ON MEANS . . . FOR THE . . . . PROLONGATION OF LIFE . . . . .

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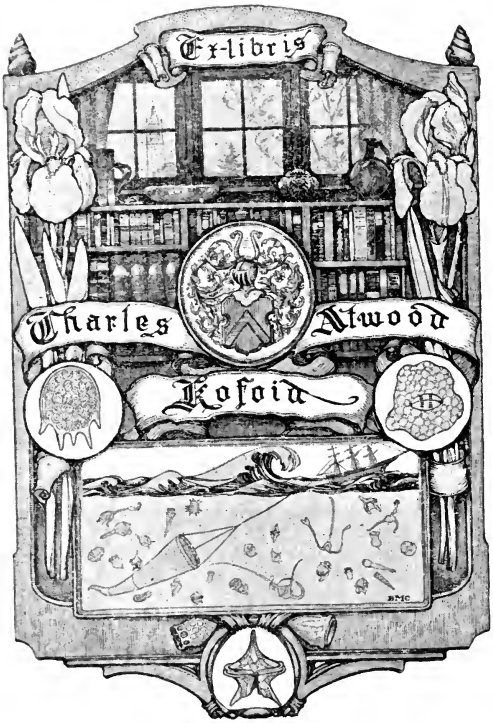
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FOR

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THIRD AND ENLARGED EDITION OF A LECTURE DELIVERED BEFORE THE ROYAL COLLEGE OF PHYSICIANS ON DECEMBER 3RD, 1903

BY

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Work and Moderation are the main sources of health, happiness, and long life

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PREFACE TO THE THIRD EDITION.

In publishing an enlarged edition of "Means for the Prolongation of Life," I have acted on some suggestions made to me by readers of the former editions. Thus I have added a short description of most of the more common articles of food, their digestibility and their *rôle* in the nutrition of the body. I have also divided the contents of the little treatise into a number of sections for easier reference; but I have otherwise left the arrangements and the greater part of the text as in the original lecture.

I have also endeavoured to make the Bibliography and the Index rather more complete.

Since the delivery of this lecture in 1903, several excellent communications on the same subject have appeared, by Sir Lauder Brunton, Professor Metchnikoff, Dr. William Ewart, M. Jean Finot, and others, from which I have derived much useful information.

During the years which have passed since the

first edition I have been strengthened in my views by intimations from many aged persons, who had carried out my advice for ten and twenty years, and more.

Grosvenor Street, HERMANN WEBER.
London, W.,
June, 1908.

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ON MEANS FOR

THE PROLONGATION OF LIFE.

I.—Introductory.

Mr. President, Fellows of the College and Gentlemen,—The subject of the prolongation of life is a very large one, especially if considered with regard to the whole population from infancy onward.

The diminution of infant mortality and the improvement of the hygienic conditions of towns and houses have raised, and will continue to raise, the average duration of life. Here is a wide field of usefulness, and one of the most important sections of it will be the combat with the various forms of pathogenic microbes (Pflüger [100]), in which men like E. Jenner, Pasteur, Lister, Koch, and others have rendered immortal services to humanity. And besides, the greater cleanliness in all things, the improvement of dwellings and food supply to the labouring classes, and the hygienic and

physical education of the entire population, which ought to commence in the nursery, and ought to be insisted on at all schools, public and private, will not only contribute to the prolongation of life, but improve the whole race, so that our grandchildren ought not to hear any more of the deterioration of the physique of recruits and other candidates for the army and the professions and trades. By such means the resisting power of the organism to disease ought to be developed from an early period of life. The education, moral and physical, of each individual ought to lead to the development of the entire organism for the adequate performance of active work during a long period of mature life, followed by the period of old age, in fairly vigorous health with enjoyment of useful work, leading at last to the final period of gradual and painless cessation of the functions of life. We do not expect this evolution at once ; but we must steadily work for its attainment in future generations. Dr. P. K. Pel [98], in an excellent address on the art of living long and happily, urges with justice that all school boys and girls ought to be taught how to maintain their health and to avoid injurious influences. This very promising subject will,

however, as far as possible, not be touched in the present discourse, which will relate principally to the prolongation of the life of adults by the arrangement of the manner of living. This more limited field of work deserves likewise our serious attention, since the death-rate of persons after about 55 or 60 has scarcely decreased during the last thirty or forty years, while that of children and adults below 45 is now considerably lower than it was then, as shown by the annual reports of the Registrar-General. We must endeavour to reduce also the death-rate of persons in advanced years by increasing the longevity of the individuals.

This lecture, I must premise, is a purely empirical and preventive contribution, and does not enter into the pathological anatomy so ably treated by Sir G. Humphry [58], by Dr. Savill [109] in his interesting papers before the Medical Society in March, 1897, nor into the clinical symptoms sketched by Sir Clifford Allbutt [1, 2 and 3], by Dr. Savill, Dr. F. Parkes Weber [132], Oertel [88], G. W. Balfour [10], Metchnikoff [76 and 77], and others; nor shall I say much about the mental changes which have quite lately been discussed by Prof. Osler [93] and by Sir Samuel

Wilks [142]. I shall only suggest a manner of living by which they may be postponed as long as possible, excluding in this discourse treatment by pharmaceutical remedies, and by organo- and serum-therapy.

I must also abstain from entering into the interesting subject of "comparative longevity," for which I may refer to the works of Buffon, Flourens, Sir E. Ray Lankester [69], and others, and restrict myself entirely to the longevity of man.

Much has been written on this subject from remote antiquity up to the present time. When I think, for instance, of Galen's "De Sanitate tuenda," Cicero's "De Senectute," Bacon's "Historia Vitæ et Mortis," Sir William Temple's chapter "of health and longevity," Hufeland's "Makrobiotik" [57], Sir John Sinclair's "Code of Health" [114], Pflüger's [100], Ebstein's [33], and many others good essays on this subject, it may look presumptuous that I address on it so learned a body; but the facts that I have occupied myself with it for half a century, and with a certain measure of success as well in others as myself, and that I may perhaps open up some fresh aspects, embolden me to place before you in a condensed form some of my

experiences and views ; and I am further moved to this course by an astonishing disregard of the means of prolonging life on the part of the public as well as the profession. Since the delivery of this lecture in 1903, several excellent communications have appeared on prolongation of life, amongst which I may mention Sir Lauder Brunton's address [15], Professor Ewald [36A], Dr. W. Ewart's [37] and Professor Metchnikoff's very instructive and philosophical works [76 and 77], and M. Jean Finot [39].

II.—Natural Duration of Life.

Before we consider, how we can attain the natural term of life, we must say a few words about what we may regard as the *natural term*. The great ages attributed to the Hebrew patriarchs need not occupy us here. It is enough to point out that at the time of the Psalmist no such ages were reached, since he puts the limit at 70 and 80 years. This may at the present time be considered the natural or normal term of life, but by careful arrangement of the manner of living this term may be increased in many persons to 90 and 100, and occasionally to more, which we might call supernormal

longevity, at least under present conditions, though in course of time it may become normal longevity. The difficulties of verifying the statements of great ages in past generations are very great, and due criticism has not been exercised. Even the generally accepted great ages of Henry Jenkins, Thomas Parr, and the Countess of Desmond are, according to the investigations of Mr. W. Thom [122], to some degree mythical. We have no proof that these three persons reached the ages which are attributed to them, but Mr. T. E. Young ("On Centenarians," 1899) cites from the records of life assurance and annuity societies in England 7 cases of male and 15 cases of female lives having lived to between a hundred years and a hundred and five years and eight months. This statement we may receive as perfectly trustworthy, but considering the very large number of lives among which these 22 cases of the duration of life beyond a hundred years have occurred, we see that such a duration of life is excessively rare. Dr. Tatham, Superintendent of Statistics of the General Register Office, has kindly informed me that according to the census of 1901 there were, in the whole population of England and

Wales, living above ninety years, 3,056 males and 6,482 females, in all 9,538 ; and above a hundred years, 47 males and 99 females, in all 146.

The Registrar-General of Scotland reports [102] that in 1903 the deaths of all ages were 38,136 males, 37,866 females ; the deaths at or above 100 years of age were 8 males, 11 females. In 1904 the deaths of all ages, 38,851 males, 39,130 females ; the deaths at or above a hundred, 3 males, 13 females. In 1905 the deaths of all ages were 37,196 males, 37,340 females ; the deaths at or above a hundred, 7 males, 14 females. Sir Lauder Brunton, in his suggestive address on Longevity, states on the authority of the Registrar-General, that during the last half-century a continuous increase of the average duration of life has taken place, from a little over 40 in 1854, to a little under 48 in 1900 ; but that in the decades from 60 to 90 years there is a slight diminution, and that this is also the case at the age of 100 in males, while there is a little increase in females. "The number of men living to 100 years per 100,000 of the population from 1891 to 1900 is only 7, and of women 24, as compared with 15 men and 36 women in 1838 to 1854."

These figures are, however, Sir Lauder fears, vitiated by the fact that there is a tendency to over-statement between the ages of 55 to 65, "a tendency which grows as the age advances, so that very little reliance can be put on the data of extreme ages." With greater strictness in registration during the last decades, reliance can be placed on the more recent figures.

There can be no doubt that circumstances which we may comprise by the term "environment" influence the duration of life. Those who live in crowded industrial districts; those who are obliged to share small and ill-ventilated rooms with many others; those who have to spend the whole day in confined factories, easily fall victims to infectious disease, or become sooner decrepit than those who live in the open air and sleep in well-aired bedrooms. Otherwise the nature of occupation or profession, provided there is nothing actually unhealthy in it, does not seem to exercise a decided influence on longevity; but the latter is different in different countries. Thus, according to communications by Dr. Ormstein, a greater proportion of people reach high ages in Greece than in most other countries, a fact which already Lord Bacon had noticed; and Metchnikoff makes

a similar statement with regard to the Balkans. This is probably due to the climate and other environments. We know that in Norway, Denmark and Sweden the average duration of life is longer than in the South of Europe ; and Hufeland [57] mentioned already in the 18th century that life in colder regions is longer than in warmer ; but that extremes of cold are not conducive to longevity.

It has been stated that some *races* are more long-lived than others. This is to some degree true, but much of the difference seems to depend on climate and other environments. There is, however, one race which is decidedly more long-lived than other races, namely, that of the *Jews*, unless they are living in the greatest poverty and in most unhygienic circumstances, as in Russia. In whatever climate they live, they are, as a rule, distinguished by comparative longevity. It may be that they were originally better constituted, but it appears almost certain that they have derived much benefit from their having obeyed during many centuries the wise hygienic and moral laws of Moses. Through this, we may assume, a peculiar kind of heredity for long life has been gradually developed. Dr. Jossé Johnson [62] has quite lately discussed this point

before the Life Assurance Medical Officers' Association.

III.—Mode of Life of Long-lived Persons.

In examining the circumstances under which man is likely to reach the natural term of life, and especially the manner of living by which this end can be promoted, we must not allow ourselves to be deterred by the experience that some of the most long-lived persons have led injudicious lives, and that great longevity occurs occasionally under the most different circumstances. After having carefully entered into the records of more than 100 cases of very long-lived persons, I have reason to say that by far the majority of them were temperate; were small meat-eaters; lived much in the open air; led an active life; many a life of toil, with great restrictions as to food and comforts; that most of them were early risers; that a great number of them had a joyful disposition, and performed their work cheerfully; and that only a few were intemperate or idle and lazy persons. We must keep before our eyes the means and circumstances by which the health of man is produced and maintained, and those by which it is usually

deteriorated, since the former are likely to promote, while the latter are almost sure to prevent, longevity in the large majority of cases.

We must, in laying down certain rules towards the promotion of a long life, and of a vigorous and happy old age, not be checked by the remarks which we constantly hear, that such rules are irksome, that it is better for man to live a short and enjoyable life than a long and tedious one with many restrictions ; that it is not worth while to live to an old age full of suffering and of physical and mental weakness. No, we do not wish to prolong life merely for living long ; but to prolong mental and bodily energy, and this with a measure of enjoyment and usefulness, and without bodily suffering. I have been in intimate relation with many distinguished persons, male and female, who had reached old age. It is true that some of them were suffering, and that the mental faculties of some were impaired, but the majority had retained their interest in the development of science, in the evolution of social problems, and in the condition of their own families ; they were often able to give wise counsel, and to show the way to progress and fortune ; they were eager to read and to learn, and never found a day too long. Dr. Frank

reminds me of the conversation on this subject between Socrates and Cephalus in Plato's "Republic," where Cephalus maintains that those who possess a well-regulated mind find old age no intolerable burden, but, on the contrary, are more happy in the mental repose and freedom from passions. Many of my old friends who had been pessimistic in youth and early manhood, have become optimistic in old age, attended by "hope, the kind nurse of old age."

We are convinced, from a large experience, that the manner of living required for the prolongation of life is irksome only at the beginning, that it becomes easy by habit and leads to health of mind and body, to usefulness, to freedom from suffering, and to happiness much greater than that to be obtained by yielding to the desire of indulgence in sensual or frivolous enjoyment. When I hear that a life of work and moderation is tedious, I am always reminded of the words of Fernando in "The Tempest":

> "And most poor matters
> Point to rich ends."

