiration and respiration of the feet.

This is the vital and serious objection to the use of rubber in all its forms. To put it in a nutshell, the only danger in getting the feet wet is the possibility of chill, on account both of increasing the rapidity of the heat loss by evaporation, and destroying the non-conducting power of the originally porous sock and shoe. It makes little difference whether that moisture came from the outside in the form of rain water or from the inside in the form of retained perspiration. If you are going to walk, in any real sense of the term, and wear rubbers, you are exceedingly likely to find your feet almost as damp and sticky from perspiration at the end of your tramp as they would have been from the rain or the slop without them. They should therefore only be worn as a temporary protection at times when little or no vigorous exercise is to be indulged in, or as a means of protection from chill by invalids, or those in delicate health. Except in those forms which are little larger than sandals, they retain the perspiration and promote various diseased conditions of the feet. They incline to produce the very condition of moisture which they were intended to protect against. And above all, they do more to encourage the wearing of thin-soled, flimsy, and utterly irrational shoes than almost any other influence outside of fashion. The vast majority of individuals, young or old, in anything like reasonably good health, would be much better off by wearing substantial, firm-soled shoes, with a water-proof layer incorporated in the sole, good firm, porous stockings, cotton in the summer, and wool, though not

necessarily, in winter, and let rubbers as completely alone as possible, wearing them only as an emergency protection in extremely sloppy or stormy weather. Even those who are continuously exposed to wet and cold, like hunters, fishermen, and lumbermen, after a full trial, have almost abandoned rubber as constant footwear, preferring to wear thick woollen socks and heavy leather boots, and take the chances of an occasional wetting, rather than be exposed to the internal debilitating bath of perspiration brought about by constant wear of rubber boots.

CHAPTER XII

THE IRREPRESSIBLE TENDENCY OF BABIES TO GROW UP

MYSTERY surrounds a cradle. The haze has golden lights in it, but there are storm colours at the edges. Wherever Mystery is, Fear lurks close. This tiny rose-leaf life which has fallen so strangely into ours may fall out again as suddenly and as irresistibly. The lightest pressure of a finger would stop the ebb and flow of that tiny breath tide, the faintest puff extinguish that little spark. It has lived but one day. Why should it live another? But stop a moment.

One day old, did you say? It is a quarter of a million years! The vital spark that is in its veins has not been extinguished once in that time—else it would not be here. All that time it has been fighting battles against adverse circumstances and winning them. It represents the conquering strain of fifty thousand generations. Is it going to go down in the first round that happens to come under your eye?

Every curve of its little body, every crease of its skin, every detail of its nervous system, every little unconscious trick and movement, is the mark of a battle won over Fate. It is the hero of a thousand fights. Why should it not continue to conquer?

But it looks so helpless and so tiny. True enough—

but that little pink morsel of wrinkles and laces is actually now prepared to give you a test of his quality, a demonstration of his age-long pedigree, at the same time to perform an athletic feat which strong men would find difficulty in rivalling.

Work a forefinger carefully into the palm of one rose-leaf paw, and wait until he clamps down on it. Do the same with the other, and when both are firmly clutched, lift slowly but steadily upward. You can lift him not merely into a sitting position, but completely clear of his couch, and there he will swing, his toes six inches above the bedclothes, from three-quarters of a minute to a minute and a half, without the slightest apparent effort or discomfort on his part.

Now catch hold of a horizontal bar yourself, with both hands, as if you were going to "chin" yourself. Draw up your feet from the floor and see how long you can hold on. You are in good training if you stay there one minute, and it will seem like an hour to you. And this is a fair illustration of the baby's grasp on life. The origin of this singular habit is, of course, an open question. It evidently is of no particular use to the baby under his present circumstances. A cold-eyed scientist would tell you that it was a survival of age-long ancestral habits of clinging to branches in tropical tree-tops. But to tell a doting mother that her darling midget shows even a suggestion of blood kinship with a tailed creature—arboreal in its habits—takes more courage than I possess. Some graceless creatures would even go so far as to say that the immortal "Rock-a-bye Baby in the

Tree-top" was also an echo of the same period. But out upon them! Besides, it may be proved on internal evidence that a baby possessed of such a grip as this would *not* fall if there were a bough anywhere that he might clutch.

Moreover, we are now in a position to apply mathematics to the problem. There are deserts of appallingly uninteresting figures known as "vital statistics," but an expert can find an oasis among them here and there, and there is one for the refreshment of the anxious parent.

I am aware that it will seem almost like vivisection to apply statistics to a helpless infant, but I believe the end will justify the means in this particular instance.

A century ago the anxious parent of the new-born babe had good reason to be uneasy. That was still the age of dirt and a huge infant mortality.

Less than half the children born lived to be five years old—in London, in 1750, 74.5 per cent. died—and more than one-third perished in the first year. Now such a condition is rapidly disappearing, and remains only in our slum and most ignorant peasant communities.

To-day the average mortality in the first five years of child life in the entire United States is less than twenty per cent. The mortality for the first year, about ten per cent., and eliminating the slums and our foreign population, the rate is nearly three per cent. lower yet. So that *your* baby, gentle reader, has ten chances to one of reaching his first birthday, five

to one of reaching his fifth, and three to one of attaining adult life. Surely this is not an outlook to justify serious worry or constant anxiety for fear that some dreadful thing will happen.

"But what can I do to keep my baby in the fortunate eighty per cent.? How do I know that he won't fall into the luckless twenty per cent. without my being able to prevent it?"

Don't worry, but *trust the baby*. He is not half so ignorant and helpless as he looks. In fact, if you will study his little physiognomy carefully, you will see that he is not worrying in the slightest about the situation, and is perfectly sure of himself. A grave complacency, a calm self-satisfaction, is the dominant expression of the child countenance. And it isn't there by accident. The baby, the child, knows exactly what it wants to do at any given time or under any given circumstances, and in nine cases out of ten, if you will let it do, under reasonable limitation, pretty much what it wants to, you will not go far wrong. A baby knows *when* he wants to eat, and is provided with an excellent and most musical apparatus for conveying that fact to your apprehension. He knows *what* he wants, and will reject vigorously what doesn't suit him. And you may be sure that he knows far better than most adults when he has had enough.

This faculty is present from his very earliest appearance upon the stage of life. During the first three days of his existence the healthy baby cries but little and sleeps almost constantly; and we have now

discovered that during this period he not only requires no food, but *is better off without it.* He is still digesting and living upon the nourishment in his blood derived from the veins of his mother, and until that process is completed, food in his little stomach is a foreign body. In fact, the impression that colic or "colickiness" in a baby is a natural characteristic is chiefly due to the senseless insistence of officious nurses and anxious mothers upon crowding things into the baby's stomach during his first three days. There was another clear indication on the part of nature of this fact, if we had only been open-minded enough to see it, in that there is no natural supply of nourishment for the child until the close of these three days. The horrible things that are poked into the unfortunate baby's mouth in order to correct this stupid oversight on the part of nature and keep it from starving to death would almost stagger credulity.

A mixture of lard and molasses, administered on her dirty finger, was a favourite dose of one old nurse in my experience, who had a wonderful reputation in her neighbourhood. The finger, by the way, given to the child to suck, or used to introduce substances into the mouth, or to rub them on the gums, is a fertile cause of colic and other disturbances all through babyhood. The poor baby can't escape from it; but how would *you* like it if some old nurse or servant were suddenly to thrust her finger into your mouth and compel you to suck it?

His faculty of knowing *what* he wants in the way

of food is equally to be trusted. He is largely a creature of circumstances here, and if what he really likes doesn't happen to be offered to him, he, of course, can indicate no preference for it. He vastly prefers nature's own source of nourishment, and is a thousand times justified in his preference. Nature has taken a quarter of a million years in fitting a cow's milk to grow not a baby, but a calf, and a mother's milk to grow a baby, and we cannot expect to completely reverse the process in one generation. Not only is the natural supply a far better food, but it is infinitely freer from risks of contamination and the conveyance of disease.

The greatest pains, and, if necessary, considerably prolonged delays, are well worth while to secure this source of supply. If, however, this source cannot be made available, then cow's milk furnishes a fairly satisfactory substitute, and there are exceedingly few children who cannot be satisfactorily reared upon it, as is indicated by their distinctly preferring it to any other form of food that could be offered.

Baby foods and patent foods of all kinds and descriptions they instinctively dislike and with good reason. In the first place, they are made to sell, not to eat. They can never take the place of fresh cow's milk, and are seldom even a suitable supplement to it. In fact, the sole virtues that they possess are due to the milk in which they are mixed and administered. Most of them consist chiefly of starch, on account of its cheapness, which the salivary glands of the baby's

mouth are unable to digest until after the fifth or sixth month, except in very small quantities.

The pre-digested milks and milk-powders are just as undesirable, for part of their nourishment has usually become changed in the process of digestion or preparation into what are practically waste products, while at the same time their food-value has been lessened. The only place where we nowadays find scurvy is in the children of the well-to-do or in certain foundling hospitals where they have been fed too exclusively on these prepared foods. They are for the most part frauds of the first water compared with their claims, and the most expensive and least desirable foods upon which a baby can be fed, all of which we would have avoided years ago if we had watched the face that the healthy baby makes when he is asked to taste one, and had acted upon the hint.

Afterward, of course, he learns to like them, just as a boy does tobacco or a man alcohol. The baby is a born carnivore, living upon liquid flesh, which must be given to him *alive,* without even pasteurising, which kills milk, and deprives it of some of its valuable qualities. It should only be resorted to where the only milk to be had is hopelessly dirty or liable to contain disease germs.

After once securing a suitable brand of milk he will remain happy and contented, and consequently grow like a young weed for months. Then, just before his teeth begin to show through the gums, he develops an appetite for more solid food, shown unmistakably by his determination to clutch anything within his

reach, thrust it into his mouth, and chew hard on it. Now, for the first time, his saliva is ready to digest starch, although his pancreatic juice has been capable of dealing with small quantities of it for some time previous. The first and keenest appetite, however, in the line of solid foods is not for bread or crusts or any form of starch, but for meat, and this should be given him freely to chew in moderate amounts.

The widespread belief that starchy foods are the proper and natural diet for children, and meat dangerous and "heating to the blood," is a pure and most deplorable superstition, attended everywhere by disastrous results. It seems to have been due partly to stinginess, on account of the greater cheapness of the starchy foods, and partly to the rigid old puritanical superstition that leads us to distrust our own likes and dislikes, and to argue that if we long for a thing very much it must be bad for us. The baby's stomach for the first year is almost purely carnivorous in size and shape. Two-thirds of his diet should consist of flesh foods, either milk or meat. In fact, during his first three years the starchy food should be little more than padding and exercise stuff for his growing teeth. The commonest single cause of malnutrition among the children of the poor is the excess of starchy foods upon which they are reared; and milk and beef juice are our most potent medicines in the children's dispensaries. It was not by accident that the baby cuts his front or meat teeth first, and his grinders or starch teeth later.

About the second or third year, or even the fourth

or fifth, if allowed to develop naturally, he will display a strong taste for sugar. I am convinced, from careful observation among unspoiled children, that this sugar instinct does not develop so early or so violently as is popularly supposed. In unspoiled children—that is, those that are left largely to their own devices—unless it is put in their milk or baby food, or given them as a "treat" by some foolish adult, they display little or no excessive preference for sugar over meat, milk, or bread, until the fourth or fifth year. Even then, if they are allowed to have plenty of it in pure form at opportune times, they will seldom gorge or surfeit themselves with it in the way they are usually supposed to do if they are unrestrained.

Few things could be imagined more irrational than our attitude toward sugar in infant feeding. Regarding it as a luxury ourselves, we teach them to take it as such, and then, by stinting them of it, bring an unnatural and overmastering hunger for it. After these many years, laboratory workers assure us, upon most incontestable evidence, that sugar is one of our most valuable single foods, and especially for growing children. It is readily absorbed, refreshing, the best and safest reliever of fatigue that we know of, being probably more nearly the form in which the food fuel is burned in our muscle engines than any other that we have. It has just recently even found its way into that most cold-blooded and matter-of-fact regimen upon the face of the earth, the German Field Army Ration, and that by ounces, daily.

Yet we might have guessed this years ago if our ears had only been open to the wisdom of babes. Its only defects are its overmastering attractiveness to the unjaded palate, which is in itself a high-class certificate of merit from a biological point of view, and the fact that it lends itself rather readily to the encouragement of any fermentations which may happen to be going on in the alimentary canal. If only the precaution be taken to allow children to satisfy the first keenness of their appetite upon less cloying foods, like milk, meat or bread, they may then be given as a dessert almost all the pure sugar or sweet fruit or pudding that they will eat, not only without harm, but with great benefit. The only reason why they cannot be safely allowed to begin a meal with it is on account of its cloying quality, which clogs the appetite long before a sufficient amount of actual fuel value has been taken in; but this cloying quality is precisely the thing which at the end of a meal will be sure to protect us from excess.

The soundness of the baby's instincts for sleep needs only to be mentioned to be admitted. Yet I have known anxious parents who worried seriously over the enormous amount of time their baby wasted in sleep, when he ought to have been developing his intelligence in preparation for his life struggle. One word of warning, however, might be given—don't wake the baby for *anything*, short of the house being on fire, not even to feed him.