At first the walking and working may appear poor matters, and not less so the moderation, when one has to curb a good appetite before a richly covered table; but then come the rich

ends, health and happiness, and a long and happy life, full of activity, to terminate frequently by falling asleep without suffering.

On the other side, it is a fallacy to think that those who indulge themselves by immoderate eating, drinking, and sensual enjoyment can do so without the risk of great suffering, often associated with unhappiness in advancing years. Experience has shown us that the majority of those who have habitually indulged themselves do not die suddenly and easily in the midst of their enjoyment, but suffer often for months and years before death releases them.

Self-indulgence leads mostly to failure and unhappiness, *self-control* to success and happiness.

IV.—Heredity.

Amongst the circumstances connected with longevity the most prominent is *heredity*, which means an inherited good constitution. I have endeavoured to ascertain what are the principal factors of this inherited longevity, whether it is to be ascribed more to one system of the body than to another. Though almost all seemed to have had an all-round good constitution, yet there were differences in the different long-lived

families; but all of them were endowed, as far as I could learn, with a vigorous heart and good blood-vessels, and I am inclined to ascribe to the circulatory system the greatest share, which, however, cannot be separated from the respiratory system and from the vaso-motor part of the nervous system. It is, as a rule, not the vigour of the muscular system which leads to longevity; athletes and men with great muscular strength form no large percentage of the long-lived people; nor does great intellectual power seem to be a prominent feature; nor a strong digestive system, which, although useful when well-managed, often gives rise to the temptation of over-feeding, while a weak digestion compels moderation, and thus leads frequently to a longer life and happier old age than is obtained by those endowed with a strong digestive system.

The chances of a person belonging to a *long-lived family* are, *cæteris paribus*, much better than those belonging to ordinary families, but it is a dangerous fallacy to rely too much on such a privilege. In a family well known to me, for instance, out of 11 children, whose parents (both) died above ninety, 5 men and 4 women, leading satisfactory lives, lived to 88 and more, while 2 addicted to alcohol died between 60

and 70. In another family of 8 children, whose father had lived to 87, while the mother had reached the age of 96, only half of them, viz., 3 daughters and 1 son, lived beyond 86, while 3 sons and 1 daughter died under 70. The first 4 had lived judiciously, while of the 4 dying rather prematurely, 2 sons had over-indulged themselves with eating as well as drinking, 1 with drinking only, and the daughter having had a large family became mentally depressed by frequent sources of grief and anxiety.

The tendency to *early death* is likewise hereditary in some families to such a degree that careful assurance offices refuse members of such families; but by judicious management, if commenced early enough, the life can be considerably prolonged in spite of the inherited tendency to early death, which seems to be mostly associated with a weak vaso-motor system.

We must endeavour to profit by the favourable influences of heredity, but counteract the unfavourable; we need not die at the same early ages as our forefathers did; we must not adhere to fatalism, which is one of the worst doctrines, but trust in our own work, and in the truth of the proverb that "God helps those who help themselves." Most persons descended

from short-lived ancestors have it in their power to prolong their lives by a judicious manner of living.

It seems to me a matter of importance to keep the idea of our power of influencing heredity constantly before our mind. In the same way as different hereditary varieties can be produced in animals and plants, hereditary tendencies can, I think, be produced in man to long life by protecting him from, or making him avoid, injurious influences—dietetic, meteorological, climatic, hygienic, social, &c., and by replacing the injurious by favourable influences. If this view were to be taken up generally, and acted upon, we might have, in the course of time, many long-lived and few short-lived families. Much, no doubt, can be done by physical education, great moderation and suitable occupation ; but the most powerful influence would be exerted by well-selected marriages, and by preventing ill-suited ones ; but this, I fear, will never be sufficiently in our power ; and it would not be quite natural, since love is not generally influenced by considerations of health.

In advising persons with a hereditary tendency to rather early death, it is most important

to become acquainted with their family history, the *causes of death of their parents and blood relatives*, since by combating the tendency to these causes of death, from as early a period as possible, we mostly succeed in prolonging life. This is conceded by the majority of medical men with regard to tuberculosis ; but numerous deaths between 50 and 70, which are caused by the weakness of the fibres of the heart and of the coats of the arteries and capillaries, can be avoided or, at all events, greatly retarded, by regular exercises, including walking and breathing exercises, and great moderation in food and alcohol ; the tendency to atheromatous and allied changes, to arterio-sclerosis, to apoplexy and paralysis, by similar means ; and not less so that to stone in the urinary organs, where the great restriction with regard to food rich in purin is especially important ; the tendency to senile bronchitis and pneumonia, which form so frequent causes of death in advanced life,[1] by much air in and out of doors, by respiratory and other exercises tending to strengthen the heart and the lungs ; the tendency to epilepsy and to certain forms of dipsomania which are

[1] See the statistics in Dr. Savill's paper already quoted.

allied to epilepsy by total abstinence from youth onwards ; and almost all other hereditary causes of early death can mostly be warded off by judicious arrangement of the manner of living. By appreciating the individual constitution, the tendencies to disease indicated by the family history, by the habit of the body, the occupation, &c., we are often able to prevent disease, and the *prevention of disease* is one of the great means of prolonging life. The progress of public hygiene will in this matter, we may hope, bear more and more fruit, but every single individual must in his own case endeavour to avoid exposure to disease and infection, above all things syphilis (Mechnikoff). We must endeavour to recognise all the weak points of the entire organism, especially the weakest, and direct our attention to *strengthening these weak points. Above all things we must bear in* mind that *good air* in and out of doors is one of the most powerful factors in improving and maintaining health, and prolonging life. We have often heard from many persons the objection that they cannot bear much open air, that it causes with them catarrh, rheumatism, neuralgia and many other complaints, but most of these objectors became gradually convinced that it was not the abund-

ance of air which caused these troubles, but the injudicious and imperfect way in which the air was admitted into the room; for instance, by small chinks in the windows instead of by fully opened windows, or by imperfectly closing doors, and by sitting between the door and the fireplace, or by driving in close carriages with the window of one side partly open, instead of driving in an open carriage or in an open bath-chair. Admitting the air through a small opening causes *draught*, which often produces in sensitive persons a local chill of the eye, the ear, the neck, or other parts, while by allowing the air to reach the whole body the latter becomes soon accustomed to it, is strengthened, and gains in resisting power. It is scarcely necessary to add that I do not intend to recommend old or delicate persons to expose themselves to a combination of cold air with high wind.[1]

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[1] The question of *living in good air* has many aspects. To mention only a few points, we ought not only to spend several hours every day in the open air, but the house we live in, if in town, ought to lie in a broad street or an open space, not in a narrow lane, shut out from sun and air; if in the country, not in a hollow surrounded by high hills, or in a deep valley, but on the brow or slope of a hill, well above the bottom, or in an open locality, fully exposed to the sun and air. The house itself must be

I could give a great many instances of persons who escaped the diseases of their parents and near relatives by well-adapted management. I will, however, only mention five, beginning with my own case, because you know me and see me before you.

Case 1.—My mother died before she was 60 from weakness of the heart, inherited from father and grandfather, which led to frequent attacks of bronchitis and general dropsy; my father died in his sixtieth year from cerebral apoplexy; he had not been an abstainer himself, and his forefathers, during four or five generations, had taken largely the strongest kinds of hock and port, and died from affections of gouty nature, including one of paralysis and one of apoplexy. By moderation and abundant exercise of mind and body, including breathing exercises (p. 47), I have escaped death from these causes, and have greatly prolonged my life, although I must confess that I have not quite effaced the gouty tendency inherited from five generations, although it is much less in evidence.

Case 2.—Nearly fifty years ago a gentleman consulted me at the age of 41, who suffered from frequent attacks of bronchial catarrh, from weakness of the heart, was rather stout, had a sedentary occupation, took much meat, and was inclined to constipation and bleeding piles. His father had

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constantly kept well aired; the windows of the bedroom must be open during the whole day and, in part at least, during the night. The beneficial influence which the acting on these rules exercises on health can scarcely be over-estimated; it is most marked in children, but hardly less so in adults and those far advanced in age.

died from "chronic bronchitis with dropsy" at the age of 61, his paternal grandfather from "bronchitis and congestion of the lungs" at 64; while his mother, belonging to a rather short-lived family, had died from "pneumonia," aged 59. By means of great moderation in eating and drinking, with attention to his bowels, by living much in the open air and in well-ventilated houses and rooms, by regular breathing exercises, abundant walking exercise and regular occupation, the tendency to bronchial catarrh, to constipation and piles disappeared, and he lived to the age of 75, when he succumbed to a severe attack of influenza. Three brothers and one sister, who had not followed out similar regimens, but had indulged themselves more or less, died before they were 60, from chronic diseases of the heart or of the respiratory organs.

Case 3.—In 1862 I was consulted by a gentleman aged 44, whose father and grandfather had died under 64 years of age from apoplexy; while his mother, who had belonged to a fairly long-lived family, had died after much grief and worry at the age of 69. The patient was of florid complexion, muscular, slightly above the average weight for his height, had had two attacks of gout, and was in the habit of eating and drinking abundantly. He was induced to diminish the quantity of meat to a very small amount, and to take it only on two days in the week, to give up stimulants almost entirely, and to take much open-air exercise, in addition to daily breathing exercises (p. 47), with the result that the attacks of gout ceased after some years, that his general health became perfect, and that he was able

to enjoy the pleasures of intellectual and social work up to 78 years of age, when he began to show signs of weakness of the heart after an accident which prevented his continuing to take active exercise. The final cause of death was pneumonia. Two brothers and a sister of this gentleman, who had indulged their appetites and taken little active exercise, died between 60 and 66, from apoplexy, and others at earlier ages from bronchial attacks and failure of the heart.

We may fairly assume that life in Case 3 was considerably prolonged through his combating the family tendency to apoplexy and failure of the respiratory system and heart, by means of much exercise and by a judicious manner of living; and the same may be said of the subject of Case 2 with regard to the inheritance of tendency to weakness of the heart and respiratory system.

Compare on "The Prevention of Apoplexy," Clifford Allbutt's paper [3].

Still more striking is the effect of the manner of living in counteracting the hereditary tendency to early deaths in Cases 4 and 5.

Case 4.—A. C., a member of a family of five sons and five daughters, consulted me when at the age of 35, complaining of weakness, shortness of breath, especially after lunch, frequent sleepiness, particularly after meals. His family history was very grave. His father had died at 49 from bronchitis; his paternal grandmother at 55 from pneumonia; his paternal grandfather at 48 from

"dropsy"; his mother had died suddenly at 52 from "failure of the heart"; his maternal grandfather at 51 from apoplexy; his maternal grandmother at 56 from "dropsy." His life had been refused by several insurance offices. The patient was a solicitor who took little exercise, lived freely in eating and drinking, and slept mostly over eight hours. The heart was feeble, the face was red from congested capillaries. I advised him to take meat only once a day; to limit the stimulants to a quarter of a bottle of light hock or claret, and the sleep to six hours. In addition, he was ordered to take breathing exercises (p. 47) every morning during a quarter of an hour, a hot bath followed by a cold shower, and to walk two hours a day. This manner of living led, within two months, to great improvement, after which the daily walking exercise was supplemented by a whole day's walking or shooting at least once a week. On this regime A. C. lived in good health up to the age of 74, when he died from influenza.

All the four brothers of A. C., who lived on the plan that they must "*sustain*" themselves by eating and drinking much, and avoid exertion in order to prevent "wearing out," died between 49 and 56 (one from failure of the heart, one from apoplexy, one from an operation for stone, one from cause unknown to me). Of the five sisters, three died from various diseases under 56, one from accident at 45; the fifth, who died at 75, is the subject of Case 5.

Case 5.—A married lady, aged 36, a sister of the subject of Case 4, consulted me on account of shortness of breath, œdema of the legs, and varicose

veins. She had had four children, the youngest being 3 years old. Her heart was dilated; she was rather stout; the urine was normal. She was in the habit of eating rather largely and taking much water and soups at lunch and dinner. She took scarcely any exercise. She was ordered to take meat only once a day; no soup and no other fluid at the two principal meals; to begin with very gentle breathing exercises and two short walks every day in all weathers, and gradually to increase the amount of breathing and walking exercises. Within four weeks the œdema of the legs had disappeared, and after another month she was able to walk two hours every day. On this plan her health further improved and remained satisfactory up to the age of 70, when I lost sight of her; but I heard later that she had died at 75.

V.—Cause of Death from Old Age.

Death from *old age* is caused by a kind of *atrophy of the tissues and organs* connected with changes in the capillary blood-vessels, and, in some cases, atrophy of the ductless and hæmatogenic glands. For the more accurate description of these senile changes I again refer to Dr. Savill's paper already mentioned [109], and to the articles on "Old Age" in the second edition of Allbutt and Rolleston's "System of Medicine," by Dr. Parkes Weber [131] and

myself [134]. We must counteract this tendency to *senile atrophy* by supplying the tissues and organs with healthy blood ; and to do so we must endeavour to produce a healthy state of the blood and to maintain the blood-vessels and lymphatics in a sound and vigorous condition. Life, we may say, depends to a great extenton the state of the organs of circulation, including the heart, the capillaries and lymphatics, which latter have in old age a great tendency to obliteration, and our aim must be to keep the lymphatics, arterioles and capillaries in working condition, and to prevent or postpone as much as possible their degeneration or obliteration by atheromatous and other changes connected with old age. It has often been said, with justice, that the best way to effect this is by keeping the organs in *action*, while *inaction* leads to decay. We must therefore endeavour to maintain the former and to prevent the latter.

Professor Metchnikoff, in his philosophical and suggestive works, "The Nature of Man" [76, pp. 240-1] and "The Prolongation of Life" [77, pp. 25 ss.], ascribes this decay to the action of macrophages, which name he gives to the larger kind of phagocytes, viz., cells which effect the absorption of exudation, and

the destruction of hostile microbes. He maintains that these cells, useful as they are in absorbing hæmorrhages and exudations, are instrumental also in the changes of old age, that they surround the vital parts, the higher cells of the brain and other organs, the tubules of the kidneys, &c., that they absorb them and transform them into connective tissue, thus producing the fibrous degeneration of organs which is one of the main changes of senility. This explanation of senile decay does not in any way militate against the view that we must endeavour by all means in our power to keep up the nutrition and functions of all organs and tissues of the body by promoting the activity of the nutritive capillaries, since the macrophages attack decaying but not healthy tissues.

VI.—Action of Exercise on the Heart and Blood-vessels.

The physiological processes connected with the all-important question, the *exercise of the organs*, have been studied by Ludwig and his pupils, including in this country especially Sir Lauder Brunton, and independently by Dr. George Oliver, of Harrogate [91]. During the action of an organ its arterioles become

widened, more blood flows into the capillaries and the lymph spaces ; more food and more oxygen are carried to the tissues, and at the same time the waste products are removed. This has often been demonstrated on the muscle whose regular contraction causes increase in size and strength ; it is, however, not only the muscular fibre which gains, but the nutritive vessels and absorbents themselves gain equally much by being kept in action. The increased afflux of blood which is caused by the action of the muscle forces the small vessels to work, and to conduct more blood to the organs and tissues, and thus their coats are maintained in a sound condition. At the same time the lymphatics are kept in action by the removal of the increased amount of fluid from the lymph spaces, containing the used-up material. Similar is the case with the brain and nerve centres ; the acts of thinking and of initiating movements in the voluntary muscles lead to afflux of blood to the nerve centres, to increased nutrition of the ganglion cells and nerve-fibres, and at the same time of the minute vessels, efferent as well as afferent. The increased afflux of blood to the brain by the act of thinking has been shown by the ingenious experiment of Mosso [81], one of

Ludwig's pupils, who, as you know, has constructed a finely balanced table on which he placed a man in the horizontal position, and demonstrated that during the act of thinking the head becomes heavier, so that the head portion of the table goes down.

The healthy condition of the *heart* and *blood-vessels*, which is necessary for maintaining the nutrition of the organs and tissues, is effected by keeping them in constant action. A certain amount of action is inherent to them without any effort of the will. This amount of inherent action varies considerably in different individuals. In many constitutions the system of circulation, and, through it, the health of the organs, remains satisfactory during a long life without any special stimulus [p. 14]; but in other constitutions it is apt to decay at a more or less early period of life, and these tendencies to early decay are, as already mentioned, in many families hereditary, and must be counteracted by judicious means.

If we review the different means in our power to prevent early decay and to keep the circulatory system in a healthy condition, we find that the most efficacious means are given by the different forms of *exercise*. Muscular exercise is one of the most powerful means of preventing

arterio-sclerosis which Sir Lauder Brunton in his address on Longevity [15] calls "the great enemy to longevity."

The mode of action of *muscular exercise* Dr. George Oliver, of Harrogate, explains ingeniously in his address delivered before the British Balneological and Climatological Society in May, 1903. He has lately been making a large number of experiments on the effects of respiratory and muscular exercises on the blood pressure and on the tissue lymph circulation, and he informs me "that all these exercises (respiratory and muscular) produce the same effects, namely: (*a*) A rise of blood pressure and an increase of tissue fluid during the continuance of the exercise; and (*b*) a rapid decrease and immediate fall of the pressure, and a diminution of the tissue fluid on the cessation of them"; and he has found "that the rise and subsequent fall in pressure and in tissue lymph are greater when these two forms of exercise are combined, than when one or the other is practised alone." He concludes "that exercise (whether respiratory or solely muscular, or both combined) stimulates the fluid exchange between the blood and tissue space." Sir Lauder Brunton, in his lecture on Atheroma [13],

describes how each contraction of the muscle drives the fluid onward, and how with each relaxation its tissue juice and products of waste are sucked into the lymph spaces and lymphatics. Thus amongst the effects of all forms of exercise, one of the most important is the promotion of the *removal of the waste products* of the tissues. Many chronic affections, such as gout, premature decay of the small nutritive blood-vessels, are caused by the imperfect removal of the waste materials.

Walking Exercise.—The most natural form of exercise is *walking*. By walking we all know the action of the heart and the breathing are accelerated; more blood is passed into the blood-vessels, which are obliged to contract more vigorously and carry it with greater energy to the different organs and tissues, nourish the latter and become themselves nourished by the work. At the same time the number and depth of inspirations are increased, more oxygen is taken up and more carbonic acid is given out, and the metabolism of the whole body is promoted. Walking also influences the action of the heart in another way; by the contractions of the muscles of the feet and legs more blood is attracted to them and all afferent vessels of the

lower extremities carry to them more blood from the heart, and the efferent vessels, the veins and lymphatics carry more blood back to the heart and force it to contract more energetically. The condition of the veins of the lower extremities is much improved by walking. Many persons have naturally weak veins, which are apt, owing to want of contractile power of their coats, to become distended and varicose, and under injurious influences, such as overfeeding, habitual constipation, goutiness, long-continued standing, &c., to become inflamed. Thrombosis of the veins of the legs and phlebitis are mostly due to such conditions and circumstances. Although much walking exercise is to be avoided, while the veins are inflamed or thrombosed, yet regular walking is one of the best means of prevention. The circulation of the blood and lymph in the abdominal cavity is likewise powerfully accelerated by the act of walking; as well through the increased pumping action of the heart, as also by the increased contractions of the diaphragm and abdominal walls. All the organs of the abdominal cavity, including the sympathetic nervous system, share the improved state of the circulation. In addition to these effects of walking we must take into considera-

tion the fluid exchange between the blood and the tissues explained by Dr. Oliver's observations previously mentioned. Another effect of walking and of all muscular exercises, is the improvement of the nutrition of the muscles, and this in itself is a most important means of counteracting the natural tendency to decay ; for the atrophy of the muscles is in most persons one of the first manifestations of senility, and is one of the main causes of the loss of weight and the power of heat-production in aged people. Yet another effect of walking and other muscular exercise, is a change in the distribution of blood in the body : the action of the muscles produces increased afflux of blood to them, by which blood is removed from the internal organs, and stagnation of blood in the latter is counteracted. This circumstance explains also an experience which many people of limited strength make on themselves, viz., that hard walking or other hard muscular exercise taken soon after meals disturbs their digestion. One of the causes of this is that the action of the voluntary muscles attracts part of the blood which the stomach requires for its work after meals.

Many persons, including men of literary occupations, even medical men, and many

women, think that walking exercise is quite unnecessary; but the great majority of them suffer in later years from the neglect of walking or other active exercises. The organization of man, the large lower extremities with which he is provided, show that they are destined for active use.

The *amount of walking* necessary and useful to maintain health varies widely in different persons and even in the same persons under different circumstances; we may say from half an hour to two or three hours a day, part of which may be taken in the morning, part in the afternoon.

We must consider not only what it is *desirable* to do, but what *can* be done. Great is the difference in different persons and even in the same person at different times. It depends not only on the general strength of a person, but also on the varying state of health, on habit, on age, on the meteorological surroundings, such as heat or cold, humidity, movement or stagnation of air, on the clothing and other circumstances. What is only just sufficient for one is great excess to another, or to the same person under different circumstances. In persons unaccustomed to exercise a long walk or an active climb of some hours can produce an overstrain of the heart of

grave import, while the same person after some training can make a similar exertion without even any feeling of fatigue. The amount which is useful and possible must be judged by the condition of the individual at the time being. We cannot lay too great stress on this point. We have repeatedly seen irretrievable harm and even fatal termination caused by hard walking, especially climbing in the Alps and in the mountains of Scotland, and by exhausting running and rowing matches, in persons who were not in a vigorous condition when they undertook them, while they had been able to undergo greater exertions six or twelve months before, when they had become accustomed to them by gradually increasing work.

The *pace* of the walk likewise deserves consideration, and ought to be different in different individual conditions. We hear sometimes that persons are told to walk two, or three, or four miles an hour, but no general rules can be laid down excepting perhaps this, that the pace ought not to be so great as to cause palpitation of the heart or breathlessness, and, on the other side, ought to be quick enough to produce a gentle glow of the whole body. Here, again, *habit* is of great importance, and this ought only

to be trained gradually, and not to be changed suddenly. When a person, accustomed to a rate of one or one and a half to two miles an hour, is induced by companions to walk four miles an hour or more, great harm is occasionally done. It is said, sometimes, that a person above 65 ought not to exceed two miles an hour, and ought on no account to run; but by careful training a habit may be produced which allows a much quicker rate even at the age of 75 to 80 and more, if all the organs are sound. Whatever can be maintained by the aged, as well with regard to the pace as to the amount of exercise without causing exhaustion, ought to be maintained, but *exhaustion* ought to be avoided. *The condition of the organs is of greater importance than the number of years.*

I may mention here that I have seen in hundreds of cases, that persons advancing in years after having been prevented by illness or other causes from taking their regular walks, felt fatigued when first resuming them, and inferred from this that they were too old or too weak to take proper walks, and in consequence discontinued them, lost power and inclination, and actually became prematurely old. If they had commenced with short walks and gradually

increased them, they would have acquired again the habit of exercise, at least to a moderate degree, and postponed the senile decay. Whenever I have been in time to encourage the resuming of exercise in a proper way, much of the former power has been regained and the decay has been prevented. The same holds good, with the giving up of the exercise of the mind, or of professional or other work. To many persons the retiring from business or from work with an old age pension is the cause of premature decay.

People in advanced age mostly are unable to take as much exercise as those in middle age ; but, as already said, habit produces many exceptions, and short walks at all events ought to be maintained, if possible, once, twice, or three times a day.

Although, as already said, we exercise by walking not only the muscles and blood-vessels of the legs, but influence by it almost all other parts, and all the tissues of the body and their component cells, we ought also to practise movements of the *arms*, the *trunk* and the *neck*. Most persons can combine this with the regular breathing exercises [p. 47], and those who cannot ought to devote at least five to ten minutes once

or twice every day to separate exercises of arms, and neck and trunk. I ought to mention that it is important to exercise the *left* hand and arm as well as the right, since by neglecting the proper use of the left arm, a portion of the right hemisphere of the brain suffers in nutrition. The thorough drying and rubbing after the morning bath affords already some exercise to the arms and trunk, and this can be advantageously supplemented by further movement before dressing again. We combine in this way a *short air bath*, with the water bath and the exercises ; and this air bath exercises a beneficial influence on the skin, and, through it, on the nervous system and the circulation.

Those who possess fairly healthy organs of circulation derive more benefit from gentle uphill exercise than from walking downhill or on the level ground. Also in weakness of the muscular fibre of the heart and moderate degrees of dilatation, graduated uphill exercise, as suggested by Oertel [88], has a most beneficial effect.

It is scarcely necessary to remark that these suggestions as to walking are intended only for healthy persons (amongst whom we include persons with old mitral affections with perfect compensation), but not for convalescents from

acute diseases, and least so from rheumatic fever with recent heart complications.

This regular walking exercise, provided the health is fairly good, ought not to be interrupted by so-called *bad weather;* it ought to be taken in all kinds of weather, may it rain or may the sun shine, may it be cold or warm. Many people with a tendency to rheumatism are excessively afraid that walking in rainy weather may cause fresh attacks of rheumatism or increase the rheumatic troubles from which they are already suffering, and on this account stay at home on rainy days; but with proper protection by clothing, strong boots and umbrella, and changing the clothes at the end of the walk, this fear is mostly unfounded, provided the rain is not combined with strong cold winds. Almost all otherwise healthy persons become easily accustomed to every state of weather, and the tendency to rheumatism and catarrh from chills is either totally overcome by it, or at all events very much diminished. This rule holds good for children and aged persons as well as for the age of manhood. When I asked, through a mutual friend, Moltke, the great general, by what means he had maintained his health and activity, he answered: "By great

moderation in all things ; by regular outdoor exercise in all weathers, good and bad ; never a whole day at home." He was in his ninetieth year at that time. This rule, however, is not applicable to those whose resisting power is already much weakened either by disease or by old age, and to those who have a strong tendency to bronchial attacks. They, or at all events many of them, ought not to expose themselves to the fogs or strong, cold winds of our English winters and springs, but should either stay at home on the more inclement days and take indoor gymnastic and extra breathing exercises, or, if they can afford it, spend those seasons in warmer and sunnier climates, or at one of the sheltered localities of the southern or south-western sea coasts of England or Ireland. These localities ought to be provided with numerous divided open shelters where invalids can sit for hours in the open air without being exposed to cold winds and rain.