Clock-work regularity in feeding has been a fetish at whose shrine many luckless infants have been

sacrificed. The baby is not built like a grandfather's clock, which will run down unless it be wound up at scrupulously regular intervals. When he really has got room in his little inside for more food, he will not waste any time in sleeping over the matter, but will wake promptly and inform you unmistakably of the fact. Then feed him, and not until then.

Much of the attempt to get children into so-called "regular habits" in the matter of feeding is coloured by a regard for the hours of slumber of the nurse or parents rather than the welfare of the child. Nor is there any inherent virtue in getting children to bed "in good time" in the evening, or up at a similarly imaginary virtuous hour in the morning. The first few months of their lives they needn't be allowed to know the difference between day and night; and even from a purely selfish point of view, they will disturb your slumbers far less upon this plan than upon one of attempted regularity.

Similarly, as to their natural instincts for sunshine and fresh air. The first thing a baby stretches out his little hands to is the light. Let him have all he wants of it, remembering, of course, that for the first few months he will display a good deal of the old cave-dweller instincts in this regard.

Fresh air, and plenty of it, is also one of his inherent rights, which he will vigorously demand. There seems to be an extraordinary fear abroad that "something" will happen to the very young baby if the windows of its room are not kept closed. It is so universal and so utterly irrational that I cannot help sus-

pecting a taint of the old spook dread, of Jinns and Nixies, that were anxious to swoop off with the souls of very young children. As a matter of fact, so intense are the activities of a child's tissues, that it needs more fresh air in proportion to its weight than does an adult, and isn't in the least afraid of a gentle draft, as it has high powers of self-heating.

The deep, tub-like cradle, or even basket, is a relic of barbarism, and should be abolished. Let the fresh air of heaven play all around the little one and it will seldom catch cold. On the contrary, it will become proof against this form of infection. Closed windows, stuffy rooms, thick bedding and high-walled cots are the surest breeders of the respiratory diseases which they are imagined to prevent.

Where do you suppose we put our most hopeless and serious cases of pneumonia or bronchitis in babies nowadays? Out on the roof of the hospital, with only a canopy over them, and snow all around them, and many a child whose case has been given up as hopeless in the ward below has recovered under these conditions. It is not only the consumptive who is put out to live and sleep in the open air nowadays.

In short, give a child as much fresh, pure milk as he wants, whenever he wants it, as much sleep as he will take, all the sunshine he can get in northern latitudes, and let him live in a gentle current of pure, fresh air day and night, with plenty of room to kick when he feels like it, and most of the possible evils to be dreaded in his horoscope will be averted.

CHAPTER XIII

THE NATURAL GROWTH OF CHILDREN'S MINDS

THAT the child has instincts that can be trusted to carry forward its physical development, few will deny. But that he has any such "light within," to illumine and direct his mental progress, would perhaps be doubted. Yet there are few things more certain. Just as the germ of the flower is contained in the tiniest seed and will reveal itself with as absolute certainty as will rootlets and leaves when proper conditions of heat, moisture, and light are accorded, so the germ of the mind of a child is present in his little body and will develop and unfold itself with the growth of the latter.

The only way to stop the growth of a child's mind is to stop his body from growing. Appetite is the mother of the mind and muscle is its father. At its lowest estimate the body with its brain is the tool of the mind, and good work cannot be done without good tools. And while opinions may differ as to whether our systems of education have the greater control over mind or body in later life, in childhood there is little question that we can do three times as much for the body as for the mind—directly—and we can now point to the overwhelmingly unanimous and consoling result of practical experience, that children

reared and educated on this plan of doing all that can be done for the body are as superior in the clearness and vigour of their minds as they are in the strength and beauty of their bodies.

Hundreds of children are now on record who have never seen the inside of a schoolroom, or had a single period of formal mental training as such, until eight, ten or even twelve years of age, and yet have been up with children of their age in the classrooms—and generally ahead of them—within two years of entering school. Keep children growing healthily and answer their questions so far as you can, and you have fulfilled the whole duty of parents and will have little need to worry about the mental development of your offspring.

Yet it is little wonder that as we look at the pink, sleepy morsel in the crib, and think of the tremendous gap that has to be bridged between that and full manhood or womanhood, a gasp of dismay or a shiver of apprehension strikes us.

There is an excellent and most reliable aid at first hand—the child himself. Just follow his lead as intelligently as you can, and you will find success eight times out of ten. If you don't believe it, just look at his face. Do you see any doubt or hesitation or worriment there? Not a particle. His expression, if he has been properly fed, is one of the blandest and most placid self-confidence. And he has a right to the expression. As we saw in considering his bodily growth, he is millions of years older than he looks. As a matter of fact, he is older than you are by the

amount of your own age at his birth. He is not only Time's noblest, but nature's latest and most finished product. Two-thirds of his brain building is already done.

Though the child's body at birth weighs barely one-twentieth of its adult weight, his brain weighs one-third, and by five years of age will have reached nine-tenths of its final bulk. In other words, before the child enters school at all, or has been submitted to any of the formal processes of education, two-thirds of his mental development is accomplished. And if you will try to get him to admit you to his intimacy as his equal, which he may be induced to do, although knowing at heart that he is your superior, instead of gazing down upon him through your pince-nez with that ludicrous air of condescension based so naïvely upon your superiority in inches, you will find that the little rascal seems to be fully aware of it. His attitude is well illustrated by the story of the five-year-old, who, after much tribulation on his own and his mother's part, had succeeded in mastering the magic art of words of one syllable, and was beginning to apply this master key to the names of the animals on his blocks and in his favourite picture book. His mother, who had been pitying him on account of the rocky and uphill road to learning which stretched before his tiny feet, came unexpectedly into his nursery and found him sitting in front of the hearth with his back toward her, and one of his picture books on his knee, his pudgy finger tracing the mystic characters. Suddenly he closed the book, put his hand

to his forehead, and ejaculated in an awed tone, "Great Scott, how much I know!" And his was the more rational attitude.

The correlation between mind and muscle is obvious in the earliest days of life. The first test of muscular vigour, the hand grasp, is an indication of the mental possibilities as well. Not one child out of a hundred who at ten days of age grasps firmly and clings to a finger or pencil rubbed against his pink little palm will ever fall below the average intelligence of his race. The absence of this or even a feeble or flabby hand grasp in a baby is a serious and menacing sign —either of low vitality or of mental defect. Even at birth the mental machinery is all there, the fire is lighted under the boiler, his first movement starts the piston. All he has to do, so to speak, is to limber it up by exercise, tighten the coupling belts as each new division of the machine comes into action, and in a little while the whole engine is running smoothly, noiselessly, and efficiently. And the beauty of this wondrous body-brain-machine is that all you have to do is to start it up, keep fuel under its boiler and water in it, and it will slowly but surely adjust and develop and balance itself, working off the friction points, co-ordinating its different rates of revolution in the different parts until finally it is working at full speed, full power, and in full harmony.

Natural conditions will call for every one of its potentialities, one after another, and inevitably develop them, unless fatally interfered with. In short, an immense amount of time and effort is wasted—

and worse than wasted—in *teaching* a child to develop powers and to do things which it would inevitably do and learn of its own accord, in its own good time, if left to itself.

Take, for instance, such a simple process as learning to walk. By the average, doting mother the acquisition of this marvellous accomplishment by her baby is looked upon as something little short of a miracle, a thing to be hoped for, prayed for, but scarce expected. Other common or ordinary babies, of course, have done it times out of mind, but *her* precious one—oh, he is so little, so soft, so kittenishly curled up! Can he ever straighten out and stiffen those chubby legs of his until they will bear him erect and carry him wherever he wants to go? Consequently, from the moment that his back is stiff enough to enable him to support the weight of his intellect, all kinds of half-adoring, half-despairing experiments are tried upon him to this end.

He is held so that his feet will just touch the floor, and gradually lowered until he can bear a little weight on them. Usually he has the eminent good sense to go down "sodge!" whenever this happens. But sometimes, at six or seven months old, he may make a feeble, wabbly step or two, supporting his weight on two legs instead of four, as is natural and proper at this age.

So soon as this first flickering imitation of a wondrous feat has been elicited, he will probably be placed in a runabout, supporting him under his armpits, and allowing him to propel himself by pushing on the

floor, or suspended in a life-preserver ring at the end of a spiral spring, in which he can bounce up and down and kick, and give his delighted mamma the impression that he is "learning to walk," all of which is charming amusement for the parents and doting relatives, and fairly good fun for the child, but a pure waste of time. And if in any way successful in inducing the little one to balance his entire weight on two limbs even a month or two earlier than he would have done so without interference, is all to the bad. It is hard enough all our adult life to have the entire weight of the body thrown upon two limbs instead of four, and the bad eminence of the knee joint in pathology, the terrific frequency of flat foot, weak ankles, and pain in the back are chiefly due to it. But to throw this abnormal strain, to which the human species has hardly yet fairly adjusted itself, upon the soft, gelatin-like bones, tender joint-surfaces, and soft, almost unarched feet of the young baby is utterly wrong.

The foundations of many a case of flat foot, of weak ankles and of bow legs are laid at this period, although the latter will not usually appear in consequence unless the nutrition of the child fall far below par.

Let the baby follow his ancestral instincts, and scuttle vigorously about on all fours to his heart's content until he discovers that, admirably safe and rapid as a means of locomotion this may be, it takes up all your hands, and doesn't give you a chance to clutch things or to reach interesting objects off the

top of tables in the way that the more perilous bipedal locomotion does. He will accomplish the astounding feat of walking alone with as absolute certainty as he will increase in weight, and at a period only a month or two later than that which will be attained with the most vigorous coaching and conscientious teaching.

The baby doesn't *learn* to walk, he *grows* to walk. You could no more stop him from acquiring the accomplishment under anything like healthful conditions than you could keep him from growing taller.

"But," says some one, "this is not a mental accomplishment." As a matter of fact, it is. For by the time that he has solved the problem, the baby has given himself a course in some of the deepest questions of philosophy, namely, the relations of space and time. Of course, he would not recognise either of these concepts if he met it on the street. But he already knows practically just as much about them as the philosophers do. He has learned to correlate smell impressions with touch impressions, sight impressions with impressions of warmth, some pleasurable, some painful, as when he grabs the electric bulb. He has learned to roughly gauge the distance of an object that he wants to reach by the degree of the divergence of the light rays coming from it, or the different pictures which they make on his two retinæ. He has taken the longest step he will ever take in a year toward passing his matriculation exams.

Any healthy child above the level of feeble-mindedness, and surrounded by members of his species, will

grow to talk just as naturally and as inevitably as he will grow to be two feet long by the time he is two years old. What particular language he will talk will, of course, be determined by that which is spoken most constantly in his hearing. But, unless confined to the society of deaf mutes, he will inevitably speak some language before he is three years old. The well-meant attempts to teach him to talk before his natural and appointed time do nothing but distract his mind from his own little method of solving the problem.

Nothing could be more ludicrously irrational than the prevailing impression that in order to teach a child to solve the mystery of speech it is necessary to talk "baby talk" to him.

It is a delightful amusement for adoring relatives and nurses, who take to it with astonishing facility, and appear to find in it a rich and never-failing vehicle for the conveyance of their ideas. But pity the poor baby! The prevailing impression that he understands it better than he does plain, direct English is a shameful aspersion upon his intelligence and one of those superstitions grown up from heaven knows where.

As a matter of fact, growing to talk by a baby is a comparatively simple and easy affair, but it spreads over so long a period and reaches such a wonderfully complex result at last that it is apt to impress us as more complicated than it really is. This is something of the line it follows:

The first sounds that a baby makes are not only absolutely spontaneous, but unconscious. I have seen

very young children repeatedly frighten themselves by the shrillness of their own cry, either of delight or fear.

It is not long before the pink little possibility of a man begins to notice that his cries are responded to, the hunger yell by food, the fear cry by petting, the "Goo, goo!" of satisfaction by answering gurgling sounds and ticklings and pattings. He gets the idea that he can make himself heard and attended to.

So far his speech is inarticulate. Now comes the cutting of it up into sections, which, of course, is done by the muscles of the lips and the tongue. Naturally, his first and most frequent interruptions of the pleasure gurgle are by the opening and closing of the lips in the familiar movements of taking in food, giving rise to the "Mum-mum-mum" and "Pap-pap-pap" series. And generations of proud parents have eagerly adopted these sounds as *their* names.

Gradually it dawns upon him that certain forms of this babbling gurgle are responded to with extravagant signs of delight by certain strange and extraordinary features of the landscape surrounding him, which perhaps he has just begun to pick out from their background. He consequently is apt to repeat these babblings whenever these apparitions come into his neighbourhood. And now the proud father and the doting mother are quite sure that he recognises them and calls them by name, which is perhaps true in the same sense that he recognises the fire in the nursery grate, or the bright red table-cloth.

His next step probably is to imitate the sounds that

he hears made by the more interesting objects in his vicinity—the barking of his dog, toy or otherwise, the mewing of his kitten, the crowing of the cock under his window. These marvellous manifestations of intelligence are hailed with such delight and regarded as calling for the creatures imitated, and they are promptly brought within his reach. This naturally strengthens in his mind the association between the sound and the object, and suggests to him another way of getting what he wants. A little later he begins to notice that these strange, big, irrational creatures by whom he is surrounded are apt to make certain other noises in connection with things that interest him, such as "drink," "water," "bread," "out," "trot-trot," and unconscious imitation of the sound is apt to cause the object or action to appear, and again another magic word or power is put in his possession. And so he goes on, step by step, until the whole glorious gift of speech is in his grasp.

The whole process is a spontaneous, self-initiated one —first, of unconscious babbling; then of noticing the effects of the sound; then of imitating the sounds made by, or associated with, objects, and seeing that these objects appear when they are called.

Nothing that the most devoted nurse or mother can do in the way of "teaching" will hasten the process more than the fraction of a degree. I have been able to watch the development of several children whose parents had sufficient self-control to refrain from doing much in the way of trying to teach them to talk, although well-meaning and horrified relatives would

occasionally break in, for fear the poor child would grow up speechless. The results were interesting. In both cases the little ones made little or no effort to talk, in the ordinary acceptation of the term, excepting, of course, the usual gurglings, babblings, and imitating of sounds, until they were nearly two years old; and then they fairly burst into speech, developing their words with astonishing rapidity and much greater accuracy than the average child of their age, who had been goaded into attempting to make sounds which his little vocal organs are entirely unfitted to produce.

Here we have brought the child fairly into possession of the power of thought by purely natural and chiefly physical means. Language in its most complicated adult form is a muscular product, breath sounds cut up into sections by the muscles of the lips and tongue. The only thing that remains is to connect these sounds with objects, and how loosely and casually and with what infinite variety of results this has been done, the languages of the world bear witness.

This brings us to the last and most important consideration—that is, that all the time that our little bundle of nerves and dimples has been swinging his little fists about in front of his face, occasionally hitting himself in the nose or the eye, clutching at his pink toes, and grasping at the sunbeams, bumping into things and balancing himself on his sturdy legs, he has been developing not only his body, but his brain and his mind as well.

Every inch of that magnificent mass of grey matter which we call the human brain is built up by, and dependent upon, the exercise of the five senses or the use of some muscle, and the relations and correlations that have to be established between the two. The very areas of the brain which are later used for thought are built by muscular action. When the child grows a little older, and comes under the domination of nature's greatest schoolmaster, the play instinct, then this process of brain building proceeds at a redoubled pace.

The sports of a child are the imitations of the life work of his savage ancestors. His hidings and chasings, his mimic battles and sieges, his ambuscades and slaughters, his trappings of plume and belt and sword, are unconscious imitations of the very processes by which his ancestors lived in the past, which built their brain up to the level which it had attained, and which are required to develop his up to the threshold of the twentieth century. No schoolroom ever built is the equal of nature's great school of play, and no schoolmaster ever born was half so sagacious and effective as the great play instinct. The meaning of play goes deep. We are only just beginning to appreciate how subtle and far-reaching it is.

We are beginning to grasp the truth of the epigram of the French philosopher, "It is the time one loses that one gains." No game worth playing can be imagined which does not with muscular strength and quickness develop powers of perception or accurate calculation and keen, quick, sound judgment, to

say nothing of self-control and co-operation with others.

Five years ago I ventured to express the belief that a child born of reasonably intelligent parents and brought up in a home well supplied with books and papers would learn to read of his own accord in self-defence with a little assistance from his family at the right moment. Since then I have seen the experiment made, and with most successful results. Illiterates are born only of illiterates and can grow up only in illiterate homes.

The average American child will grow to read before seven, "cipher" before eight, and write before ten years of age, just to answer his own questions and preserve his own self-respect. The same instinct which leads him to explore the orchard and woods beyond will lead him into and "through" geography. His love of the story takes him right into the heart of history and of literature. He is a better botanist and biologist at ten than most conventionalised grown-ups.

One of the most intelligent and progressive schools of pedagogic thought to-day, the Herbartian, has for its motto all through the curriculum, "Study and follow the interests of the child."

Trust your child, follow his lead, and he and Mother Nature together will bring you safely through, even to Commencement Day.

CHAPTER XIV

CHILDREN AND CANDY, OR SWEETS TO THE SWEET

REASON is always trying to play tricks upon instinct, to "teach its grandmother how to suck eggs," as the old saw runs. Instinct is as old as the hills, reason was hatched only yesterday, and has the boundless self-confidence of youth. Its favourite game is to improve upon nature, sometimes successfully, sometimes not.

One of its latest plays is to solemnly forbid our eating candy, on the ground that "sugar is bad for us." Now, however did it reach that wondrous conclusion? Of course, like the most of us, it won't give its real reason first. We all usually make up our minds to a thing on personal grounds, then proceed to cast about for reasons why we do it which will sound pretty in public. So reason puts on an air of scientific wisdom, and announces that "sugar spoils the appetite." And here it has plenty of supporters. Until within very recent years, the one thing that most food reformers have succeeded in agreeing upon, much as they differ in everything else, is that sugar is "bad medicine" and to be avoided.

But this particular argument against sugar is little better than a sham, for the business of a good food *is* to spoil the appetite, temporarily at least. If it

doesn't we might as well fill ourselves by snuffing up the east wind like the wild ass of scripture or by eating health-foods.

Sugar is different from the near-foods, as the exercise you get in chewing it doesn't give you an appetite. The grain of truth in the charge, apart from the property of satisfying the appetite, which it shares with all real foods, is that sugar has a peculiar cloying or satiating quality, which kills the appetite before an adequate amount of nourishment has been eaten. We "loathe the honeycomb" long before we have fuel enough under our boilers to carry us through the run to the next eating station.

But mark how instinct has adapted itself to this peculiarity. In all natural meals and menus sugar and sweets come last on the bill of fare, giving a graceful and pleasing finishing touch, and filling in, as it were, the chinks between the coarser and less soluble viands preceding. Let healthy children follow their unspoiled appetites and satisfy their keenest hunger on meat, potatoes and bread and butter, and they may then eat all the sweets and candy they want with which to finish up, with perfect safety and distinct benefit. Eaten like this, sugar seldom or never does harm, and is a valuable and important addition to the diet. Its quickly cloying action is a safeguard against excessive indulgence.

To young Master Reason's next charge that sugar may "sour the stomach," give rise to fermentative changes, we plead guilty. But side by side with it in this plea must stand all the starches: bread, biscuit,

crackers, potatoes, rice, beans, mush, cakes. All these must be looked upon with suspicion, if "liable to ferment" is to be a taboo. As a matter of fact, two-thirds of the abnormal acid fermentation which occur in the food tube are due to starches, and not to sugar.

So far from being less easy of digestion than the starches, *every starch taken into the mouth has to be changed to sugar before it can be assimilated.* Not cane sugar, of course, but grape sugar, or glucose, an even more easily souring substance.

So that the charge against sugar of "souring the stomach" collapses completely, unless we are prepared to incriminate equally all the starches, and most of the fruits. All fruits, even the sourest, contain considerable quantities of sugar.

In short, it is not the sugar that sours the stomach, but the stomach that sours the sugar. Take plenty of exercise, plenty of time at your meals, plenty of sleep, live in a draft, and you can eat all the sugar you want. It will do you good, not harm.

To the next allegation, that it causes decay of the teeth, we set up the same defence, "Not a bit more than the starches." The only way in which either of them can harm the teeth is by souring the stomach, or by overloading the blood with the acid products of defective carbohydrate assimilation. These are at least three times as likely to be caused by starches as by sugar. Its direct effect upon the teeth is good, both antiseptic and cleansing. If the teeth are not properly cleansed after sugar or candy has been eaten,

as they should be after any meal, fragments of food lodged between the teeth and saturated with sugar furnish a superb culture medium for the bacilli of fermentation and dental decay. Lactic acid is *the* acid of dental caries, serving as an advance guard for the bacteria of decay, and this is readily produced by the fermentation of starch, milk, or sugar. Moral: Brush your teeth well after every meal, so as to leave nothing between them to ferment and decay.

Sugar locally has well-marked antiseptic powers, as shown by its universal use in preserving fruits, vegetables and meats. It has even been used as a dressing for wounds with excellent results, except that it is decidedly irritating. That is why it burns and aches so when it gets into a hollow tooth. Indeed, this aching and the fact that the temporary, or "milk," teeth are naturally loosening and apt to decay about the time the child's appetite for sugar is keenest are the chief bases for the ridiculous superstition that "sugar makes the teeth decay." It is one of the bogies of the nursery.

As Dr. Robert Hutchison, the well-known English authority on dietetics, expresses it, "The fear that sugar may injure children's teeth is largely illusory. The negroes, who live largely on sugar-cane, have the finest teeth the world can show."

The accusation that sugar causes or plays any specially important part in the production of rheumatism, gout, or diabetes, is not only baseless, but absurd. Its only relation to them is that like any other

food, if taken in excess, it may aggravate the symptoms by upsetting the digestion. A more beautiful example of infantile logic than the naïve conclusion that the glucose in the urine of the diabetic was due to his having eaten too much sugar could hardly be imagined. It has only two fatal defects in it: First, that such of it as comes from the food comes chiefly from starch. Secondly, that the serious part of it *doesn't come from the food at all,* but from the breaking down and conversion into sugar of the patient's own tissues by this strange disease process. It is precisely inability to absorb sugar and burn it up in his body engine that kills the diabetic. He dies of sugar starvation and its consequences, not of a surfeit of sugar.

To the final count that sugar is dangerously attractive to the natural man, not to say child, we plead guilty. But why? Simply because the experience of thousands of generations has proved it to be one of our most useful and important foods. That is what "tastes good" means in biological dietetics. Scientists are just beginning to wake up to its true value. A two-year-old toddler sucking a bit of honeycomb, in the days of the cave-man, knew it already, though he couldn't have spelled it to save his little neck, let alone analyse it.

As Robert Hutchison says, "Sugar is one of the most important forms in which carbohydrate can be added to the diet of children.

The great reduction in the price of sugar which has taken place in recent years is probably one of

the causes of the improved physique of the rising generation."

The most recent physiological researches upon muscular action show that most of the energy which moves our bodies comes from the burning of sugar in our muscle cells, and the food which will most rapidly relieve the sense of fatigue and start the body machine going again is a few lumps of pure sugar. No other food that we can take is so rapidly absorbed with so little effort or gives off its contained energy so quickly for the use of the body. We can eat and utilise sugar when we are too tired to digest anything else. As a "pick me up" it is better than alcohol, and far cheaper. This is why every diet that the wit of man has devised contains sugar. Children and savages of course crave it eagerly. All animals try to get it in some form. Even wolves, foxes, bears, badgers, raccoons, and wild cats will drink out of the sap troughs in sugar groves, and eat greedily of raspberries, cherries, grapes, and melons in season. The hunters and trappers of our American frontier would put a box of matches, a small bag of salt and a cake of maple sugar inside their buckskin shirts, and set off for a month's trip. Indian tribes would season their stews and hashes of meat with maple sugar, as we would with salt and pepper.

To-day the most utterly, matter-of-fact, boiled-down, unsentimental diet on the face of the earth, the German Army Emergency Ration, after thousands of trials, contains several ounces of sugar in the form of chocolate tablets. The other ingredients are

bacon and pea meal. A package of this compound small enough to be readily carried in the knapsack will keep a soldier in marching trim for four days. No other ingredients of the bulk will fill the bill.

In short, sugar is, after meat, bread and butter, easily our next most important and necessary food. You can put the matter to a test very easily. Just leave off the pie, pudding, or other desserts at your lunch or mid-day dinner. You'll be astonished to find how quickly you'll feel "empty" again, and how "unfinished" the meal will seem. You can't get any working man to accept a dinner pail without pie in it. And he's absolutely right. The only thing that can take the place of sugar here is beer or wine. It is a significant fact that the free-lunch counters run in connection with bars furnish every imaginable thing *except sweets*. Even the restaurants and lunch grills attached to saloons or bars often refuse to serve desserts of any sort. They know their business! The more sugar and sweets a man takes at a meal, the less alcohol he wants. Conversely, nearly every drinking man will tell you that he has lost his taste for sweets. The more candy a nation consumes, the less alcohol.

The United States Government buys pure candy by the ton and ships it to the Philippines to be sold at cost to the soldiers in the canteens. All men crave it in the tropics, and the more they get of it, the less *"vino"* and whiskey they want.

In fine, the prejudice against sugar is born of puritanism and stinginess, equal parts. Whatever children cry for *must* be bad for them, according to the

pure doctrine of original sin; besides, it costs money. I know families in the rural districts yet where the head of the family groans over every dollar's worth of sugar that comes into the house as a sinful and "unwholesome" luxury.

Give children plenty of pure sugar, taffy, and butterscotch and they'll have little need of cod-liver oil. Indeed eminent doctors have advised the substitution for years past. The only check to be imposed is to keep them from eating it at the beginning of, or as a substitute for, a meal. Like any other food, they may eat more of it than is good for them, if not watched; but they simply won't thrive without it in some form. And if the children of larger growth would "pamper their appetites" a little more, make more careful study of flavours and qualities, and spend more money on choice foods and delicacies, they'd spend far less on stimulants, narcotics and medicines. The man that keeps his boyhood taste for cakes, pies, and candies isn't half so likely to crave alcohol to excess. The warden at a great penitentiary once said that if a prisoner could still relish apple pie there was hope for him. Perchance it is the candy habit that saves women from drink.

So don't be afraid of the Christmas and birthday candies, the fruit cake, or even the mince pie. They're readily assimilable, disaccharid carbohydrates of high caloric coefficient. If they hurt you, it will be your fault not theirs.