Days of Prolonged Exercise.

It is of great use for those who are still in fair vigour to take regularly, once a week, *a day of more prolonged exercise*, up to three, four and six hours ; and those who live in town

ought to spend this day of extra exercise in the country, if possible, on account of the purer air and the change of scene. The benefit of such a long walk is increased if only a very small quantity of food and fluid is taken during the walk, for instance, a sandwich or a few plain biscuits, and an apple or an orange. This is, indeed, an important matter, for if much food, and perhaps also fluid, especially alcoholic, is taken during the long walk, part of its good effect is lost ; and if, by increasing the appetite, it leads to the consumption of too much food during the following days, the benefit is likewise diminished. One of the visible effects of such a walk, combined with a very restricted taking in, is that the body loses mostly between two and seven pounds during the walk. The amount of loss varies according to the condition of the walker, the duration of the walk, and other circumstances ; as a rule, not without exceptions, large persons lose more than small ones ; fat persons more than lean ; those who are unaccustomed to long walks lose more than those who habitually take them ; those who drink much before starting more than those who have taken only a small amount of fluid. A fast walk connected with some

climbing leads to a greater loss than a walk at a slow pace and on level ground. The amount of, or the absence of, sunshine, the temperature, the relative humidity of the air, the presence or absence of wind, and other agencies, exercise considerable influence on the amount of the loss of weight. This loss consists almost entirely of increased secretion of water through the skin, the lungs and the kidneys, but with the water some salts and excretory substances are removed. By the simultaneously increased removal of fluid and diminution of supply of solid food and of fluids more used-up material is withdrawn, and the somewhat thirsty blood and starved tissues are enabled to take up more new material. The weight lost on the long walk is usually regained within two or three days. The *increased removal of waste products* is one of the most beneficial influences of such a weekly long walk.

Many persons, including some medical men, are of opinion that it is injurious to take much active exercise, especially in advancing years, that the body is sooner worn out by it than by rest or very restricted exertion. A friend of mine, who was known by many of you, the late Mr. George Pollock, often told me this, and tried to dissuade me from my long walks, as he

believed that they would "wear me out" sooner than rest. He did not succeed in dissuading me, as I am sure that this "*wearing out*" theory of the organs by making them work is wrong. The animal body is not a machine made of dead substance like wood or leather, but is made of living organs and tissues which by action are not worn out, but nourished and maintained in working order, provided always that the exercise is not over-exercise. Many more people wear out too soon from *over-rest* than from *over-exercise;* and this is true, not only with regard to the muscular, but also with regard to the circulatory system and the brain. It is true that work causes wear of tissue, but the wear is compensated by increased supply and increased power to assimilate this supply and to remove the waste material. Dr. Martin Luther's motto, "*Rast ich, so rost ich*" (If I rest, I rust), is perfectly true. Old persons accustomed to much exercise may go on taking it *as long and as much as agrees with them, and need not think of the number of their years;* but they must keep up the habit if they wish to keep up their power, for if they leave off walking for some weeks or months, it frequently happens that they cannot resume it without injuring them-

selves, unless they do so with great judgment and very gradually (comp. pp. 35, 36 and 38). In this respect there is a great difference between the old and the young. Young people who have been prevented taking active exercise by one cause or another, can easily resume it and gradually increase the amount; but in old persons the muscular fibre, the involuntary as well as the voluntary, has a great tendency to become atrophied, unless it is kept in action, since the small nutritive vessels and the small lymphatics become atrophied by want of action.

Another advantage of several hours exercise in the country is the exposure to the open air, which is scarcely to be overrated; it strengthens the skin and the nervous system, and through this the digestive system and the whole organism; it cheers the mind; it increases the resisting power to meteorological influences, and diminishes the liability to chills and other morbid microbic affections, and this *resisting power* is one of the great factors of longevity. Life in the open air, by itself, even without exercise, increases the resisting power, and ought therefore to be arranged for delicate persons who are unable to take much active exercise; it may be done by driving in open carriages or

in bath chairs, by lying in hammocks, or by sitting and lying in open verandahs, or in *open shelters*, such as now fortunately are being multiplied at most of the seaside resorts, and ought also to be abundantly supplied at all inland health resorts and in private gardens and parks. It is not for tuberculosis alone that open-air treatment is useful, preventive as well as curative, but also for almost all other chronic deviations of health and tendencies to disease, such as affections of the blood, of the nervous and digestive systems, chronic rheumatism and gout. Prolonged daily exposure to the open air exercises also a most beneficial influence in the bringing up of children.

People to whom the so-called "walking without an object" is tedious must endeavour to find an object; I have often, for instance, succeeded in inducing people to take regular walks, by suggesting to them to keep dogs, and, in consequence, they walked for the sake of their dogs. When the dog scheme is impracticable, I often succeed, though sometimes only with difficulty, by explaining the ways by which open-air exercise and open-air life influence the health of the body. When persons understand this, their knowledge stimulates their will, and

the will overcomes the dislike, and increases their power, and gradually the feeling of improved health leads to actual enjoyment of that which had formerly been tedious to them.

Walking or Climbing Tours.—Still more beneficial than the once a week extra exercise is the plan of taking once or twice a year a *walking or climbing tour of three to four weeks or longer*,[1] in mountainous districts, especially in the neighbourhood of and on glaciers, with three to six hours active walking or climbing on most days of the week, provided that the organs of the body are free from disease, and that they be gradually accustomed to the increased work. The amount of benefit to be obtained from such tours, if judiciously arranged, can scarcely be exaggerated. They exercise an actually rejuvenescing influence in which every organ of the body shares more or less, from the brain to the skin and hair. The power for mental work is increased, the view of life's duties and worries and hardships is corrected, and often I have observed that the hair of the head

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[1] "On the Hygienic and Therapeutic Aspects of Climbing," by Hermann Weber, M.D., *Lancet*, October 28 1893.

and beard, when commencing to turn grey, has resumed, after good courses of climbing, more or less of the original colour. The action of the heart is likewise in all persons tangibly improved, in some to an astonishing degree. Again and again I have witnessed in many others and in myself, that while before the climbing tour a slight exertion in walking caused the pulse to rise from 60 or 65 to 110 and 130 and more, the same or even a much greater exertion produced, after the climbing tour, only a rise to 80 or 85. The pulse tracings by the sphygmograph are equally significant. Inseparable from the strengthening of the heart is that of the blood-vessels, especially the arterioles, the capillaries and lymph vessels on which depends the improvement of the nutrition of all the tissues and organs of the body. The removal of waste products to which I have already alluded as an important effect of all forms of exercises, is most thoroughly accomplished by these walking and climbing tours. Dr. Austin in his interesting paper, "On Mountain Climbing for Professional Men" [6], justly remarks that climbing tours exercise a powerful influence on strengthening the will, the importance of which I shall discuss later on. I must, how-

ever, lay stress on the condition already mentioned, that the different organs of the body must be sound if such courses of extra exercise are to be practised. I have repeatedly seen great harm follow them in persons affected with diseases of the heart, the small blood-vessels, the lungs, the liver, kidneys and spleen, in various forms of diabetes, albuminuria, and anæmia. For these, too, open air and exercises are very beneficial, but their use must be carefully arranged according to the individual condition; over-exertion is always very injurious. The practical rules laid down by the late Professor Oertel, of Munich, for diseased states of the muscular fibres and valves of the heart are most important [88]; but similar rules and restrictions are required also for other morbid affections besides those of the heart.

Respiratory Exercises.—The remarkable improvement in the heart's nutrition and action, and in the condition of the blood-vessels effected by climbing tours, is, I think, to a great degree caused by the deep inspirations which are necessitated by the act of climbing, especially steady and prolonged climbing. This consideration has led me to pay particular attention to *respiratory exercises*, which since then have been very

useful to myself and many others, especially persons with weak heart muscles.

I make no claim of originality for these movements. Although I have come to them more than thirty years ago by my own observations and experience, I gladly acknowledge that I have been forestalled in their publication by others, and especially by Dr. Harry Campbell's excellent work on "Respiratory Exercises in the Treatment of Disease" [19]. As in walking and other bodily exercises, the amount and modus of respiratory movements which are useful greatly vary with the individual condition, and must be adapted to the latter. It is often injurious in cases of weakness of the heart or lungs, or the sequelæ of pneumonia or pleurisy, or other acute disease, especially rheumatic fever and influenza, to begin at once with forced respiratory movements. I have mostly commenced, even in healthy persons, with moderately deep inspirations and expirations continued during three to five minutes, once or twice a day, and have gradually increased the exercises to ten minutes or a quarter of an hour. The depth of each inspiration and expiration, and the duration of holding the breath, are likewise to be only gradually increased. At the begin-

ning an eighth, a sixth, or a quarter of a minute for every inspiration and every expiration ought to be sufficient ; if this is well borne, each act may be gradually prolonged in duration, so that in the majority of cases each inspiration and each expiration may be brought up to a minute and more, although in the majority of cases half a minute is quite enough for each act. I usually advise to inspire in the erect position with raised arms and closed mouth, and to bend down the body during expiration so that the fingers touch the ground or the toes. The expiration may be made quite well with open mouth, if preferred, but for the inspiration the breathing through the nose with the mouth shut has advantages, such as warming the air and removing palpable impurities by the passage through the nasal cavities. By degrees one can learn to make several up and down movements or various exercises of the arms, such as bending and stretching, or moving in a circle during every inspiration, and bend and raise the body several times during the expiration. By this alternate bending and raising of the body we gain the additional advantage of strengthening the lumbar muscles, and through this successfully combating the tendency to lumbago. Another useful com-

bination with the respiratory exercises is the turning of the body in the erect position round the axis of the spinal column alternately, with deep inspiration from left to right, and with expiration from right to left, with the arms raised to the horizontal position. By this movement we bring into action, in addition to the lumbar muscles, some of the muscles of the spine which are apt to be only imperfectly used by most persons, especially in advanced years, and the stiffness of the neck and spine and the tendency to stoop, so common in old people, can be to a great degree corrected by such means, if commenced in good time, and practised regularly and thoroughly, although we ought not to be satisfied with this, but ought *always* to walk and stand in the fully erect position. The swinging of the arms round the shoulder-joint is likewise a useful combination, say the swinging of the right arm with inspiration, and of the left with expiration. Other combinations with muscle and joint movements will occur to those who have accustomed themselves to these respiratory movements ; but the latter ought always to have our principal attention, since to them the beneficial effect on the heart and lungs is mainly due. In addition to

the influence on the circulation, the respiratory movements keep up the nutrition and efficiency of the lungs themselves, which undergo in old age a kind of atrophy ; the walls of the smallest divisions and air cells become thinner, and a kind of senile emphysema is developed, which by these exercises is to some degree prevented. By improving the nutrition of the lungs we also counteract the tendency to chronic bronchial catarrh and to pneumonia which form frequent causes of death in old age. Another important influence consists in maintaining the elasticity of the chest walls, which are apt to become stiff in old age, and thus to interfere with the free movements of the lungs and the pleura. If for some reason the erect position should be inconvenient, the mere respiratory movements can be made also in the horizontal and sitting positions. I have already alluded to the additional advantage of the compression of the abdomen, which is effected by deep expirations, and which ought always to be practised thoroughly ; all the organs contained in the abdominal cavity are compressed, especially the stomach and intestines, and the blood is squeezed out of the veins, which yield more easily than the arteries, owing to the flaccidity of their coats. We may further

point out that the action of the serous membranes of the pleura, the pericardium and the peritoneum are also beneficially influenced by the deep respiratory movements, which constitute a kind of massage to the lungs, the thoracic walls, pericardium and heart (Sir Lauder Brunton). All the organs of circulation, heart, arteries, veins and lymphatics are powerfully influenced by the deep respiratory movements. In trying to explain the effects of these respiratory movements we must not forget the important item of the fluid exchange produced by them between blood and tissues (Oliver).

Breathing exercises, and also other gymnastic exercises of a milder kind, are as necessary for women as for men. They ought to be practised by them without stays, as the free movements of the organs of the chest and abdomen are impeded by them.

We must, however, not restrict our lung-gymnastics to these few minutes of respiratory exercises; but we must create the habit of always breathing not superficially but thoroughly, and taking at several other times of each day deep inspirations and expirations, especially while walking. At first we are apt to forget this, but by often reminding ourselves of it, it is not

difficult to create this *habit of deep breathing*, and the advantages of it are very great, in improving the condition of the blood, in strengthening different organs, as explained, and in maintaining the resisting power of the organism, and thus preventing disease.

The benefit effected by these respiratory practices abundantly repays the time spent on them. Very often I have seen that persons who got out of breath by short walks and climbs, and for this reason abstained from them, and in consequence suffered in their health and spirits, have become, with the help of these movements, active walkers and climbers, improved in every function of the body, and have outlived by many years their brothers and sisters who had not practised them. The breathing exercises are especially useful to literary workers, statesman, professional men and others who are unable to take one of the usual modes of exercise. The most convenient times for practising them are in the morning before or after the bath, when the body is loosely covered with flannel, and in the evening when dressing for dinner, or before going to bed. I ought to add that these ordinary breathing exercises are not suitable for very delicate persons ; they are, for instance, injurious in great dilata-

tion of the heart, with or without valvular disease ; such affections require much milder movements, and are benefited by them, like those practised at Nauheim ; nor are the more energetic breathing movements suitable in *active* tuberculosis and in tendency to pulmonary hæmorrhage, and in the early stage of convalescence from severe acute diseases. In more quiescent forms of tuberculosis, or in arrested tuberculosis, however, and in the imperfect expansion of the lungs, resulting from pleuritic effusion, they can be rendered beneficial by practising them judiciously. I need scarcely say that by the improvement which walking and climbing tours and respiratory exercises effect in the nutrition of the tissues, they increase the resistance to diseases, microbic and others, such, for instance, as arterio-sclerosis.

Other Forms of Exercise.—These respiratory exercises, combined with movements of the limbs and trunk, are different from P. H. Ling's so-called "Swedish gymnastics," but the latter are likewise most useful for the maintenance of health, and they can be adapted with numerous modifications, according to individual conditions, to many persons who are unable or disinclined to take ordinary walking or riding exercises, or

who have local defects of movement from disease or want of use. Sandow's well-known systematic exercises, and the so-called Danish exercises, and Streber's gymnastics (Streber's Zimmergymnastik), too, have many similar advantages, and also ordinary gymnastics as they are practised, especially in Germany, under the name of "Turnen," although the latter, excellent as they are for the maintenance of health and the muscular development of the healthy, are rather less suitable to old age than to the earlier periods of life, unless they are specially adapted to the more or less altered conditions of the aged body. The same may be said of military training, which forms one of the most beneficial means of development of nations, physical and mental. All these exercises not only increase and maintain the muscular force, but strengthen the whole organism, and its resisting power against disease.

Cycling has been strongly recommended by some men as a good form of exercise, preferable in many cases to walking; but I think that the great majority derive much more benefit from walking. In some instances where the dislike to walking is very great, or where there is some defect in the feet or legs by which walking is rendered difficult, cycling is often a

good substitute. I have, however, seen a number of men, as well as women and children, who have become ill from over-exertion in cycling. We can understand this, if we consider that the feeling of fatigue in cycling is perceived less than in walking, and that therefore the danger of overstraining is greater in the former than in the latter form of exercise. For the majority of elderly persons, and such as are defective in agility, the tricycle is preferable to the bicycle.

A most useful form of exercise, which involves a more or less prolonged and regular exercise in the open air, occupying mind and body at the same time, is *Golf*. Another kind of exercise requiring still more mental attention, more than any other gymnastic exercise or sport, is *Fencing*. Every movement of the opponent requires to be constantly watched and acted upon instantaneously. At the same time it promotes the greatest precision and a certain degree of neatness of movement, and brings into action almost all the muscles of the body with the least expenditure of force.

Angling is another pursuit to which many of my friends have ascribed their health and happiness and long life. Isaac Walton himself, the

father of angling, as we may call him, lived to be 90. Long hours in the open air, with constant moderate exercise and meditative contentment of mind, go far to explain this.

Gardening is likewise a source of health and long life to many persons, rich and comparatively poor. It occupies the mind in an agreeable manner, and ensures a certain amount of exercise without over-fatigue, in the open air.

Another convenient form of exercise, especially useful in gouty people, recommended by Dr. Oliver, is what he calls the *static or tension exercises*, which consist in the static contraction of all the muscles of the body, while standing, from one to two minutes several times a day. In goutiness the arterial pressure is increased and the tissue fluid is prevented from returning to the blood and lodges in the tissue vacuoles. Tension of the muscles diminishes the arterial pressure, and allows the tissue fluid to be absorbed. Dr. Oliver finds that one minute's tension clears up as much as 20 per cent. of lymph. These tension exercises may be practised best an hour before all meals, when Nature itself produces a normal fall in the arterial pressure ; but other times may be substituted, if more convenient.

While recommending walking and climbing tours, and respiratory exercises, and various forms of gymnastics, I must guard myself against the indictment that I disregard the value of riding on horseback, rowing, cricket, football, tennis, swimming, hunting, shooting, and many other kinds of sport. I, on the contrary, regard them as most useful to a very large number of persons, but I am unable to enter upon them in this short discourse. To all, *if properly exercised*, may be applied the Arab saying, "The days spent on the chase are not counted in life's course." We might even say that they add to the sum of life.

VII.—Digestive Organs and Food.

Attention to the *digestive system* and *food* is almost as necessary for the promotion of longevity as that to the circulatory and respiratory systems, which are intimately connected with them.

We usually understand by *food* organic substances suitable for the maintenance or the increase of the body, and serving as sources of energy necessary for the execution of work and the formation of body heat (von Noorden [85]). The ordinary articles of food consist of proteids, carbohydrates, fats, different kinds of organic and inorganic salts and water; there are, besides, in the food substances other constituents such as extractives, condiments, ethereal oils, which are not

regarded as necessary for the body, and the functions of which are not quite clear, but which may act as stimulators of various groups of cells, and may thus influence the metabolism (von Noorden). The proteids, the mineral constituents and water are chiefly concerned in replacing waste, while the carbohydrates and fats are the chief energy-yielding substances, in which function they are, however, greatly assisted by the proteids (R. Hutchison [59]). The mineral substances, especially phosphorus, play a much greater *rôle* in the nutrition of the cells and the metabolism of the body than is usually assumed.

We derive our food partly from the animal, partly from the vegetable kingdom. The principal articles of animal food are the different kinds of meat or flesh food, eggs, milk and casein preparations. Under flesh food we may include beef, mutton, lamb, veal, pork, poultry, venison, game, the different kinds of fish, lobsters, crabs, oysters, also snails, &c. Under vegetable food, the different kinds of grain: wheat, rye, oats and barley, rice, maize, millet, &c.; almonds, nuts, dried beans, peas, lentils, the green vegetables, tubers, fruit and mushrooms.

The various kinds of *flesh food* are characterized by a large proportion of proteids; they contain about 25 per cent. of solids and 75 per cent. of water; the solids consist of 75 per cent. of albumen and 25 per cent. of gelatinous matter, extractive matters, fat and mineral substances. The action of the different kinds of flesh food on the body is not quite the same, but the idea entertained by many persons that so-called *butcher's meat* is much more liable to cause morbid changes

in the metabolism, leading to diseases of the blood-vessels, gout, excess of uric acid, &c., than the so-called white meats and fish is not proved (von Noorden [85]); and G. Oliver found the blood-pressure, after the ingestion of white meats, very similar to that after butcher's meats. I must lay some stress on this point, because I have often found that patients suffering from gout, renal troubles, uric acid, stone, eczema, hæmorrhoids, &c., thought they might eat large quantities of poultry, game, venison and fish, if they only avoided beef and mutton, an error which had caused great aggravation of their troubles, while the greatest moderation in, or total avoidance of, all flesh foods, and substitution of vegetables, milk, and milk derivatives, led to perceptible improvement or cure.

Although the different kinds of flesh food exercise a more or less similar influence on the metabolism of the body, it does not follow that it is to all persons the same, whether they eat half a pound of beef, or of mutton, or veal, or pork, or chicken, or fish. There are in this respect great differences in different persons, and even in the same person according to the state of health. There is, further, a wide difference in the digestibility of meat according to the age of the animal or the state of its nutrition, or the part of the body from which it is taken, or the way of cooking. Allowing for such differences we may roughly say that tender and well-prepared meat belongs to the easily digestible and most nourishing articles of food. It does not, however, contain all the substances which are necessary for the maintenance of health, and must be supplemented by the addition of others.

Different kinds of *fish* are differently borne by the same person or by different persons. Whiting, sole, brill, smelts, pike, and the more lean kind of fish are, to the majority of people, more digestible than the richer kinds, such as salmon, mackerel and eel. We may designate the former, if carefully cooked, easily digestible, but not more so than well-selected and well-cooked meat. Fish cannot be regarded as an entire food, still less so than meat.

Eggs are to the majority of people easily digestible, but some persons cannot bear them, and on a few they really act as a poison. They are very nourishing. Hirschfeld calculated that a hen's egg of medium size is equal to nearly 2 ounces of lean meat, and to nearly 9 ounces of good milk. They are more easily digested in the raw, or only slightly boiled, condition. The yolk is more nourishing than the white, it contains less water, more proteids, fat, and mineral matter, including iron and phosphorus, the white is free from fat. The latter raw, or only slightly boiled, is more easily digested than the yolk. The late Sir J. Y. Simpson, of Edinburgh, the celebrated gynæcologist, was in the habit of restricting some delicate patients for many weeks and months almost entirely to the raw white of eggs, well beaten up and seasoned with a little salt, and did so with great benefit to their health, and I have been able to corroborate his experience on this point. Eggs have, to persons suffering from the uric acid diathesis, the advantage of being almost free from purin bodies.

Milk is one of the most useful articles of food, I may even say the most perfect food, as it contains

all the substances required for the building up and the maintenance of the body. The sale of milk ought, therefore, to be under the strictest supervision of the authorities, including the farm and its inhabitants, the cows, the milk cans, the transmission from the farm to the dairy in town, and the supply of the public by the dairy. In addition to all this, however, in the house of the consumer the greatest care should be taken to avoid contamination of the milk by exposure to impure air, or cats, or flies, or by the use of unclean vessels. Metchnikoff [77] directs attention to the very important point, that milk gives rise in the stomach and intestines to the development of the *milk bacillus*, a friendly bacillus which combats the hostile bacilli found in the intestinal tract, and thus counteracts putrefaction with its injurious consequences (auto-intoxication). This bacillus is also developed outside the stomach when the milk is allowed to stand and become sour. *Sour milk* is often declared as injurious, but this is by no means the case with regard to the majority of people who bear it well. To Sir Thomas E. Fuller, the former Agent-General for Cape Colony, I owe the information that a kind of sour milk forms an essential article of food amongst Kaffirs, and that many Europeans, affected with various chronic illnesses, have lived on it almost entirely for long periods and have ascribed their recovery to its use. The addition of preservatives to the milk, to prevent its becoming sour, which has of late become general, is not always judicious, and ought to be allowed only exceptionally and with great discretion. The question of taking milk boiled or unboiled must

be answered principally according to the quality of the milk ; if the milk is obtained from healthy cows, and is otherwise pure, it is to most, though not all, persons more digestible, and also more nourishing, in the unboiled than in the boiled state, but if the purity is uncertain it is more prudent to boil it. The actual boiling ought, however, to be restricted to a few minutes, or even less. For most purposes it is enough to raise the temperature of the milk to about 60° to 66° C. (about 140° to 150° F.), and keep it at that temperature for about a quarter of an hour. Strongly boiled milk seems to have caused in some infants fed on it a kind of scurvy. Many excellent articles have been written on the value and digestibility of milk (Pawlow, Metchnikoff, Verhaegen, Hutchison, &c.). *Buttermilk* is easily digestible ; it is less nourishing than ordinary milk, as it has lost a large portion of fat, but it is still a valuable article of food and is not sufficiently appreciated ; it is also more diuretic than the whole milk. *Cream* contains much more fat and much less casein than milk ; it is well borne in moderate quantity by many people, but causes in some a kind of biliousness, and it is not so complete a food as ordinary unskimmed milk. *Skim milk* contains more casein and less fat than ordinary milk, and is a cheap and good article of food when supplemented with carbohydrates, such as potato and bread ; it agrees better with most persons suffering from disease of the kidneys than unskimmed milk or cream.

Butter, well prepared and fresh, is probably the most easily digestible, and at the same time the most palatable of the fatty substances used as food.

The amount of real fat in butter varies considerably; the average may be regarded as between 75 and 82 per cent., the remainder consists of water and a small quantity of casein and milk sugar. When I designate butter as easily digestible, I mean in the raw state, for after having been cooked, especially after having undergone frying, it deranges the digestion of many persons by the development of butyric and other fatty acids, in which it is very rich. In this respect *margarine* has an advantage over butter, as it contains scarcely any fatty acids, and in consequence of this and the absence of casein, keeps much longer and becomes not so easily rancid. It has not the nice flavour of the finest kind of butter, but it is a very good article of food, especially for cooking, and is much cheaper. The prejudice against margarine is unfounded.

Cheese, another derivative of milk, varies considerably according to the way of making it. There are hard and soft varieties, according to the degree of pressure exercised in removing the whey from the casein. If the greater part of the fat is removed from the milk, and a *lean* cheese is produced (such as most of the Dutch cheeses are), it agrees much better with persons of weak digestive powers, by being less apt to develop butyric and other fatty acids in the stomach. If all the cream is left, a fatter cheese is produced, such as Cheddar and Gruyère, and still more so if cream is added. Cheese is very nutritious, 1 lb. of cheese being equal to about 3 lbs. of beef, but it requires careful mastication. The softer varieties of cheese, like Brie, Camembert, Limburg, disagree rather fre-

quently, partly because they are mostly swallowed without much mastication, partly from being taken when already too much decomposed. A moderate quantity of cheese, taken as a meal with bread, or milk, or potatoes, is well borne by most persons; but, if taken at the end of a full meal, it often disagrees, and cannot be recommended.