In the main, what has been said of sugar applies to candy, since sugar is its principal ingredient. Its posi-

tion, however, differs in two respects: in that it contains other things besides sugar, and that it is eaten not only at or after meals, as a food, but also apart from meals, as a pure luxury or means of enjoyment. It is, therefore, the most generally abused form of sugar in two senses. Most of the denunciations hurled against it are unfounded. It is, when pure, a readily digestible food of high nutritive value. A box of chocolates will sustain life and strength longer than almost anything else of the same weight and bulk, except pure fat. There is nothing positively injurious about it, and much that is beneficial. Its only danger of any consequence lies in its attractiveness, which allures to excess.

Another popular impression which I believe to be largely unfounded is that candy is particularly subject to dangerous adulteration. Of course, it is often adulterated, but not a particle more frequently than any other prepared food. Nor are its adulterations, in my judgment, as apt to be as dangerous as those of such ordinary articles as butter, cheese, preserves, and canned goods. In fact, candy is practically protected against adulteration in a somewhat unexpected way; namely, by the necessity of its tasting sweet.

Now, there is, fortunately, no other substance which has this property in a sufficiently high degree to deceive the dullest palate except sugar. There is nothing that the wit of man has been able to invent which will even respectably imitate it. Those chemical preparations which taste sweet, like glycerine or saccharine, are instantly detected by their disagreeable

burning taste, and besides, they are much more expensive. With glucose at two and a half cents a pound, it is simply absurd to attempt to adulterate candy, so far as two-thirds to nine-tenths of its bulk and all its sweetness are concerned, and in so far as candy is made of sugar, it is good and wholesome. For sugar is one of the few things which is practically never bad. It neither ferments nor spoils with keeping, nor turns mouldy, nor sours on heating. In fact, it preserves itself just as it does everything else which is put into a strong solution of it, from strawberries to ham.

Almost the only adulteration possible is a substitution of glucose for cane sugar. This, of course, is dishonest, as substituting a cheaper substance for a more expensive one, and the sweetening power of glucose is not so great as that of cane sugar, nor its flavour so pleasant. It is apt to leave a sourish taste in the mouth, which shuts it out of all but the cheaper candies, but from a hygienic point of view there is little to object to in the substitution.

Glucose, or grape sugar, is not only just as wholesome as cane sugar, but, as a matter of fact, all cane sugar taken into the body has to be converted into it by the digestive juices before it can be absorbed. As all starches, as we have already seen, have to undergo the same change (technically known as hydration: the addition of one molecule of water to the starch molecule), it can readily be seen that grape sugar is one of the chief natural foods of the body.

Beet sugar, by the way, is the same form of sugar

as cane sugar (saccharose), with only a few minor differences, such as not being so intensely sweet, and crystallising and whitening more perfectly.

As to the other materials that enter into candy, their name is legion, and one can deal only in the broadest generalities in regard to them. Roughly speaking, they may be divided into three classes: those that are added for their physical properties to give a certain consistency, such as cream or a paste, colouring matters and flavouring extracts.

Contrary to popular impression, it is in the first class that the danger lies. Though many of the flavouring extracts, for instance, would be poisonous if taken in large doses, they are used in such minute quantites that the danger from them is comparatively slight. A terrible bugbear has been made out of the fact that some of them are the products of the distillation of sawdust, rags, coal tar, and heaven only knows what other unsavoury substances. But while this is true, curiously enough, many of these ethers, esters, and aldehydes are almost absolutely identical with the chemical compounds which give to fruits and flowers the flavours and odours which we prize so highly. I need not remind any practical cook that the flavours ordinarily used in the higher artistic combinations of the kitchen, such as almond, vanilla, and many forms of lemon extract, are poisonous if used in excess.

Candies are not a whit more dangerous than custards, puddings, or creams. These artificial extracts are so exceedingly cheap that they may be used in a larger amount than necessary, for good measure, so

to speak, but this can easily be avoided by the exercise of a little common sense, especially that commonest but most important sense, the sense of smell, and letting rank-flavoured candies alone.

High flavours in both candies and cookery are danger signals, and should raise a suspicion of what they may conceal in the way of offensive odours from poor or spoiled materials. A few cheap candies that are made with spoiled eggs, poor gelatine or rancid butter are "doped" with these pungent flavours to conceal the fact.

The same may be said of the colouring matters. These, in the better class of candies, are usually harmless animal or vegetable matters, the commonest of which are cochineal, derived from an insect which grows upon the wild fig, and saffron. All shades of red, brown, and yellow can be derived from these, but blues and greens used to be made from fresh infusions of flowers and leaves, like violets and spinach. Now, however, harmless vegetable colours of all tints prepared by firms making a specialty of their production, are almost exclusively relied upon.

Horrifying as it may sound, aniline dyes are extensively used, especially in the production of those patriotic stripes which rejoice the youthful eye, but expert chemist after chemist has analysed this "painted" candy, buying the samples at random in the open market, only to find the dyes present in such infinitesimal amounts as to be entirely devoid of danger.

This brings us to the one inherent source of danger in candies, namely, the materials used to give body to

it. These are chiefly white of egg, cream or milk, gelatine, starch, butter and natural gums, like those of the mallow or tragacanth, or the pulp of quince seeds.

Most of these are, in themselves, not only entirely harmless, but digestible, and even add to the nutritiousness of the compound, such as the butter in taffy or butterscotch, and the milk or white of egg in creams. The only objection to these is that unless they are well mixed with sugar they are likely to spoil; and in fact it is the rancid butter and cream, or spoiled eggs chemically treated, or poor quality of gelatine, which are used in cream pastes or caramels by some unscrupulous makers, that are the chief dangers in eating candy.

The better the cream or caramel, however, the less of these extraneous materials of any quality are used. An expert candy cook can produce almost any desired consistency with pure sugar, by regulating the temperature, the length of boiling, and the amount of water. Occasionally small amounts of cream of tartar or glucose are added to "break the grain" and prevent "setting" or hardening.

Here, however, it is a question of the honesty of the maker and knowing the brand of the candy you are eating. The better-known makers of candy are usually scrupulously particular in this regard, and here, as everywhere else in the food market, it never pays to buy cheap stuff. If you do, you are exceedingly liable to be cheated or to be ptomaine poisoned. The risks run are not a particle greater than those braved in eating pies, puddings, cakes, or any other

article of food whose pedigree you are not absolutely sure of.

At its worst candy is not half so dangerous as hash, soup out of a stock-pot, bread pudding, or any other of the sacred mysteries wrought out of stale and decaying odds and ends, which are worshipped by many model housekeepers. The substitution of starch for butter or cream to give body to the cheaper creams and pastes, while very disagreeable, is harmless, and like the use of rancid butter, or even cheaper fats, such as suet and lard, will promptly reveal itself to the unblunted palate. In fact, candy is peculiarly protected from many adulterations and dangers by the very delicacy and purity of the flavour demanded of it.

At one time arsenic was said to be used to give a green colour to the cheaper grades of candy, but it was never common, and has passed out of use entirely since the introduction of aniline dyes.

To sum up, candy when eaten in moderate amounts and toward the close of or shortly after a meal is a harmless and often beneficial addition to our diet. The risks from its adulteration are small, probably less than in any other elaborately prepared food. Its danger lies in its attractiveness and its power to kill the appetite before a sufficient amount of itself or other food has been absorbed.

While a liking for it is perfectly natural and wholesome, an excessive craving is generally a sign of disease. Those young ladies who are said to live chiefly upon candy and pickles do not owe their pallor to the

candy they eat, but to some definite morbid condition, most generally based upon a lack of proper exercise in the open air or of sufficient sleep. This should be corrected by proper hygienic or medical means, and then their normal appetite for more substantial foods will return. Failing this, it is perfectly idle to try to cut off their supply of candy. They had better eat that than nothing, which will be their choice until their normal condition is restored.

The bad effects of candy are chiefly the fault of the person who eats it.

CHAPTER XV

PLAY AS AN EDUCATION—THE SCHOOL OF PLAY

FEW things are more striking than the apparent wastefulness of nature. Whether it be in the countless millions of living forms born only to perish, or in the acres of rich wheat soil swept out to sea every hour by the great rivers, in the awful slaughter of war or the wanton misery and ruin due to gambling or the drink habit, it confronts and saddens us on every hand. It has ever been held to be one of the chief blots upon the fair shield of nature.

But like all other blemishes, the more closely we study it the clearer it becomes that the waste is only apparent, and the more plainly the good beneath it stands out. Death is now seen to be no loss or destruction, but only a change of form, a returning of the materials used up in nature's unsuccessful experiments to the great crucible of mother earth, thence to emerge again in new and more perfect forms, thus enabling her to conduct the most extensive experiments with a mere handful of material. Death is one of the chief economists of nature instead of a waster, a friend and not an enemy of life. The tons of silt, swept down by Nile or Mississippi flood, sink into the abyss of ocean, only to reappear in miles of broad and fertile delta furnishing wheat for millions, or by their

weight upon earth's elastic crust to upheave far inland kingdoms of swamp and sea-bottom, to form the corn-fields of new nations.

The fierce ordeal of war is the stern nurse of all the manly virtues, drunkenness the constant and effective eliminator of the unfit, gambling but the noble daring of the empire-builder, the explorer, the trade-prince, run wild. The loss involved in all these is but a fraction of their gains; the waste, a stepping stone to future economy. Even in the pulsating rhythm of healthy life, the same odd contradictions confront us. We live to move, to see, to hear, but a third of our existence is spent with closed eyelids, stopped ears and relaxed muscles, kinetically dead, only statically alive.

We live to move, speak, think; but two-thirds of our lives are devoted solely to acquiring and devouring the food fuel, which when burned in our body engines will give off these manifestations of energy. We eat to live, but we also live chiefly to get enough to eat. Three-fourths of our life is apparently spent merely to gain the privilege of continuing to live. We eat food to get strength to earn more food, and so *ad infinitum*.

Philosophers and transcendentalists in all ages have mourned over the fearful amount of time wasted in feeding, resting, and caring for this dull body of ours —"my brother the ass," as Francis D'Assisi tersely put it. To-day we are beginning to grasp the conception that mental gifts and spiritual graces are the perfect flower of our modest body-plant. Aiming

at the finest possible blossom, do we waste time in cultivating and feeding the roots?

In the field of education we find ourselves face to face with a striking instance of apparent waste of energy. This is the phenomenon of play, the irrepressible instinct of the young human animal to waste his precious time in frivolous and utterly unprofitable pursuits. The spirit that evoked that ludicrous outburst of purblind theological despair, "Satan finds some mischief still for idle hands to do" is gone. "Satan's mischief" was chasing the butterfly and pulling the pussy's tail, field work in nature study and primitive experimental physiology; God's work, learning the shorter catechism. In the language of Montaigne's profound paradox, *"Il est le temps qu' on perd, qu' on gagne."*

This is the tendency which makes the child a rebel upon instinct. It is the born foe of authority, in whatever guise, the enemy alike of both Church and State. The one thing which the priest, the pedagogue, the philosopher are united in saying the child should do, is the very thing he will not—sit still and learn. From the view-point of authority what could be worse; he has but a decade or so to prepare for the serious business of life and the risks of eternity, and he would waste every hour of it in play? Poor bespectacled, old, grandmotherly authority, she has an evil time of it these days.

For ages this was accepted as one of the conflicts of nature, the natural enmity of the carnal mind against everything that was good. But in these

naturalistic times the mere strength of the impulse begins to command respect. We feel it to be entitled to at least a fair investigation and study. We are coming to the conclusion that whatever the natural man uniformly wishes to do has a decided element of good in it. One of the first—and silliest—uses man made of his reason was to look down upon instinct. Until quite recently, all that was necessary to condemn an impulse or action was to say that it was the result of "mere brute instinct." The moment we begin to investigate the pedigree of instinct we find that it is the crystallised result of the experience of millions of generations. It is worth while to remember, what a moment's reflection will show us, that no instinct for that which is seriously injurious can develop. A race which invariably tended to do the wrong thing would promptly eliminate itself.

Nay, the same process is going on in the life of the individual. The formation of good habits, of which we hear so much, is merely the struggle to turn the promptings of reason, based upon the mental experience of the race, into instincts in the individual. This, of course, is not to say that instinct never makes a mistake. It makes almost as many as reason does. An instinct which grew up under one set of conditions may prove injurious under changed surroundings, and like any other impulse that moves the human mind—physical, moral, or divine—if followed to excess, it may become injurious. But from the evolutionary point of view, the mere fact of the existence of an instinct entitles it to a most respectful considera-

tion. Many of our best and most useful actions are done upon instinct.

So that instead of distrusting the play impulse, its very strength would prepossess us in its favour. We should conclude that it must, at least, have been of high value to the race in the struggle of the past. And we should certainly, as pedagogues, endeavour our utmost to "hitch our wagon to this star" and enlist it upon our side in the process of education. Our point of view has changed entirely. No longer do we strive to fit the child to an education, but rather to fit education to the child. We are beginning to believe, with Browning, that the impulses of the natural child, like all else in the unspoiled world, "mean intensely and mean good." We mean to make this force our ally if possible, instead of our enemy as hitherto. This in a word is what the "New Education" means, with its wave of child-study.

Education has consisted altogether too much in training the child to do just what he didn't like to do—often for little or no better reason than to discipline him, to "break him in," to teach him that there was "no nonsense" about real learning. We can probably all remember when we counted no study meritorious, unless it was hard. If we enjoyed work it wasn't study.

This presumptive confidence of ours is supported at once when we turn to the pedigree of the play-impulse. If there be any one character whose degree of development distinguishes man from the animals, and the higher animals from the lower, it is play.