Valuable articles of food mainly derived from milk, allied to cheese, and even more nutritive and more digestible, are *sanatogen*, *nutrose*, *eucasin*, and *plasmon*; they are proteids of milk, combined with small quantities of alkalies, especially soda and ammonia. One of their merits is, that they contain phosphorus in an organic combination with albumin which is readily absorbed and enters into the nutrition and metabolism of the cells of the body, as shown by the experiments of Beddoes and others with sanatogen (casein-sodium glycerophosphate).

Much greater is the difference in the various kinds of *vegetable foods*, as well with regard to their chemical composition and nutritive value as with regard to other influences on the organism. On the whole, they are less rich in proteids, but are the principal furnishers of carbohydrates, prominently in the shape of starch, dextrin and sugar. The majority of the vegetable foods, excepting the nuts, almonds, and oil-bearing substances, contain less fat than the animal substances. Another characteristic constituent of vegetables is the cellulose by which most of the carbohydrates are surrounded, and which necessitates the dissolving power of cooking, and the digestive processes to effect the transformation of the carbohydrates into

absorbable substances. Many of the vegetable foods, especially fruit and green vegetables, are further characterized by various vegetable acids, and amongst the saline constituents by a larger proportion of potash salts, which are of importance in the metabolism of the body.

The most important group of the different vegetable foods is formed by the *cereals*, the principal representatives of which are wheat, rye, oats and barley. They contain proteids and carbohydrates, some fat, cellulose and mineral matters, in fact, all the constituents of the human body. Wheat and rye are of the greatest interest to us, as bread, our staple article of food, is prepared from them. In England, almost only wheat flour is used, while in Germany, rye bread (black or grey bread) was in former years eaten by the greater portion of the population, wheat bread (white bread) only by the richer classes, but gradually the use of white bread has there, too, become more general. Rye bread contains a much larger amount of cellulose, and, owing to this, a larger proportion passes through the bowels, unabsorbed, than of fine white bread, it is, therefore, weight to weight, less nourishing than white bread. On the other hand, rye bread does not become dry so quickly as white bread, and keeps longer fresh, which is an advantage in some rural districts, where bread is, or used to be, baked only once or twice a week.

There are a great many kinds of bread, differing according to the fineness of the flour and the manner of preparation, and the removal of parts of the corn or the addition of other substances. We cannot enter into a description of the different

kinds, but must say a few words about so-called *brown bread*, known in Germany and France as "Graham bread," from the fact that the celebrated chemist, Professor Graham (afterwards Master of the Mint) was the first who, in a scientific way, brought the advantages of using, in the preparation of bread, all the constituents of the wheat—the bran and adjacent parts rich in salts, as well as the fine flour of the centre of the corn, before the public. As Liebig devoted a special article, in his chemical letters, to Graham's plan, the term "Graham Bread" was adopted on the Continent. Not all kinds of brown bread, however, are the same. The majority of bakers mix a certain varying amount of bran with white flour, while Graham wanted all the constituents of the whole corn—"whole-meal bread." The corn may be so thoroughly ground that the flour is comparatively fine to suit certain delicate conditions of the intestines, or only roughly ground, making a coarser bread more useful to many persons.

The late Sir Henry Thompson [122] has given a good prescription from which, for instance, Spiking and Stewart make a very useful bread (Thompson's whole-meal bread). This kind of bread is nutritious, easily digestible to most people, and helpful in assisting the action of the bowels. Some persons, however, with an irritable mucous membrane, or with a suspicion of ulceration in the stomach or intestines, ought to use a bread prepared from a much more finely ground corn, or from flour deprived of the bran. A rather larger proportion of brown bread passes off with the fæcal matter than of white bread, owing to the great amount of cellulose contained in the bran, the

fæces are usually rather more bulky, and a smaller proportion is absorbed, compared with white bread. Considering the advantages and disadvantages of white and brown breads, the advantages of the latter (Graham's and Thompson's bread) greatly predominate for the majority of people, though not for all.

Bread, although an excellent article of food, is not quite as perfect as milk, but combined with the latter, it is sufficient for the nutrition of the human body. It is easy of digestion, if not taken too fresh, and if thoroughly masticated. Biscuits, rusks, and toast are still more so, partly because by their dryness and friability more perfect mastication and admixture of saliva are necessitated, partly also because they are already digested to some degree by the processes of preparation. Comparing equal weights of toast and biscuits with ordinary bread, the former contain more nourishment, since they consist of more solid substance and less water.[1]

Oats are very nourishing if well ground or rolled. They cannot be used, owing to the absence of gluten, for making bread; but the different preparations in commerce, such as oatmeal, Quaker Oats, Waverley Oats, &c., yield excellent porridge and similar dishes, which when combined with milk

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[1] There are several other preparations of wheat in use which possess advantages with regard to digestibility and nutritive power. The best known are macaroni, semolina, shredded wheat, florador, granola, and Allenburys' foods.

and its derivates, offer all that is required for perfect nutrition.

Barley forms likewise a most useful article of food, though it contains rather less proteid than wheat. It is not quite suitable for making bread, as it is poor in gluten ; but by the addition of wheat flour it yields a satisfactory bread.

Different from the cereals just mentioned is *maize*, which contains less proteid, but more fat and carbohydrates. It cannot be used for bread from its want of gluten, but it is easily digestible, and has much nutritive value. The numerous preparations in use, maizena, cornflour, oswego, &c., form excellent puddings. I have often come in contact with natives of Upper Italy in the Swiss and Italian Alps, who for three or four months every year lived entirely on polenta, milk and cheese, performing much active work and enjoying perfect health. The addition of milk and cheese supplements the small proportion of proteid contained in maize.

Rice contains still less proteid than maize, and very little fat, but it is richer in starch. If well boiled it is easily digested and almost entirely absorbed. *Tapioca* and *arrowroot* and *salep* from the roots of some plants, and *sago* from the sago palm, may be regarded as forms of starch.

Another important class of vegetable seeds, comprised under the term of *pulses*, is represented in our dietary by *lentils*, *peas* and *beans*. There are some differences between them, but they have in common a large amount of a variety of proteid named *legumin*, or vegetable casein ; they have a smaller proportion of carbohydrates than the

cereals, and are poor in fat. They are very nourishing, but require a strong digestion. Owing to their containing much sulphur they are apt to give rise to flatulency. They ought to be taken only as part of the food, *i.e.*, together with other kinds of food, such as green vegetables, fruit, milk, bacon, &c., and only sparingly by persons of sedentary habits and gouty disposition, since they are comparatively rich in purin.

In the south of Europe *chestnuts* form a valuable article of food. They are rich in carbohydrates and possess a fair proportion of proteids. Well cooked, they are easy of digestion to most healthy people, but people with delicate digestion ought to avoid them.

I abstain from discussing the value of almonds, nuts, fungi, olives, &c., since their use is rather limited.

Green vegetables are rich in water and in cellulose, but poor in nitrogenous matter, in carbohydrates and fat, and they contain a relatively large quantity of mineral matter, such as potash and lime, and combinations of phosphorus. By cooking they lose a great part of their solid matter, and take up water, so that some cooked vegetables contain only 1 per cent. of solid matter and 99 per cent. of water. They are not easily digestible for the majority of persons with weak stomachs ; but much depends on the process of cooking and their being fresh or stale ; vegetables fresh from the garden are much more easily digestible than stale ones. The different forms of cabbage, brussels sprouts, cauliflower, belong to the more nourishing kinds of green vegetable, but cause in many persons flatulency, while cooked lettuce and endive and veget-

able marrow are less nourishing but well borne by a larger number of persons. Spinach is, to the majority of persons, the most useful vegetable, and similar to it is cichory ; the branches of celery when well cooked and young are likewise good. Green beans require thorough cooking, and not less so young peas ; the latter, when they become older and more mealy, partake somewhat of the character of pulses above-mentioned. Asparagus are fairly well digested by most people, but ought to be taken in only small quantities by gouty persons, since they contain some purin.

Onions, the favourite vegetable of the inhabitants of southern regions, are apt to cause flatulency in the more northern climates where the habits of people are different, and ought to be avoided by persons with delicate digestion or taken only sparingly.

Vegetables with much oxalic acid, like rhubarb, can likewise not be recommended to the majority of persons, partly on account of the oxalic acid they contain, partly, as in the case of rhubarb, on account of the large quantity of sugar which is generally added to it.

The nourishing value of green vegetables is small compared with meat, cereals and pulses, but they are useful by their saline constituents, especially potash salts, which help to keep the blood alkaline and render the urine less acid ; they are therefore specially adapted to persons with tendency to gout, stone, and some skin affections. Owing to the large amount of cellulose contained in green vegetables only a small portion is absorbed, while a larger portion passes off with the fæcal matters, giving them bulk, and stimulating the intestines,

and thus, to some degree, counteracting constipation. It must, however, be remarked that in persons who endeavour to restrict themselves almost entirely to green vegetables, the bulk required is so large, that it leads to great distension of the stomach and intestines, which can only be avoided by substituting for a portion of green vegetables, cereals and pulses, milk, cheese, eggs, or small quantities of flesh food.

Amongst the *roots* and *tubers* used as food, the most important is the *potato*, owing to its large amount of starch, combined with a small proportion of nitrogenous substance, some salts and extractive matters. Potatoes form a valuable article of food, when combined with other nutrients, containing more nitrogenous matter and fat, such as milk. They are easily digestible when well prepared, thoroughly cooked and mealy, and when they are well masticated. Boiled or roasted in the skin they retain most of their nourishing material, boiled without the skin they lose a certain amount, especially of their saline ingredients. Passed through a fine sieve in the form of mashed potatoes or thick soups they are mostly well borne; but fried in thin chips they are indigestible to many persons, and have, besides, lost much of their food value.

Amongst other *roots*, turnips, carrots and beet-roots are much used; they are characterized by a large amount of water, carbohydrates (especially sugar), and salts and a very small proportion of nitrogenous matter. They form to healthy persons a useful admixture to other articles of food, and specially flesh foods.

In connection with the vegetables rich in carbohydrates we may say a few words about *sugar* which is the purest carbohydrate food. In moderate quantities—of 1 to 4 oz. a day—it is easily digestible to most healthy persons, though it disagrees with a minority by causing rapid fermentation. Taken together with other food it is better borne than by itself. In tendency to corpulence and diabetes it is to be avoided. Sugar is called by some authors a muscle food, but this term leads to misunderstanding, as it cannot be actually transformed into muscle, but it produces *energy* and *saves* the muscle during exertion. I have often found this in myself and my guides in severe climbing; when unprovided with tea or coffee, and when our strength began to flag, a few lumps of sugar helped us on wonderfully. Large quantities of sugar, however, when taken together with a full amount of animal or mixed food, prevent thorough metabolism of the proteids, and may lead to diseases of metabolism, such as gout, uric acid concretions, diabetes, and indirectly also arterio-sclerosis.

The different kinds of *fruit* are mostly characterized by a large amount of water (80 to 90 per cent.), a varying quantity of sugar and dextrin (about 4 to 10 per cent.), some vegetable acids, a small quantity of starch (in some fruits only), and a considerable quantity of cellulose. Their digestibility varies according to their ripeness and the amount of acid and cellulose. *Ripe* and *tender* apples, grapes, raspberries, figs, cherries, plums, apricots and peaches are to most fairly healthy people easily digestible, if taken in small quantities, and when the stomach is not already filled with

other food, as it often is after dinner. Several fruits, like strawberries, exercise an injurious influence on some people, causing urticaria, eczema, and gouty conditions. Many people suffer from flatulency and diarrhœa after raw fruit, while they are able to bear it cooked. By cooking, however, part of the carbohydrates and fruit salts is lost. In apples this is to a great degree avoided by simply baking them in their skins, instead of boiling or stewing them when peeled; but even in this way they lose some of their aperient action. Although the nutritive value of fruit is small, they are useful by diminishing the acidity of the urine and helping to keep the blood alkaline, like green vegetables.

It is of great importance with regard to fruit, to avoid the introduction into the body of impurities—microbic and other poisons—attached to them. With apples, pears, bananas, &c., this can be avoided by peeling them, but with others, such as raspberries, currants, grapes, strawberries, &c., it is difficult to escape some degree of danger, excepting by the greatest thoroughness in washing, and even this does not give perfect safety. The same is the case with green salads and other uncooked green vegetables.

It is impossible to lay down strict rules of diet, as the rule which is good for one is unnecessary and sometimes injurious to another. Articles of food which cause indigestion in one person, or at a certain period of life, or in a certain condition of a person, as for instance beef, eggs, lobster, strawberries, or mushrooms,

are perfectly well borne by another person, or even by the same person under changed conditions, even in weak health. One has to study in every case the constitution, the size, height and weight, the age, the degree of activity—mental and bodily—the individual peculiarities and the influence of habit, and to arrange the quality and quantity of food accordingly.