With the birth of infancy, helplessness, comes parental care and all that this implies, on the one hand, and intelligence on the other. Play signifies possibility of education. It is the mother of intelligence in the offspring, as love is in the parent. The one physical character which varies absolutely and constantly *pari passu* with the degree of intelligence of the animal form, is the length of its period of dependence. And this means the length of its period of play. Play is the voluntary rehearsal and practising, under parental protection, of the actions and accomplishments upon which, later, existence itself will depend.

A little consideration will show this clearly. The young frog needs no parental care, for it is able to fend for itself and secure its own living from the moment of hatching. Hence it spends no time in play, but so to speak, goes to work at once. Its part is so simple that it needs no rehearsal. It may even be compared to that of the subordinate actor in the play, who had the glory of his name on the bills, but whose sole part was to say, "Dinner is served." The recognition of said dinner (and mate when the time comes) and the chemotactic lunge toward it comprise pretty much the "whole duty of frog." They are drawn by food, and by the mating impulse, much as the toy swan in the bowl is drawn by the little red magnet. They are little more than a bundle of delicate electrochemical reflexes. There is a vague popular impression that they play at least one game, "leap-frog," but this is an error. It took boys to invent that. Every

leap of a frog is a serious business effort to capture food or escape an enemy. And he makes it, as Falstaff was a coward, upon instinct.

The same state of affairs prevails in fishes, although these, later in life, go through some very pretty little darting and chasing evolutions, which seem to be from sheer joy of movement, and hence to that extent are of the nature of play. But the tiniest silver flake of a fry will dart upon a worm or flash away from a duck's beak as promptly and intelligently as the King Salmon himself. Fishes have no play-time, and hence are practically incapable of education. The utmost that has ever been achieved in this direction has been the training of carp and gold-fish to come to be fed at the sound of a bell.

In the basin of the great fountain at Fontainebleau, the fat old carp—Benedictine Brothers, all but the rope girdle—will rush toward you in the expectation of something to eat, the moment your shadow falls on the water, instead of darting away from it as from a pestilence, as a mountain trout will. An ingenious friend of mine devoted many months of time to the endeavour to carry gold-fish one step farther. He readily trained them to come to a certain corner of the aquarium to be fed at the sound of a bell. Then, dropping a string from the lever of the clapper into the water, with a worm tied to it, he led them to ring the bell themselves by tugging at the worm. But though all the rest of the group would run for the food whenever one of them rang the bell in his onslaughts on the worm, he never could get

their little imaginations to vault the gap and connect the tug on the string with food. No matter how hungry he let them get, they never would pull the bell-string for food. Their intellect was capable of a one-step association process, but not of a two-step.

It might be said in passing that the "Educated Fish" or "Singing Fish" of the penny shows and circus bills is merely a seal.

There is little need to go lower down in the scale for our basis, as most observers are now agreed that invertebrates, in spite of the remarkable complexity attained by those wonderful little automata, the bees and ants, are in reality incapable of education, and practically devoid of that power of association memory which is the modern physiological equivalent of "consciousness" or "intelligence."

A community of ants, for instance, with all its wondrous division of labour and power of combination for social ends, is merely a horde of automata, each one or class of which is born with certain definite and almost irresistible impulses toward a certain line of action. One group, the nurses, are drawn to the eggs and pupæ, as steel filings are drawn to a magnet; another, the foragers, to food of every sort; others, the warriors, are similarly attracted by the literal "smell of battle," the odour of the bodies of hostile ant-tribes. You may cut any one of them into successive little bits during the performance of their duty, and what is left of them will go right on with the process. Let a forager once fix her jaws in food, or a warrior in her enemy's body, cut off her head

and her jaws will still hang on. A South American tribe is said to use ants' heads as surgical sutures. The lips of the wound are brought together, a large warrior ant is induced to fasten her forceps across the line of union, her body is cut off and her head and jaws remain as a permanent "lock-stitch" until the wound has healed, when they are broken and lifted off.

It was at one time believed that ants could communicate ideas to one another, from the fact that a forager who finds food will shortly return with a swarm of her fellows, or a warrior attacked by the enemy will draw her comrades to her aid. More careful experiment, however, has revealed that all that is communicated is the smell or taste of food in the first case, and the pungent odour of angry strangers in the other. Ants recognise their friends even after long absences, and promptly tear to pieces strangers introduced into their nests or territory, but rub a friend with the juices of an enemy's body, and he will be attacked at once, while a stranger flavoured with the extracts of a dead comrade will be welcomed with open arms.

These creatures are devoted to their work and to the community about as an acid is devoted to a base. Their industry is a sign of what from a human point of view we should term stupidity rather than intelligence. And the "little busy bee" is just as bad. Yet we have held both up to the young, for centuries, as moral examples! What wonder that they refused to follow them? Philosophers may reason, but chil-

dren know better by instinct. We used fairly to hate the little insect prigs. We were sure there was something wrong with them if they never played. And so there was.

Even in so charming and accomplished a class of animals as birds, with their wealth of colour and song, we find comparatively little of the play instinct. They are, however, the more interesting from the fact that they may be divided into two great groups, in one of which *(Altrices)* the play instinct is present to a limited extent, while in the other *(Præcoces)* it is almost totally absent. The first has a fair possibility of education, the latter little or none. The first and larger of the two comprises those birds which build usually cup-shaped nests, commonly in trees or other elevated positions, in which the young are hatched naked and helpless, requiring the utmost care and attention of both parents to keep them alive. The other group builds its nests for the most part upon the ground, and the young are hatched, clothed, open-eyed, alert, and ready to run and feed for themselves from the breaking of the shell, some even ready to fly.

A familiar example of the *præcoces* is the chick, which will peck vigorously at food, or any light-coloured or shiny particles, within twenty minutes after hatching. This group have practically no play period, their nearest approach being fighting for worms. They go to the serious work of life at once, and as for their capacities for education—well, every one knows how much brains a hen has. In spite

of the fact that the whole Gallinaceous family, hen, partridge, pheasant, turkey, as well as the water fowl of this great group, the ducks and geese, have been most intimately associated with man for centuries, on gastronomic considerations, the only respect in which they have advanced one iota has been the tenderness of their flesh, and the size and frequency of their eggs.

A pet hen is a *rara avis,* while pet lambs, calves, colts, and even pigs, can be numbered by the score. In a most affectionate and somewhat extensive intimacy with beasts of all sorts of some forty years' standing, I have known personally only one pet hen, who would come into the hall every day to lay her egg in the umbrella-dish of a hat-rack, while I have been acquainted with scores of educated members of the other group, pigeons, canaries, thrushes, hawks, crows, parrots. Though these *altrices* have less play impulse than mammals, yet they have distinct traces of dances, parades and games of various sorts, and their intelligence keeps closest step therewith. The tendency culminates in parrots and mynahs, which are full of fun, even rising to the pitch of playing and appreciating a joke, and are in consequence head and shoulders the most intelligent of birds. Laughter is a sign, as well as an effect, of wit.

The moment we pass the line of feathers and enter the kingdom of fur, we are in a more playful atmosphere at once. Slight in the pouch-bearers (Marsupials)—I have watched little "Joey" kangaroos for hours without seeing any play, except a little mock

fighting and chasing—the play impulse rapidly increases with each rise of type and intelligence, until in the highest groups its vigour has become proverbial, "playful as a kid," "frisky as a kitten." And here its prophetic character is so obvious that one needs only to have his attention directed to it, as in Karl Groos's charming work. The bundle of fur and purr we call a kitten darts after the tip of her own or her sister's tail in precisely the same fashion that she will dash after every sign of fur that she sees slip through the brush and bracken later in life. Her pounce upon the rolling ball of yarn or spool is a ludicrously vivid rehearsal of her fatal leap upon poor mousie or bunny, when meat at dinner has become a necessity to her. Her eldest brother springs upon his much-suffering mamma and threatens her life and ears in precisely the same fashion as he will fight for the championship of the roofs in the full dignity of cathood and whiskers, even accompanying the process by prowlings of most comical ferocity.

The gambols of the young lamb jerk those absurd-looking legs of his about in every possible direction, until they come to really belong to him and will carry him wherever he wills. His playful buttings and plungings are a preparation for future battles for lordship of the flock. His tendency to rush to the top of the highest hillock that he can find, and from that post of vantage butt down all assailants, "King-of-the-castle" fashion, is an inheritance from mountain ancestors, the identical manœuvre which Seton

Thompson has immortalised in the splendid stand of "Krag, the Kootenai Ram," against the wolf-pack.

Nor is play a whit less precisely prophetic and admirably adaptive in the young of our own species. It is educational in the highest sense of the word. The joy of the child's heart is to mimic the pursuits of its parents and ancestors. Formal education is but a feeble imitation, often a counterfeit, of Nature's great School of Play. When the child plays it is not merely relaxing itself, getting an appetite, getting health, it is literally building and organising its body, nay its brain and mind. A quaint old story used to run, that bear-cubs were born shapeless lumps, and licked into shape by the mother-bear. Children are born little amorphous bundles of possibilities and *played* into shape. The reason why educators—even Froebel—have never recognised play at its full value is that the child's imitations begin with the pursuits of its ancestors. The child of to-day is not born in the twentieth century, but in the Glacial Epoch, on the edge of the receding ice-sheet. It is born not an Anglo-Saxon, but a Cave-dweller. Its mind is contemporary with the mammoth. Hence its earliest play impulses have no apparent practical bearing whatever. The child's mind begins where that of the race did, and passes through absolutely parallel stages in its development. This has been recognised, though most lamely and inadequately, in the Herbartian doctrine of "The Culture-Epochs," but that, as Plato remarks, in phrase that most amusingly suggests a very modern instance, "would appear to fur-

nish forth material for another discussion," one which I hope to undertake some day.

From this point of view all his plays become strikingly "prophetic" and rehearsal in character. Basing the division into stages of human progress, in both the child and the race, upon the methods of food-getting, a basis which for numerous reasons, of which space forbids discussion here, seems both most convenient and most fundamental we find five stages through which, roughly speaking, every civilised race and child has passed. These I have ventured to designate as the *"Root-and-Grubs,"* the *Hunting,* the *Pastoral,* the *Agricultural* and the *Commercial.*

Into the first of these our dear little twentieth century Neanderthal mannikin is born. To him everything movable is a possible article of diet. At whatever hazards he will test it; his one and only criterion of everything is his tiny mouth. Into that rosy opening is thrust, impartially and just as far as it will go, everything that his chubby paws can clutch, from the contents of the coal-bucket to the painted monkey on a stick. His are the dietetic impulses of the Digger Indian and the Bushman.

The moment he can crawl he starts on foraging tours of exploration. His earliest delight is lunging and clutching at glittering or bright-coloured objects, such as his father's watch-chain or his mother's ring, and unless promptly rescued from that clutch their fate is sure. A little later the rolling spool or bouncing ball attracts him, just as it does the kitten, and for the same reason. This lands him in the Hunting

stage. Even before he can walk the instinct of ambush awakes within him. No object is too small to be utilised as a shelter; he hides beneath his blankets and demands that agonised search be made for him; he lurks behind the door, the chair, under the table, to pounce out upon his pursuer with terrifying roar. If nothing else is available, up goes his little pink palm before his face, or, with even more charming naïveté, he simply shuts his eyes and is sure he is securely hidden. "Hide-and-seek," "Tag," and "Bear," whether he eats or is eaten, are a never-wearying delight.

So soon as he takes his walks abroad he peoples his modern environment with the wonders of a past age. There is a lion (cave variety) in the far corner of the potato-cellar, a jabberwock has its nest in the hay-mow, wolves and "bufflers" swarm just beyond the garden hedge, a "booger" lies in wait for him every night, in the dark corner under the attic stairs. He goes about armed for all these emergencies with clubs, swords, and even charms.

From the *Hunting* stage he rapidly graduates into that of Warfare. His darling ambition is to be a "pirut." He demands a gun, a sword, a drum, a uniform, and proceeds to organise an impromptu militia. "Prisoners-base," with its thrilling episodes of capture, imprisonment and rescue, "King-of-the-Castle," "Forts," with their mock assaults and sieges; could anything be more obvious than the both atavistic and rehearsal character of all these? The town is divided off into districts not recognised on the city

maps; the "Hill gang" invades, only at its personal peril, the territory of the "Badgers." Each gang has its rallying cry—a whistle, or even actual war-whoop —which calls every member within hearing to battle and to the rescue, its password, its captain, its favourite weapon, its rude court-martial. Here is the birth of Tammany, the campaign club, the fraternal society, yes, of the social organism, as well as the school of real war and colonisation.

Side by side with these martial movements has gone forward the development of the peaceful arts: he early becomes a centaur, inseparable from his horse, whether of the wooden or play-fellow variety: driving and coaching is his delight. He acquires garden plots and covets adjacent vineyards of table-cloth size as eagerly as Ahab did Naboth's. He plans and constructs houses of fearful and wonderful design, usually, with amazing atavistic fidelity, *first* of all in trees and caves. He hankers after every stray puppy or wandering kitten that he sees, and fills the rear premises with a motley menagerie of luckless tame crows, squirrels, toads, guinea-pigs, turtles, repeating the ancient experiments of the race toward the domestication of every living thing that could be captured and kept. When they die, as they usually do speedily, he buries them with weird rites, and erects cairns and monoliths to their memory.

Last of all he emerges into "Time's noblest product," the Commercial Stage, in which we are so proud to be living in this twentieth century. Marbles, checkers, and shells become his wampum, the swap-

ping mania possesses his soul, games are played "for keeps" or for prizes. He loads himself down with articles of barter, till his pockets bulge like potato-sacks. He begins to grasp the idea of the value of his labour, and bargains craftily for wages. Every demand of the family for personal service is met Yankee fashion with the query, "What'll yer gimme?" Even his morality is turned to profitable account (quite unlike that of his elders); he will be good for sixpence and better for a shilling. He is now qualified for Wall Street, for "success in life," and what more could one ask of any system of education?

In short, the School of Play in fifteen short years has brought him from the root-digging cave-man to the "Bear" of the Stock Exchange, the modern Captain of Industry.

But this objection will at once be raised: even granting for the sake of argument that play will furnish a valuable training in physical development, in the bread-winning crafts, and in the arts of war and politics, what bearing has it upon intellectual development? Can it ever be regarded, from the point of view of education in its narrower sense, the training of the mind, as more than a mere necessary relaxation, a simple interlude in serious pursuits, a sort of safety valve for the mental engine?

Here again our point of view has shifted enormously of late years. We have little hesitation in claiming for play well-nigh as important an influence in brain-building as it obviously has in body-building.

It is a question of origins. Both ontogenetically and phylogenetically, there can be no longer any possible question that nerve-tissue, with all its wonderful possibilities, is merely a specialised form of ordinary protoplasm; and that every ganglion cell in the entire brain came into being in response to the economic needs of some part or tissue of the body. Physiologically considered, the brain is the creature and servant of the body. It is a mere telegraph system or telephone exchange, capable of *transmitting* messages, seldom of *originating* them. It receives impressions from the sense organs and transmits them to the muscles. It is the veriest "middle-man." It usually discriminates between the stimuli messages it receives by obeying the strongest.

Whichever side we may take in the old-as-the-world battle over the relation of mind to matter, we can all agree that the mind needs a brain tool to work with, and that everything which enlarges and supplies and organises the central nerve machine increases its possibilities as a thought engine.

Now the ancestral history of this nerve-telegraph system is most interesting and suggestive. Its first appearance is a diffuse network in the outer layer (ectoderm) of the Hydra, gathering up sense stimuli from its external surroundings and transmitting them to the muscular cells which change the animal's shape, and to the stinging lassos which shoot out to paralyse the tiny organisms on which it lives. In the jelly-fish these strands become organised into a double ring around the margin of its bell, an obvious tele-

graphic "belt-line," to connect all parts of the body by the shortest possible route. In the star-fish and sea-urchin this ring centralises still further to form a collar around the mouth, with radiating branches to each arm or segment.

In the worms, we have the same ring around the mouth (or, more exactly, gullet) connecting behind (posteriorly) with a double chain of ventral nerve-knots (ganglia) running the entire length of the body. Each segment of the worm's body contains a pair of the nerve-knots of this ganglion-chain, but the pair lying above and in front of the mouth, forming the front of the gullet-ring *(supra-æsophageal ganglia)*, naturally receive by far the larger number and variety of impression messages; in other words, have the most work to do. This necessitates an increase of their "plant," so to speak, and new nerve-cells are added, until the pair of nerve-nodes swells into a so-called "brain." As this is chiefly occupied with receiving sensations of smell and taste, and in a lesser degree of light, and transmitting them to the mouth parts, it may be roughly described as a "nose-brain" *(rhinencephalon)*.

In the cray-fish we find a similar arrangement; gullet-collar and beaded chain down the length of the body, with the further step that the anterior knots of the mouth ring have swelled into a still larger brain, which has become three-lobed. As eyes have now appeared, this may be characterised as a "nose-eye" brain.

In insects precisely the same ground plan appears,

with further specialisations. The anterior knots or brain have become much larger in proportion, and we have not only a distinct eye-lobe and nose-lobe, but also a third or superior paired nerve-mass, the brain cup or "mushroom-body," the rudiment of cerebral hemispheres.

In this condition the nervous system enters the vertebrate or back-boned phylum. There are such curious and striking changes of relation (the organism, for example, having, so to speak, turned a somersault, so that the nerve-cord runs along the upper *dorsal* instead of the lower *ventral* aspect of the body, and the gullet having slipped out of the embrace of the nerve-ring) that we are unable clearly to trace the line of blood-relation between the two forms; yet the general working plan is precisely the same. We have a brain just above the mouth, tapering backward into a cord, running the length of the body, composed of successive (though no longer distinct) segmental ganglia. The brain is made up of an anterior or "nose-lobe," a middle or "eye-lobe," and a hind or "ear-lobe," while from the nose (olfactory) lobe buds off (for the first time in the lamprey) a tiny pair of cerebral hemispheres. This basal plan remains practically unchanged in all successive forms up to our own species, the chief changes being the degree of overgrowth of the cerebral hemispheres. These, starting from the nose-lobe (rhinencephalon), receive communicating fibres from each of the other two, as more and more active, extensive and complicated combination movements become necessary, until in the lower fishes (gar-

pike) they become as large as the nose-lobes; in the higher (salmon) twice the size; in the frog almost as large as the nose and eye-lobes together; in the lizard, larger than all three primary lobes combined; in the bird, about one-half the entire brain mass; in the dog, some three times the weight of the primary or basal ganglia; and in the human species nearly eight times.

To briefly recapitulate, the nose-brain grows up just in front of the mouth, to pass judgment upon the food; the eye-brain follows it, because this mouth-end of the animal literally "goes first" and is first and most frequently thrust into danger. This fixes the "capital" of the body-state, and every other interest hastens to get a representation there. The correlation and sorting of all these nerve-messages and muscle-orders demands a systematising bureau, and the cerebrum or so-called brain proper is created, built up, of quotas contributed by the three primary lobes, welding them firmly together and finally imbedding them in its mass.

And, as everywhere else in the body, this ancestral history is repeated with extraordinary fidelity in the individual history of every one of us. Our nerve system begins in the embryo as a thick, plate-like cord, running along the dorsal surface of the body-area of the yolk. This curls upon itself along its borders, and sinks into the tissues trough-fashion, to become a closed, thick-walled tube. Before it has fairly sunk below the surface it begins to bulge out at its anterior or "head" end. The front pair of projections form

the nose (olfactory) lobes (fore-brain); the next lateral pair form the eyes, optic nerves and optic lobes (mid-brain); the third the auditory and balancing lobes (hind-brain). From the fore or nose-brain spring, precisely as in the crayfish or the ant, the cerebral hemispheres; ballooning rapidly upward and backward they crowd over, around, below, behind the mid and hind-brain, until the entire contents of the skull are imbedded and enveloped in the huge cerebral cap, which forms eighty-five per cent. of their bulk.

This, it may well be urged, is the organ of the mind, and has grown up in response to the demands of the increasing intelligence. Granted, for the sake of argument: but the fact remains indisputable that it is also, in well-nigh every part, the organ of the muscles and of the senses. One of the most singular things in modern neurology is, that in spite of enormous advances, *all that we positively know* about the functions of the brain, physiologically, is that certain large areas of its surface represent certain groups of muscles and certain sense-perceptions. A large area in the central (Rolandic) region controls in map-like order of succession the muscle groups of the body from the tongue to the toes. Stimulate with electricity any one of the little "centres" (often no larger than a sixpence) and you cause the corresponding group of muscles in the thumb, the lip, the eye, to contract; destroy it, and you paralyse them. A "stroke of apoplexy," or paralytic attack, is simply the destruction of a larger or smaller number of these

centres by the bursting or plugging of the blood-vessel which supplies them. In some cases of epilepsy, we can tell precisely the point where a spicule of bone is pressing upon the brain by noticing the little group of muscles in which the "fit" starts—in the hand, the foot, the face—and trephining down upon its "centre."

Nor is this localisation confined to merely muscular activities; still higher relations are involved. Destroy one small area less than an inch square in the frontal lobe (posterior portion of third frontal convolution or "centre of Broca"), and speech is abolished at once *(motor aphasia)*. The patient can think the word he wishes to use, can recognise it when he hears it spoken, or sees it written, but speak it, never. He can make every sound that he ever could make before, but the particular group of sounds he wishes to pronounce is absolutely beyond his reach. He has sunk at one plunge to *"Homo alalus,"* and his eager babble and frenzied desire to express himself, his disappointment and even exasperation at his hopeless inability to "make the right word come," are one of the most pathetic sights in life.

Touch another of these tiny areas and the power to recognise or recall the spoken word vanishes *(amnesic aphasia);* another and the ability to read disappears *(word-blindness);* yet another and the faculty of forming the written word with pen or pencil vanishes *(agraphia),* and so on through the entire series of the language-mechanism of thought and

speech. This part of our brain seems almost like the keyboard of a type-writer.

Outside the central motor area, we can fairly definitely locate a visual centre in the occipital (posterior) lobe, an auditory centre on the outer and an olfactory on the inner aspects of the temporo-sphenoidal lobe, injury of any part of which will produce varying degrees of blindness, deafness, and loss of smell, respectively. But these sensory areas and the motor one taken together only account for about one-third of the cerebral surface *(cortex)*, leaving two-thirds of the grey matter entirely unexplained or unaccounted for, except as association areas for the combination and collaboration of the sensory or motor areas.

Our first impression was that these were the areas especially concerned in intellectual processes, the organs of the reason, the memory, the judgment; but we were soon driven from this position by the disconcerting discovery that large portions of any one of these areas could be removed or destroyed without affecting the intellectual powers in any appreciable respect. Pigeons, rabbits, and dogs, properly anæsthetised and protected against shock, could have a considerable portion of the cerebrum removed and recover without any appreciable impairment of their intelligence. In dogs, for instance, the whole frontal lobe (anterior to the motor area already mentioned), nearly a third of the entire brain, can be removed, and yet the animal on recovery will recognise his friends, come when called, seek and relish his food,

avoid danger, almost as readily as before; the only difference being that all these processes are a little more slowly or less perfectly performed. The same is true in man. A large part of the frontal lobes, which ever since classical times have been regarded as closely associated with intellectual power, may be destroyed by accident, by tumour, or by cutting off their blood supply, and yet the mental powers be in no important degree affected.

In the museum of the Harvard Medical School there is a famous skull which shows a huge ragged hole in its frontal part. It belonged to a miner who was tamping down the blasting powder into a drill hole with a heavy crowbar, when the charge suddenly exploded and drove the crowbar completely through his skull. It entered just beneath the eyebrow and came out a little in front of the middle of the top of the head. The bar was tugged out by his comrades, just so that it would not have to be buried with him, but to their astonishment he recovered and lived for many years in apparently perfect health. Nor was it a mere vegetative existence. He drove a stage-coach through the mountains of Pennsylvania for years, and the only change which his friends could notice in his mental condition was that his memory was slightly less keen and his temper a little shorter than before; changes which might readily occur after any shock of this magnitude, or even without any special cause, in a man after middle life is passed. And examination after death has now revealed equally extensive and serious injuries to various areas

of the brain cortex in a number of cases, in which during life no distinct impairment of the mental processes whatever could be detected, except that in some cases they were performed more slowly and with greater difficulty, or their general range was diminished, so that some of the more difficult feats were no longer possible. Linguists, for instance, have lost the use of their foreign (acquired) languages while retaining full command of their native tongue.

In fine, the brain still remains the most fascinating mystery in the realm of physiology. To only about one-third of its surface can definite functions be assigned, while of the remainder we know nothing, save that large areas of it may be destroyed without interfering with any mental function. As for the localisation of any of the special faculties of the mind, let alone of disposition, in any particular area of the brain, we have not a fragment of evidence in support of it and much against it.

One fact, however, stands out with startling distinctness, and that is, that large parts of the brain, and these far from the least important ones, can be directly developed by muscular movements. And it is almost certain that a considerable proportion of the remaining area is secondarily affected by the same processes. Exercise is literally the mother of the brain. As one of our most thoughtful gymnasium directors puts it, "the field of training is the nervous system." Every play and sport worth the name develops not merely strength, endurance, and fleetness,

but also alertness, quickness of response, coolness, balance, wariness, judgment that is both sound and swift.

Athletics, in spite of their more than occasional excesses, thoroughly deserve the high place they have won in college training; they are a valuable part of education in the widest sense. Our instincts here, as elsewhere, may carry us to extremes, but they are sound at bottom.

It is even impossible to draw the line precisely where physical education ends and mental development begins. Consider the extraordinary fact that the speech centre is developed *upon one side of the brain only,* the side which controls and is nourished by the most highly trained hand, in right-handed individuals upon the left side of the brain, and in left-handed individuals upon the right side, for by a curious *bouleversement* each side of the brain controls the opposite side of the body. Not only so, but the hand-centre lies close behind the speech-centre, separated only by the centre from the tongue and lips, which probably means (as a score of other considerations, which cannot here be discussed, also strongly indicate) that articulate speech is breath or throat-sounds, chopped, so to speak, into syllable-sections by gestures. So that the erect position, freeing the fore-limb for development into a hand, by the use and discipline of the weapon and tool, made possible the birth of speech. Speech, of course, it not thought, but it is its indispensable mechanism, and how comparatively little would man differ from the animals without it? No wonder

that manual training has fought its way up to such a prominent place in education.

As Cunningham has recently pointed out, it is in this "hand-region" that the human brain is most clearly differentiated from all lower forms. The size of the lower half of the Rolandic area is its best single distinguishing characteristic—*e. g.,* from the higher anthropoids.