One rule, however, we can lay down with perfect safety, viz., that *great moderation in the amount of food*, and especially of the most nourishing articles (flesh food, cheese and pulses), ought to be practised by everybody, particularly by old people, and that this moderation is a great aid to longevity; but the term "moderation" must have a different meaning for different persons and conditions, and is to be judged individually. Many people think that they may eat large quantities of highly nutritious food if they abstain from alcoholic stimulants, but this is a great mistake. In acting on this erroneous view they, or at all events many of them, gradually develop changes in their blood-vessels which may not come to their perception at once, but for all that take place, and may later on show themselves as

gout, dilatation of the heart, arterio-sclerosis, glycosuria, disease of the liver, the kidneys, &c., &c. Professor Baeumler has explained this in his recent contribution on arterio-sclerosis [9]. An unnecessarily large amount of food, especially flesh food, often, by developing disease of the minute blood-vessels, impedes the flow of blood to the tissues, and causes, in fact, their starvation, while a limited but sufficient amount, which is often erroneously called "starvation diet," improves and maintains their nutrition. *Superabundance of food leads, in fact, more frequently to starvation of tissues than what is often misnamed "starvation diet," which maintains them in a healthy condition.*

It has been observed by others as well as myself, that amongst great eaters, especially meat-eaters, there are some sufferers from anæmia (probably from alimentary auto-intoxication), and that this anæmia is increased by continued excess of flesh food. In this respect, some experiments on rats by Dr. Chalmers Watson [128] are interesting. Watson found that the bones of young rats fed entirely on meat became soft, and that the bone-marrow became diseased; as the latter is intimately

connected with the formation of blood, the anæmia of some great meat-eaters may possibly be explained by the result of these experiments, but we cannot yet be sure on this subject. The scientific basis of our knowledge of nutrition is, at present, but small, our teaching must still be based to a great degree on empiricism. The experience of all those, however, who have occupied themselves thoroughly with this question of food and nutrition, shows that safety lies only in moderation. Sir Michael Foster, for instance, says that "there can be little doubt that the ingestion of food—and perhaps especially of proteid food—in excess of what is, under the best conditions, sufficient for maintenance and activity, can only be deleterious to the organism, clogging it with waste products which may at times be of a directly toxic nature." Sir Henry Thompson was in the habit of saying, with regard to excessive eaters, "they dug their graves with their teeth." I may refer also to the two cases mentioned on p. 89 ff, and the remarks of Sir Lauder Brunton [15], that the ages obtained by old persons maintained in workhouses are often very great. "A workhouse diet," he adds, "may not be very pleasing to the palate,

but it certainly seems an efficient means of prolonging life, and it might certainly be worth while sometimes for others to adopt it whose circumstances would allow them to indulge in luxury." We may refer also to the remarks of "overfeeding" made by Dr. Hutchison in his work on "Food and Dietetics" [59], p. 53.

Often it has occurred to me in practice that persons eating largely and constantly suffering from various troubles—dyspepsia, headaches, neuralgia, rheumatism, &c.—were placed for several months on a very reduced diet, and, in consequence, got rid of all their ailments; many of them afterwards, when returning to their usual diet, began again to suffer, but recovered almost immediately on reducing their intake.[1]

As a proof of the beneficial influence of great moderation, I may mention the experience that many wealthy persons with very delicate digestion from an early age onwards, who could take but very small quantities of food, only one-third

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[1] L. Cornaro [26] already remarked, that whenever he was induced by his friends to take more than his usual small allowance, he began to suffer in various ways, and that all his troubles disappeared when he returned to his limited diet.

or one-fourth part of what the rest of their family, and the majority of people took, and only special kinds of food, such as milk, farinaceous food, and a few kinds of fruit and vegetables, and eggs, without suffering, usually were free from gout, rheumatism, neuralgia and other complaints, and lived much longer and enjoyed a much healthier old age than the more vigorous companions of their youth, who could and did eat large quantities of food with enjoyment and with seeming impunity.

Many years ago I observed on myself that the reduction of the amount of food, especially meat and other flesh food, to half the quantity I had been in the habit of taking, enabled me to do a larger amount of work without the feeling of mental fatigue and exhaustion, and craving for tea or coffee some hours after a meat lunch. When afterwards patients complained of fits of yawning, sleepiness, and inability to do good literary work some hours after a heavy breakfast and lunch, I induced them to substitute light breakfasts and lunches without or with very little flesh food, with the almost constant result of the entire disappearance of the inconveniences formerly felt. Dr. Sealy [113A] reports the same

experience, and mentions besides that his patients enjoyed the less substantial and less voluminous meals much more than the large and more nourishing ones which they had previously considered essential to their health. He also points out the great improvement caused by this plan in the circulation, the nervous and digestive functions. He suggests that much nerve force is used up by the digestion and assimilation of large quantities of flesh food. The nerve force saved by the lighter meals becomes available for other functions. I may add that I have almost invariably observed also an improvement in the complexion of persons who had exchanged light meals, with less meat, for the heavy meals which they had considered necessary.

Most persons accustomed to indulge a large appetite, whether abstainers from alcohol or not, if you tell them that they must reduce the amount of food, must take only little meat and flesh food and alcoholic stimulants, think that you are going to starve them, that it is impossible for them to do their work on reduced allowances. They are mostly confirmed in this view by their relatives and friends, especially ladies. They ascribe any

feeling of lassitude, headache, neuralgia, disinclination to active work, although this is very common in persons taking too large meals, to the diminution of alcohol and meat, and under this impression discontinue carrying out your suggestions. It is quite true that in some people such reductions, when made too suddenly, have injurious effects, at least temporarily ; but if the reduction is made gradually, the body becomes easily accustomed to it and the mind too. Some of the inconveniences felt are with some persons due merely to the fear of being lowered. Experience in many hundreds of cases authorizes me to say that gradual reduction, carried out with judgment and perseverance, leads almost always to increase of mental and physical power, cheerfulness, and the prevention of premature old age, and the privations and sufferings connected with it. The majority of Japanese live in perfect health, and perform a large amount of work on so small an amount of food as the majority of Europeans would consider insufficient to maintain life. Few people know how little food is required to maintain health, especially in advanced age. Professor Chittenden's experiments at the Yale University indisputably show that the amount of food required for the maintenance

of perfect health and strength is much smaller than had previously been assumed. In Chittenden's experiments the quantity of meat, and all other flesh food and eggs, was reduced to a small proportion of the entire intake. Amongst the results arrived at by the "Collective Investigation Committee" we find that only few (5 per cent.) of the persons above 80 years had been large eaters of animal food, and that the majority had eaten only little meat (Humphry, Professor G., "Old Age," Cambridge, 1889, p. 127), and this is the result of my own experience. Sir Henry Thompson has given excellent advice in "Diet in Relation to Age and Activity," and not less so Dr. George Keith in "Plea for a Simpler Life" (1896) and "Fads of an Old Physician" (1897), and also Dr. Burney Yeo in "Food in Health and Disease": but their lessons are not acted upon by the majority. As long ago as 1558, L. Cornaro, of Venice, showed by the description of his own manner of living, when he was more than 90, in his "Discourses on a Sober and Temperate Life" [26], how, on a very small amount of food and wine, one can maintain perfect health and happiness, and reach a very advanced age. He lived to over 100

and died without suffering. Addison gave a paragraph on this book in the *Spectator*, vol iii., No. 195, and Abernethy evidently recognized the practical correctness of Cornaro's precepts, if we may judge from an amusing sketch in the possession of the Medico-Chirurgical Society, to which Dr. Parkes Weber has directed my attention. It represents Abernethy lying on the floor, near a table covered with food and wine, at which two ladies and a gentleman sit ; to them Abernethy delivers a short lecture, from which I will only quote a few words : "You should take my blue pill now and then, fasting. Read Cornaro on Temperance, he lived to nearly the age of Methuselah ! Practise his rules and regimen (if you *can*), get up before sunrise and get to bed after sunset. Sluice yourself every morning, winter and summer, with cold water. Lie on your back as you see I do, every day after dinner." Cornaro did not require *blue pills*, because he ate less than we may suppose Abernethy's patients did.

Sir William Temple says, in the chapter "Of Health and Long Life," essentials amongst primitive people are : great temperance, open air, easy labour, little care, simplicity of diet, "rather fruits and plants than flesh" [120].

During my observations on this subject, extending over more than fifty years, I have been able to enquire into the manner of living and other antecedents of over eighty persons living to between 86 and 100 years. Although most of these persons belonged to the well-to-do classes, and were not obliged to restrict themselves, there were not more than six amongst them who had more or less habitually indulged themselves by eating or drinking largely; many, on the contrary, were remarkable for great moderation in both eating and drinking; some lived almost entirely on vegetables and fruit in large quantities, with the addition of milk, cheese, butter, and occasionally eggs, and only exceptionally took meat, fish and poultry; the remainder had been judicious and moderate, as well with regard to diet as with regard to their entire manner of living.

Vegetarians, strict as well as modified, can attain long life and can perform the same amount of work as meat eaters and mixed food eaters; but I have not been able to convince myself that in the great majority of fairly healthy people a moderate amount of meat, fish, poultry and game causes any bad effects. At the same time I must again state my

conviction, based on ample experience, that most people enjoy better health and live longer with only little meat and flesh food, and the substitution for the reduced meat allowance of a larger quantity of green vegetables, to which milk and milk products, and sometimes eggs, may be added with advantage. It is especially in advanced age and in persons suffering from gout, chronic rheumatism, arterio-sclerosis and diseases of liver and kidneys that meat ought to be taken very sparingly. Not only in graver diseases, but also in some minor complaints, meat, including poultry and also fish, in large and even in moderate quantity is not well borne. There are some people who cannot bear meat, and others on whom fish exercises an injurious influence. I have often succeeded in curing eczema, acne, roughness and scaliness of the skin, and fœtor of breath, by total abstinence during months and years from flesh and fish, and the substitution of vegetables, especially green vegetables, milk and cheese with moderation, and occasionally eggs. Often this diet led also to great improvement of the complexion. Excessive eating, we may remark, occurs also amongst vegetarians, especially those who consume large quantities of pulses, and it

produces similarly injurious effects as excess in meat eaters.

Dr. A. Haig [48 and 49] gives judicious instructions about diet, but the very strict rules laid down by him, entirely excluding meat, tea and coffee, although well suited for some, are certainly *not necessary* for *all* persons, even not for the majority, and we may add that we have seen a number of persons who, after having conscientiously tried Dr. Haig's restricted diet for many months, considered themselves obliged to return to a moderate addition of flesh food, on account of loss of strength and weight, although possibly, if they had been able to overcome their dislike to milk and its derivate articles of food, they might have better succeeded. To this question, as to so many others, Goethe's words are specially adapted :—

> "Eines ziemt sich nicht für Alle,
> Suche Jeder wie er's treibe."
>
> ("One plan does not suit all,
> Each must try how he fares best.")

Or better :—

> "What is fit for A is not fit for B ;
> Let everyone to his own course see."

A very strict adherence to stringent rules

of diet is not necessary to every healthy person ; it might even cause a species of hypochondriasis. A healthy man has arrangements in his body which allow him great latitude in dietetic and hygienic matters, without causing harm. The powers of adaptation and compensation are in strong constitutions very great. What is desirable is the acquisition of a habit of living adapted to the individual, which may be acted upon without constantly asking oneself, "Will this do me good or harm?" Even persons with very delicate digestion can acquire this habit.

Many persons assert that the teeth and the digestive tract of man point to his requiring a large share of flesh food in his diet. This is by no means in accordance with *fact ;* the teeth, jaws and intestines resemble much more those of herbivora than those of carnivora. They are similar to those of monkeys, which thrive better on vegetable than on flesh diet. It is well known that some monkeys, which never have taken any meat possess great strength, for instance, the orang-utan and the gorilla, whose teeth and intestinal organs closely resemble those of man. From this alone we might infer that meat is not necessary for strength

in the human being, and experiment proves the correctness of this inference; but we see no reason to say more than "not necessary."

If we examine the longevity of animals we find some herbivora very long lived, like the elephant and the parrot, others short lived, like the hare and the monkey; some flesh feeders, like the hawk and the eagle, are rather long lived, others, like the fox, short lived. We can therefore draw no inference from this comparison with man.

Those who maintain that a large quantity of flesh flood is necessary for average mental and physical vigour are more wrong than those who forbid it entirely. I have had intimate acquaintance with some men and women after the middle of life enjoying good health with a very fair amount of mental and bodily strength and activity, who took only green vegetables, carbohydrates, milk and cheese, all in moderate quantity, and who lived to a happy old age. They were in reality more or less strict vegetarians—belonged, in fact, to the minority of which I have just spoken. They took, however, also a certain quantity, not immoderate, of tea and coffee without any inconvenience. Excess of food, on the other hand, especially

of food rich in proteids, causes, as Sir W. H. Allchin justly says [5], often lassitude, want of energy, headache, constipation, skin affections and feebleness of the heart. I have no accurate experience of how little is required to maintain vigorous health. Several physiologists have ascertained this by experiments and calculation. I may refer to Voit, Playfair, and to the more recent researches by Horace Fletcher [40], Chittenden [23], and to the contribution on "Dietetics," by Sir Dyce Duckworth and Dr. Hutchison, in the "System of Medicine" [31]. Fletcher and Chittenden conclusively show that the health and strength of adults can be maintained by a much smaller amount of food than has been assumed by Voit, Playfair, and other authorities. There are very few adults who take too little food, but children are not rarely underfed, even in the well-to-do classes of society.