It is of course true, as may be objected at once, that the child is born with a brain most distinctively human in shape, and far larger in proportion to his body weight than that of the adult. So that at first sight it appears all ready-made, a blank cheque for the mind to sign at its leisure. But the brilliant researches of Flechsig have shown that this huge and apparently "prophetic" aggregation of nerve-stuff is simply so much virgin soil, a mass of mind-pulp. Probably every ganglion-cell, every nerve-fibre, which will be found in the adult, is already present, but the fibres are not isolated from each other and organised into systems and association groups. They are a close-packed tangle of naked wires, "spilling" the nerve currents in all direction, until they undergo a process of insulation and organisation, enabling them to carry impulse currents in certain definite directions and without spilling, known as "myelinization." This is an actual physical change which can be followed under the microscope, and goes steadily forward until the seventh or tenth year of age, *but if any area of the brain be cut off from its sense-organ or muscle-group, or the latter prevented from developing, it re-*

mains un-myelinized, as at the day of birth. When the child plays it is literally organising its brain, myelinizing its mind machine.

If then play be such an important factor, in not merely bodily but also brain development, is it not time that it was more formally and extensively recognised in our systems of education?

I say recognition, and official at that, not mere indulgent and supercilious toleration. Is it wise to continue to regard it as merely an interlude in the "serious" work of education, a necessary but regrettable safety-valve, by "blowing off," through which children will be able to absorb larger quantities of Latin conjugations, rules of grammar and arithmetic? Need we longer feebly and shamefacedly defend athletics in school and college life, on the ground that they increase the popularity and prestige of the school, and keep the boys healthy and contented, so that more "work" can be got out of them? The argument is a high compliment to the sound judgment of the young, but is it enough? Why not frankly recognise that when the boy or girl is engaged in vigorous, joyous play, he or she is carrying out an important part of the actual "work" of education, in the broad sense of preparation for life, and give "course credits" accordingly?

This was the idea which was glimpsed by the wonderful, though fitful genius of Froebel, and which he crystallised into that charming institution, a *monument perennius ære,* the kindergarten. His conception was superb in both its beauty and its truthfulness,

that the little human bud, like any other healthy plantlet, tended naturally to grow up and blossom into manhood and womanhood. All that was needed was to gratify the instincts of the one for air and sunlight, and of the other for play and "finding out about things."

My only criticism of the system is that it has become a system, almost a cult, a religious ceremonial, and that, enormous advance as it is, it does not go far enough. It does not trust nature quite sufficiently yet. It is a little inclined to load the natural play of the child with certain "instructive" elements, especially moral and mathematical (the square, the cube, the circle, and their esoteric implications), far in advance of his grasp. And surely a real "child-garden" should be in the open air! Modify it in these three aspects, and it would be ideal.

Just to get the problem into debatable form I would submit a few practical suggestions. First, that every schoolhouse should be provided with a playground, containing at least ten square yards for each pupil. This would make, roughly, for every forty children a city lot (30 by 120), for 400 children half block. For every dollar spent on the building, half a dollar ought to be spent on the playground, and I can hardly conceive of a better investment for the community. Personally, if I had to take my choice for my own child, in one of our large cities, between a school without a playground and a playground without a school, I would choose the playground.

All these spaces should be *real* playgrounds, *not*

ornamental lawns and miniature parks. I love flowers, but when I see them usurping space that belongs to children, and driving the latter out into the streets, or, worse still, into the hallways and basements, to play, I would preach a crusade of extermination at once. They are no better than parasites, floral vampires, sucking the sunshine and air needed so sadly by their pale-faced human kinsfolk.

Second, let there be organised, as an auxiliary department of the kindergarten and primary grades, a class of play-mistresses and play-masters, who shall be so distributed throughout the school district that each will have charge of from twenty to forty children. Then for each division of the district, let playgrounds be provided; or, in geographically small, densely populated districts, one for each age-group of the children. These grounds may be purchased wherever the district can afford it, but in the vast majority of towns there are abundant vacant lots, blocks and areas which could be leased; or, if need be, the use of them confiscated by the city. These could be levelled, or rather roughed down, cleared of rubbish, weeds, and garbage, parts of them sanded or gravelled for use in wet weather, and then they would be ready for the children. In short, raise children on the vacant lots, instead of potatoes, as under Mayor Pingree's admirable plan, in Detroit. Many neighbourhoods of course would be willing to provide and equip their own playgrounds, and some private grounds might be offered for the purpose.

Nor is this arrangement one whose utility would

be solely confined to the congested tenement districts of our large cities; far from it. Many a most respectable, nay, even aristocratic, neighbourhood will have no real playground capable of accommodating a dozen children within a mile square; down-town parks are for begonias, not for babies, and many an area of detached houses, in ample grounds, has so much spread of immaculate lawn and superb foliage clumps, that there is no place for the heel-prints of little feet or the litter of tiny hands.

The equipment of these grounds should be of the simplest. A rough shed-roof covering part of the space, for use in wet weather, and movable windbreaks, either board or canvas, which could be put up on the north and west sides in winter, would be advisable. With the assistance of these, the number of days in the year on which healthy children would not be much better off playing vigorously out-of-doors than cooped up in the house would be reduced to a very small minimum. Any physician of experience will cheerfully testify that children kept constantly in the open air extremely seldom catch cold as compared with those over-housed and coddled, as fully half of them are at present. In fact, a "cold" is utterly misnamed, and is caused by foul air instead of fresh.

For the younger children a capacious sand-pit, where they can grub and dig to their hearts' content, a load of "tailings" blocks and short boards of all sizes from a saw-mill or carpenter's shop, for building purposes, a few cheap accessories for the Robinson

Crusoe and "Indians" play, would suffice. For the larger youngsters, plain, strong swings, bars, ring-trapezes, vaulting-horses, see-saws, etc., could be constructed and, of course, large spaces kept always clear, levelled and free from mud or standing water, for hockey, football, rounders, prisoners' base and all the running games.

Then where the space could be secured, corners could be set apart for garden plots, for those agriculturally disposed, for little hutches and sheds for the keeping of pet birds and animals; perhaps even a small pool, arranged for fishes, frogs, newts and crayfish. But these should be kept well out of the way of even possible overflows of hearty, reckless play. Let the grounds be emphatically places where children could race and tear and scuffle as hard as ever they liked, without breaking or spoiling the looks of anything. Where they might even "make a mess," within any reasonable limits, without reproof. And with the magnificent progress already made toward securing such conditions, by the National Playground Association, headed by President Roosevelt and pushed forward by such leaders as Dr. Luther Gulick, Miss Jane Addams, and Mr. Frederic Lee and its sister organisation in England led by Mrs. Humphry Ward, the day of their coming is not far away.

As for the duties of the play-mistress, they would be largely summed up in that quaint but expressive Presbyterian term for the presiding officer, "moderator": to guard against excess of all sorts, to prevent infant tyranny, to assist in settling questions of prece-

dence and right of occupancy, to lead, and, if genuinely in sympathy with them, to join in the more elaborate plays and games, to suggest new and appropriate seasonal amusements.

In the higher grades of the play-school, gardening and botany could be undertaken, construction and fortification practically studied, excursions organised to fields and woods, to rivers, lakes and islands, hills, and quarries; where available, to art galleries, museums, and libraries. All the neighbourhood industries could be visited—mills, factories, engine-rooms, press-rooms, docks, depots. Houses, bridges, boats could be studied in process of construction. The broadest and most valuable of foundations could be laid for geography, history, physics, engineering, chemistry, agriculture, botany, zoology, sociology.

In the make-up of play-mistress and play-master, tact, sympathy, kindliness, cheerfulness, refinement of speech and of manner, sound physique and buoyant health, should be the chief considerations. Just those qualities, in fact, which are so difficult to "grade" precisely and reduce to the terms of a competitive examination, and hence so difficult to recognise, and be safe of securing under our present "mental-contents" method of selecting teachers.

As for one of the weightier objections to the scheme, that of expense, this is not so formidable as might at first sight appear. For while it would mean a large addition to the list of outdoor teachers, it would also permit a very considerable diminution of indoor teachers and economy of schoolroom space. It is the

almost unanimous opinion of all thoughtful teachers that indoor school hours ought to be and could be markedly reduced. The only thing that prevents it is the absolute inability of the vast majority of mothers (all, in fact, who are unable to afford to employ nursemaids) to properly take care of, "amuse," and watch over their children during the working hours of the day. In fact, half the time spent in school by children under ten years of age is more for the purpose of keeping them off their mothers' hands, or off the street, than for the actual necessities of instruction. Any experienced teacher will corroborate this statement. That fully as much can be accomplished in half the time has been proven by hundreds of instances and experiments. Children of the labouring classes who can spend only half their day in school make as rapid progress in their studies as whole-timers; children who do not enter school at all until eight or ten years of age, in from two to three years have completely caught up with their contemporaries, and from that time forge ahead of them.

The playground would completely relieve our schoolrooms of this nursery duty, and with its powerful educational influence utilised as an ally, it would not be too much to hope that school hours could be reduced to at least one-half if not one-third of their present length. That is to say, children need not enter the schoolroom at all before six or seven years of age; from six to nine, one to two hours a day would be sufficient; from nine to twelve, two to three hours; from twelve to fifteen, three to four hours.

If this be true, then the same room and indoor teaching force which is now required to keep awake and maintain a semblance of industry among thirty wriggling tots for four hours a day could provide for three and, if necessary, four times that number in successive batches, for one-hour sessions. In older grades, where a five-hour school day now prevails, two to three times the present number of children could be taught, and in the six-hour grades, by a little planning, double the number. Nor would this overwork the indoor teachers, for the real nerve-wear of the schoolroom comes not from teaching, but from the disciplinary duties. Every thoughtful teacher will testify that both the receptivity and the manageableness of the child are at their maximum within the first fifteen minutes of school hours, and rapidly deteriorate with each successive half-hour after a certain very moderate period, varying from twenty to ninety minutes, according to age.

Rationally managed modern schools carefully avoid attempting difficult or new work in the latter third or even half of any school period. A child kept working at concert-pitch for one hour will accomplish as much as in two or even three hours' steady drudgery. The child-mind is no more fitted for continuous application than a thoroughbred race-horse is for hauling a stone-boat. It is not that he is defective in concentration; he can concentrate like chain-lightning—and hang on just about as long. But the lightning flash has done the work. In the fraction of a second it has smelted the ore, it has welded the iron, as

safely and surely as could a blast-furnace in an hour. To keep on puffing the bellows and piling fresh coal upon the cooling metal is superfluous, if not absurd.

In fine, the plan proposed would give the child full opportunity to develop naturally, healthfully, symmetrically, according to the law of his being. It would also soon enable us to settle once for all the much-vexed question whether a child's mind has the same natural, definite, irresistible tendency to develop and mature as has his body. Personally, I firmly believe that it has. As we have seen, physiologists now no longer speak of a child "learning" to walk or "learning" to talk. He *grows* to walk and he *grows* to speak. A healthy child, under normal surroundings, will, just as soon as the muscles of his legs and back and their corresponding centres in the brain have reached a certain stage of development, proceed to walk, unless forcibly prevented. As soon as his mouth-parts and his right hand, with their central areas, are sufficiently differentiated, he will (imitating of course the word-sounds he hears made about him) begin to talk. Not even the efforts of his adoring relatives to "teach" him can prevent him. And no small amount of the instruction lavished upon children in school has about as much effect upon their mental growth as has the "baby-talk" of the nursery upon their learning to speak. I believe that the child has to guide him in this field of his growth an instinct, or rather two instincts, as real and as dependable as that of hunger or thirst. These are, on the one hand,

curiosity, the desire to know, the "want to find out," and on the other, restlessness, the resistless desire to do something, the "instinct for workmanship," as Loeb finely terms it. The natural tendency of mind, like that of matter, is toward motion in a right line, not toward rest.

I fear that such of the "discipline" school of educators as have honoured this brief sketch with their perusal, will raise a chorus of protest, because I have not even mentioned the (to them) chief point at issue, how, by pursuing play, a child can possibly learn to work. In other words, how, by doing, no matter how vigorously, the thing it likes to do, it can be taught to do the thing it dislikes. This last they hold is the chief purpose of education. The omission is intentional, because in my view the question is not really involved in the position here taken—viz., that the child in play shapes and sharpens the tools, both mental and bodily, with which he is later to work. How the transition is made from play to work is another question.

But for the comfort of those of my critics who have a just and proper lust for battle *à l'outrance,* I don't mind confessing a lively, though quite irrelevant, belief that the best possible preparation for hard, effective, tireless work is a keen, overmastering interest in the subject to be mastered or the problem to be solved: that most men work not from love of work or force of habit, still less because they have been "taught" to, but from a fierce desire, yes, vital craving for the rewards of toil—bread, power, knowl-

edge, fame. There is no fear of ninety-nine men out of a hundred failing to "learn" to work and keep at it, for the sternest of reasons.

Industry is, in one sense, no more of a virtue than breathing is. It is merely an action necessary to life. And this I will, with my body, defend against all comers, though it has nothing to do with my main contention.

CHAPTER XVI

THE HEALTH OF THE MIDDLE-AGED MAN

A MAN at fifty should be just entering upon his harvest. The years from forty to sixty are the dominant decades of life, the ages of the rulers of the world. The *"Wander Jahren,"* the years of struggle and stress, of painful preparation and laborious training, are over, the fields are white before his sickle. How can he best preserve his vigour and conserve his capital? Conditions have changed, and he must adjust himself to them.

First let him recognise the advantages of his position. He has graduated from the school of life, has earned the right to let his degrees of skill and experience work for him. What his muscles have lost in elasticity they have gained in practiced smoothness of action and massive strength. His heart has lost the bounding leap of the deer, but has gained the tireless swing of the swift Narragansett pacer "that eats up the long miles like fire." His thought engine throbs with less violent pulsations, but has gained immensely in cool, orderly, harmonious vibrations. What we once could do only by laborious effort and constant attention we now do unconsciously and with the easy deftness of instinct, or "second nature."

Let the young men blaze the trails and clear the forests. The man of the dominant decades, in our

expressive Western idiom, "don't have to." He has qualified for something better. Let him clearly see this and "bank on it," and he has solved two-thirds of the problem of preserving his vigour till old age. Sound maturity is more efficient and quite as enjoyable as youth. Don't sigh for the days that were, or count yourself inferior to the callow stripling. You are a better motor than he is, of higher horsepower, greater endurance and less friction-waste. Besides, he may be laid on the scrap-heap before he reaches your age.

The glory and triumphs of manhood are yours. Enjoy them without regrets for the past or fears for the future. Live at concert pitch, and plan to die suddenly.

Don't begin to cut down on things until they cut down on you. Keep on full steam ahead until you feel a bump, or at least a distinct grating. You'll go farther and happier and far more usefully than by anxious straining on the lookout for rocks and shoals which often don't exist, though they may be down on the charts. There are plenty such.

First and most vital, keep up your exercise and recreations, *especially* the latter. Don't drop any of your outdoor interests unless you can acquire new ones in their places. Change your sports in quality if you must (but not till then), but never in quantity, except to increase. Drop tennis when you find it exhausts you, or hurries your heart afterward or disturbs your sleep, but take an hour a day more golf in its place. If the rifle with its long, heart-straining tramps over

mountain and dead-fall tires you, so that you don't react from the trip, take to the shotgun and the stubble-fields and copses. If the gun becomes too strenuous, fall back on the rod, but don't give up your outdoor life on any account.

There is no need to take too much anxious thought about these problems. Nature has a guiding instinct for middle age and declining vigour, just as she has for youth and growing powers. As long as you like to take active exercise and sport, and feel exhilarated and refreshed (even if a little stiffened) by them, keep them up; they are doing you good. When you feel that they are getting a little too much for you, when you don't feel fresher for them next day, cut down on them a little in intensity. (In short, be guided by an intelligent study of your own feelings and preferences. They are your best guide.)

Let your motto be the advice of the Quaker apostle, George Fox, to William Penn, in regard to the wearing of the dress-sword: "Wear it as long as thou canst."

Indoor gymnastics are really of secondary importance. First, because they lack the chief benefits of exercise, the open air and sunshine. Second, because they almost invariably become monotonous and uninteresting, and are soon discontinued. For these reasons most physicians of experience regard them as practically little better than a farce. Certainly the claims made for them by highly advertised systems of physical culture are of this character. A good five minutes' arm-swinging, back-bending, side-stretching,

with accompanying deep breathing, just after the morning bath, and before going to bed at night, form a useful tonic. This should be gone through empty-handed, for dumb-bells and clubs are of little value, and practically do more harm than good, especially of the weights selected by both amateurs and professors.

Work in a regular gymnasium is of doubtful value for the middle-aged man, as, unless he be already an expert, or is constantly under the eye of a judicious trainer, he is apt to overdo, or use apparatus like the horizontal bar, trapeze or rings, which subject him to the risk of strains, jars and falls, dangerous to his stiffening muscles and joints. The great danger of a gymnasium is that the average man is firmly convinced that the more violent the exercise, the more good it will do him. Consequently, if he has only half an hour to spend, he will try to compress an hour's exercise into it by using heavier clubs, doing more difficult feats, and putting on more steam. This is bad enough for the boy with his limber muscles and elastic arteries, but for the middle-aged man it is suicidal. Excessive muscular strain is now regarded as a more potent cause of arterio-sclerosis, or senile hardening of the arteries, than either alcohol, gout or dissipation. And a man is exactly as old as his arteries.

Much the same principles apply in the matter of eating. Follow your appetite, checked by the results of your personal experience. As the old saw runs, a man at forty is "either a fool or a physician" in matters of diet. He has usually found out for himself

what kinds and amounts of food agree with him and what do not.

Most men after forty-five, or certainly after fifty, will notice a slight but distinct falling off in appetite. This is a hint that the body cannot utilise as much food as before, and should be acted upon. Although this diminution of appetite is a sign of cessation of growth and the beginning of failing vitality, it is not one of diminishing efficiency. On the contrary, by virtue of its reserve power, momentum and trained expertness, the body-machine may do more work in proportion to its fuel-needs from forty-five to fifty-five, or even sixty, than in any previous decade.

Experienced generals prefer grizzled veterans in a trying campaign to youthful troops, no matter how well drilled or conditioned, because they stand more knocking about on shorter rations and less sleep.

However, when nature doesn't need so much fuel to run your body engine, she'll let you know. Till then give her all she calls for. It is a very good sign for a middle-aged man to have a big appetite. It indicates that he has lots of work in his motor yet.

The dangers of overeating have been enormously exaggerated. Gout, rheumatism, kidney disease, cardiac degeneration, liver trouble, even obesity, occur quite as often in those who from necessity undereat as in those who "live high."

A moderate and comfortable increase in weight, after the age of forty, is a natural and healthful process, a laying by of capital against the evil days that are coming. Unfortunately, shortly after the

age at which this deposit of fat-surplus occurs the body engine is apt to begin to show signs of wear and tear, and original defects in tubing, boiler, steam gauge, and gearing reveal themselves under the strain. With infantile logic we say the first change caused the second. As a matter of experience, fat men of middle age show these strain defects less frequently, less early and bear them better than thin ones.

Obesity is *not* a disease, but in nine cases out of ten a normal process, beneficial rather than harmful. Fat laid on after forty-five is usually lost before seventy, and is neither a sign nor a cause of disease, "Anti-fat" advertisements to the contrary notwithstanding.

The dreaded fatty degeneration of the heart and liver has nothing whatever to do with general increase in body weight, however generous. It occurs more often in the emaciated than in the obese. Therefore, don't hesitate to laugh and grow fat, or starve yourself for fear the "fat will get round your heart." Nearly all weight-reducing diets and treatments reduce strength also and are dangerous if long persisted in. Fatness of even quite Falstaffian proportions is perfectly compatible with the highest grade of efficiency.

Next, take plenty of sleep. Time spent in sound sleep is never wasted. The man of middle age will find that he cannot take quite as much sleep as formerly; he tends to wake earlier and more easily, but this should make him the more insistent to take all

that he possibly can. He cannot stand the loss of sleep as he once did. If he has been up till the wee sma' hours he is more apt to feel it next day.

The power of recuperating completely in a few hours of sleep is the prerogative of youth alone. The fewer hours of sound sleep we can get the more rest in bed we should take.

As the sleep at night becomes shorter and lighter a nap in the middle of the day should be made a custom. Half an hour to an hour after lunch will increase the day's efficiency wonderfully. It is much better to sleep in the middle of the day than to go to bed at an uncivilised and unsociable hour at night.

To "rise up at the voice of the bird" is very pretty poetry, but poor physiologic economy, unless you should happen to be a farmer. Sit up as late as you can keep up an interest in any sensible subject and sleep as late as you can in the morning. Early to bed and early to rise is an excellent motto for the unprogressive.

Above all things, the man of middle age should keep up his interests. The more points at which we touch human life and interests, the more alive we are and the longer we will remain so. If you have any taste for music, cultivate it; don't let it decay. You may have given up singing, but go to the best concerts and operas. Develop any liking you may have for pictures, especially landscapes in the original; read plenty of good poetry. All these will tend to keep you elastic, responsive, resourceful, not only mentally

but physically. Life is response to environment; when that diminishes we begin to die.

Now is the natural time of life for politics, both as a diversion, the finest game on earth, and as a civic duty. Our own position is fairly established, and we can spare a little time to help others, especially the rising generation.

If the man of the dominant decades is so unfortunate as to have no hobby, by all means let him beg, borrow, or hire one. Better still, two—one indoor and one outdoor. Nothing will do more to keep him young. Roses, chrysanthemums, cherries, Orpingtons, Games, collies, bull-terriers, Angoras, wild flowers, birds, shells, butterflies, bookplates, first editions, clocks, old blue, andirons, stamps, brass, bric-à-brac—no matter what, so long as they arouse an interest entirely apart from their monetary value. Next to outdoor sports they are the best Elixir of Youth known. Don't plan to retire from business unless you have a hobby to retire on, as well as a competency.

Don't count your grey hairs. First, because it won't make them any less in number or slower in coming. Second, because it will do you harm, which they never will. This is an allegory, the meaning of which goes far.

Grey hairs are nature's accolade of knighthood for service rendered. It may not be much, but it is surely something. Be proud of it. The man does not exist outside of jail or Wall Street who at fifty has not done something for the race, as well as for himself. Often much more. Whether it be a little pushing of the ploughland farther into the flanks of the wilderness,

the doing of some bit of work better than it was ever done before, a house built, a well dug, a road opened, a price lowered, a child trained, a song sung, or written, or lived, an evil faced or beaten back, another life made happier—there is always something of which we can say, "This have I done for the world."

This is the vantage-ground of middle age—physical, mental, moral. Use it as our fulcrum and we may continue to move the world with the lever of experience till threescore and ten. Make our skill and our tiny sprig of laurel count and we can still keep abreast of the young men.

Live in the present and don't dread the future. Old age is not a disease, but a natural, painless process, as vitally and inherently necessary as youth. Like every other natural process, when it actually comes it is welcome. The same forces which raised us up as wavelets upon the great sea of life will plunge us down into its cool, calm depths again. The plunge is no more to be dreaded than the upward curl. We sparkle and glow for a few brief moments, shot through with the sunlight of eternity, then fade away into the fathomless blue again, but the moments were well worth while.

We can "live long and happy (or brief and happy), and in that thought die, glad for what was." It is pure selfishness to wish to live again or longer than is best for the following generation. Our life is not for ourselves, but for the race, and if we have set that the tiniest notch higher upon its upward course, it is enough.

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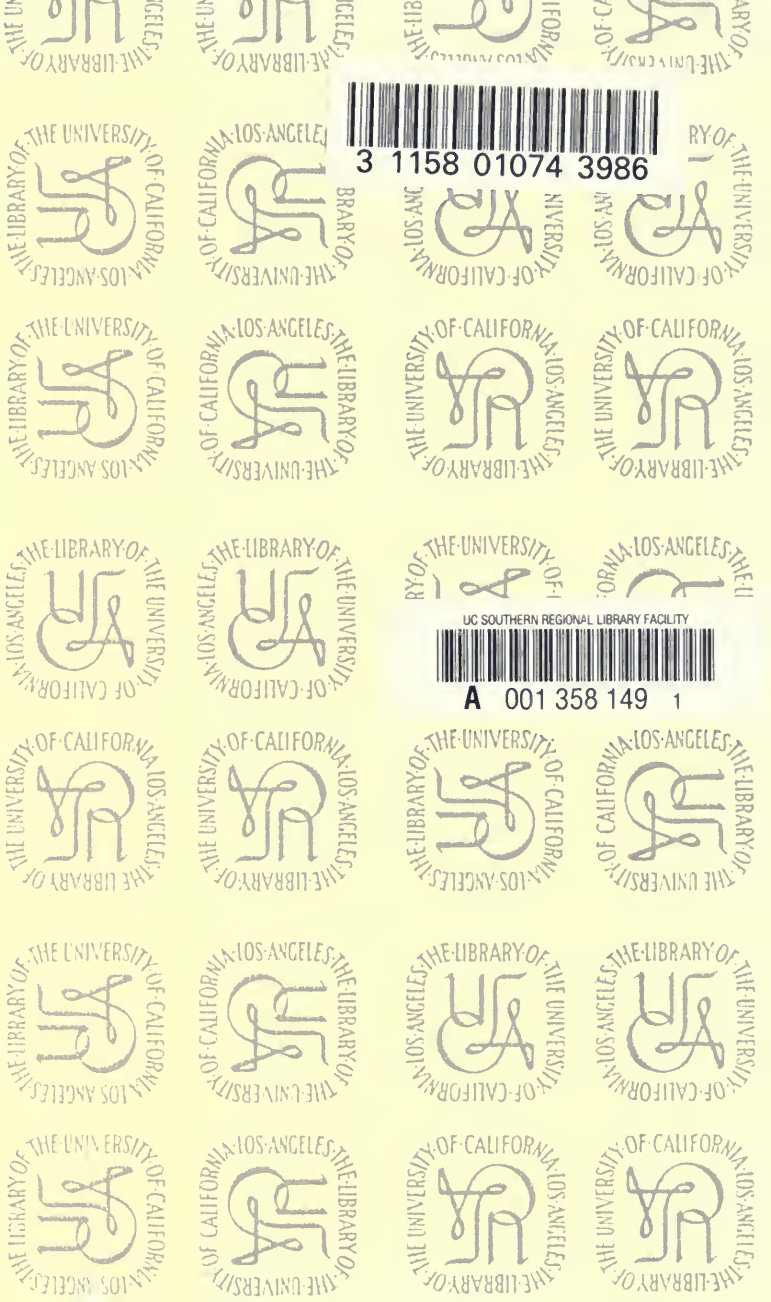
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