I venture to record here two cases which, although they are not accurate enough for scientific value, give a fair idea of the small quantity of food required for the maintenance of perfect health :—

L. T., aged 61, consulted me first in November, 1872, on account of attacks of gout and hæmor-

rhoids. His father died of apoplexy, aged 66; mother of cancer at 68. He was himself a powerful man, 6 ft. 1 in. in height, weighing 13 st. 5 lb. He was a country gentleman with literary tastes; took much meat and little exercise and slept about ten hours a day. He suffered from frequent attacks of gout, constipation, hæmorrhoids and dyspepsia.

Advice: Daily breathing exercises, daily walks of two or three hours. Less meat, more green vegetables, restriction of alcoholic stimulants to 1 oz. of whisky, 4 oz. of Friedrichshall bitter water three times a week for two months. To sleep not over seven hours.

In the course of a year the weight diminished by 12 lb., and he was altogether better; but he had had several attacks of gout. He then left off butcher's meat entirely, and alcoholic beverages almost so. In May, 1874, he was further improved; but he was not satisfied with the gain, as he felt sometimes heavy, sleepy, unfit for mental work, and we settled on the following diet (for twenty-four hours):—

4 oz. fish or poultry,
1 pint milk,
2 oz. butter,
8 oz. brown bread,
6 oz. potatoes,
12 oz. green vegetables,
2 or 3 apples,
1 oz. whisky.[1]

On this diet, to which he kept very strictly, and

[1] The whisky was left off in August, 1874.

which was carefully superintended by his intelligent local doctor, the attacks of gout disappeared entirely, and he kept perfectly well until 1880, when he became mentally depressed by the death of his only brother from apoplexy (aged 67) and a sister from pneumonia (aged 65). After travelling for some months he regained his cheerfulness and remained well till the autumn of 1890, when chronic bronchitis developed itself. He could not be induced to go to a warmer climate, and died in December, in his eightieth year.

F. W., aged 49, came under my observation in March, 1871. His family history was not good: father had died, aged 65, from "dropsy"; mother, aged 61, likewise from "dropsy." Of three brothers, two were gouty, one had died from phthisis. He led an active life in the country—fishing, shooting and rowing. He had during the last five years rather frequent attacks of old-fashioned "podagra." He took a large quantity of animal food, and about 1 pint of port or sherry or champagne daily. Height, 5 ft. 5 in.; weight, 11 st. 5 lb.; red face, large stomach—a condition which some German physicians call "alimentary plethora." The urine contained traces of albumin and large amounts of uric acid and urates, with medium specific gravity. After a course of treatment at Carlsbad the albumin disappeared, the stomach became natural, and he felt well; but later on the attacks of gout returned, and in 1874 he consented to the following plan of diet, which his doctor in the country carefully superintended, weighing the food at intervals. Ration of food for twenty-four hours :—

3 oz. meat, or fish or poultry,
6 oz. potatoes,
16 oz. green vegetables,
16 oz. milk,
6 oz. brown bread,
1 oz. butter,
2 small cups of weak tea,
Half a bottle of Zeltinger (Moselle).

This diet he adhered to with only rare intervals, and whenever he took a larger quantity he began to feel less well. He became free from gout, took regular breathing exercises, much open-air exercise, besides some work in his parish and county. After his seventieth year he further diminished the quantity of food and left off wine; he died at the age of 81 in his sleep. Both his brothers died before they were 67, from "gouty complaints," after protracted illness.

In these two men, to which I could add many others, we may assume that their health was much improved and their lives were prolonged by the change of diet from abundance to great moderation. In neither case was the family history good, and both outlived all their near relations by many years. We also see that much less food is required for maintaining health and vigour than is taken by at least nine persons out of ten. It is very probable that the food taken by these two men might have been

further reduced if it had been necessary; but as they enjoyed perfect health and strength, there was no necessity for trying an experiment. It is scarcely necessary to add that I do not ascribe the prolongation of life in these cases to the reduction of food alone, but that I attribute also a share to the breathing and other exercises.

Almost all authorities are agreed on the subject that in old age the amount of food ought to be very *limited;* Dr. George Cheyne, for instance, says in one of his rules: "The aged should lessen the quantity and lower the quality of their food *gradually* as they grow older—even before a manifest decay of appetite forces them to it" [22]. Sir Henry Thompson says: "Less nutriment must be taken in proportion as age advances, or rather as activity diminishes, or the individual will suffer" [122]. With advancing years the tendency to arterio-sclerosis and other degenerations of the small blood-vessels frequently shows itself. One of the prominent signs is increased blood-pressure, to which Sir Clifford Allbutt has recently directed attention [1, 2, 3]. This symptom, combined with others, ought to be a warning that the amount of food and alcohol ought to be reduced, sometimes even restricted to milk and

vegetables. If the disease is in an advanced state, the benefit can only be limited. *Prevention* is the great point, and the most powerful means are great moderation, especially in flesh food and food rich in purin, in tobacco and in stimulants, and this combined with a certain amount of physical exercise adapted to the physical condition (p. 33 ff.). We must bear in mind that the metabolism in old age is much diminished, and that the cells have only a limited power of assimilating and decomposing nutrient materials (von Noorden, Ebstein, &c.).

Erroneous ideas are often entertained by the public with regard to the external appearance and the weight of the body. Many old persons are alarmed by their becoming thinner, and to avoid this think they must eat more; but this is mostly quite wrong. In the majority of cases increase of weight after 70 or 75 is not good, and corpulence where it occurs is to be counteracted by the quantity and quality of the food, exercise and other means. A slow decrease in weight is mostly observed in those who reach a very advanced age. *Corpora sicca durant* was a true saying already in antiquity.

Inseparable from food is the *common salt* (chloride of sodium), which the majority of people consume with many articles of food.

Almost all foodstuffs contain certain quantities of common salt as well as of other salts (of potassium, calcium, magnesium and iron) which form part of the animal body, and only few articles, especially vegetables, require an addition of salt. The addition of a small quantity is, however, not injurious, and is, to some persons at all events, useful, since it renders some food substances more palatable to them, which is an important point; but the addition of large quantities of salt, which is a matter of habit with many people, cannot be recommended. It may be quite harmless to some persons, but to some it is injurious, especially to the gouty. In most persons suffering from eczema or a tendency to it, this is increased by the use of much salt; the substitution of chloride of potassium for chloride of sodium is advisable in such cases. Large quantities of salt are said to increase the blood-pressure and to assist, therefore, the development of arterio-sclerosis. Some observers, however, have lately denied the increase of blood-pressure by salt. The suspicion that the use of common salt may predispose to cancer is entirely without proof.

The *drinking water* deserves more consideration than it usually receives. Water may be regarded as a nutriment, it forms a large part

of the human organism, and a certain quantity is absolutely necessary for the various processes of nutrition, metabolism and excretion. The amount required for an average person under ordinary circumstances is about 4 pints in the twenty-four hours, but a great part of this is not taken in the shape of drinking water, but is contained in the various articles of fluid and solid food, meat, vegetables, milk, tea, coffee, and accessories. We cannot enter upon this subject thoroughly, but may say that the water ought to be almost free from organic matter, and to contain only a small quantity of inorganic matter, say not more than about $\frac{1}{4}$ grain of lime and 1 grain of common salt, and not much carbonic acid. The fear that soft water or rain-water, free from impurities, is injurious is quite unfounded ; but hard water, especially when it contains much sulphate of lime, causes in some persons constipation, and in some urinary concretions, possibly also gall-stones. Some authorities think that chalky water may cause calcification of small arteries, but this is not proved. The water arising from granite and gneiss agrees best with most persons.

The *sparkling waters*, often called *table waters*, so much in favour at present, are to

the majority of persons unnecessary. The term table waters in itself points to a kind of misuse, in so far as it indicates that they are to be taken at meals, while much fluid of any kind taken during the principal meals is unadvisable, since it interferes with the digestion; and sparkling waters, in addition, cause, by development of gas, distension of the stomach, and through this, disturbance of the action of the heart in many persons. They are better borne, and to some persons beneficial, on an empty stomach or between meals. When the ordinary water is pure, it is to the majority preferable to sparkling waters; but when its purity is doubtful, as is often the case while travelling, natural sparkling waters form a good substitute, although, by taking the ordinary water filtered and boiled the dangers of its impurities are minimized. Filtering alone is mostly unsafe.

It is not only the quality and quantity of food which we take, but also the manner in which it is taken, on which health depends. Food ought not to be taken when the mind or body is exhausted by overwork; rest ought to precede the meal under such conditions; further, if possible, food ought not to be taken while the

mind is in a state of anger or violent excitement.

All-important is *thorough mastication*, a subject constantly preached, but almost as constantly neglected. Many forms of indigestion and of serious disease of the stomach and intestines, many states of imperfect nutrition of the whole body, are caused by imperfect mastication and by what is called *bolting the food*. Quite lately Dr. Harry Campbell [18], Dr. van Someren, of Venice [126], Mr. Horace Fletcher [40], and others have again directed attention to this matter in a judicious and forcible manner. Sir Lauder Brunton [15] justly points out the possibility that imperfect mastication may be a cause of cancer of the stomach through the irritation of the mucous membrane by hard particles of insufficiently masticated food. Combined with the fault of bolting is often that of *washing down* the food before it is properly masticated, a grave mistake committed frequently by large eaters and by those who take much fluid during the meals, which in itself is a very injurious habit. No food ought to be swallowed before it has been transformed by mastication and admixture of saliva into a thin pap. Many articles of food, especially those containing starch, are imperfectly digested unless they have been

thoroughly mixed in the mouth with saliva, by which the starch is transformed into dextrin. Even fluid food, such as porridge, gruel, soups, coffee, tea, and chocolate, ought not to be gulped down rapidly, but ought to be taken slowly, so as to allow them to be mixed with saliva.

Amongst the great benefits of thorough mastication is the diminution of the formation of gas in the stomach and intestines (flatulency) and, further, the prevention or great limitation of putrid fermentation of the food in the intestines, which latter is connected with the development of ptomaines and pathogenic microbes.

Another effect of mastication is that less food is required, because more of the quantity taken in is absorbed, and for the same reason the bulk of fæcal matter is diminished, and the evacuations may become less frequent without the disadvantages of retention.

As proper mastication is one of the most powerful and beneficial means of maintaining health, it is self-evident that the organs of mastication, *especially the teeth* and the jaws, ought to be carefully attended to from early life to old age. Important in this respect is the selection of food for children. Many parents and nurses think it necessary to give children up

to 3 or 4 and even 5 years of age only fluid or semifluid food, such as milk, milk puddings, porridge, bread-crumbs with gravy, minced meats, by which the organs of mastication—muscles, jaws with their alveolar processes, and teeth—are not sufficiently exercised. Children above 15 or 18 months old ought to have in addition to these articles of food dry crusts, dry biscuits, bread not soaked in milk, but eaten separately. We must leave this subject to dentists, but we must insist on the importance of instruction on the management of the teeth in children as well as adults, and the use of good artificial teeth after the loss of the natural teeth wherever they can be afforded. This, we hope, will be facilitated by the manufacture of cheaper artificial teeth.

It would lead too far to enter here on the *cooking of food* by roasting, boiling, baking, frying, stewing, and other processes, although this is an important matter. I must, however, allude to one or two points which are frequently ignored. It has been shown by experiments that some kinds of food become by cooking more, others less, digestible. The amylaceous vegetables, such as potatoes, rice, maize, corn, gain in digestibility by cooking, since through

it the cellulose coating, in which the starch granules are enclosed, is burst, and the granules thus become exposed to the digestive ferment (ptyalin). All the vegetables rich in cellulose are rendered more digestible by the process of cooking. Many, however, lose some of their salts and soluble substances, which pass into the water in which they are boiled. Stewing is therefore preferable to ordinary boiling, whenever it is desirable to retain all the constituents of the vegetables. Most animal foods, on the other hand, are somewhat impaired in their nourishing value by cooking, as heat approaching the boiling point coagulates the proteids and renders the fibres of meat harder and less digestible. As, however, most people feel great repugnance against raw flesh, and as, besides, raw meat contains sometimes injurious parasites, we must endeavour to use methods of cooking by which the taste of rawness and the danger of parasites are removed, while the fibres retain their tenderness and the flavour is not destroyed. This is attained by exposing meat and poultry only for a few minutes to a temperature of 100° C. (212° F.) or more, and thus produce a kind of crust which prevents the loss of juice from the interior, and then continue

the cooking process at a lower temperature—not exceeding 180° F.—for a longer period. Altogether the process of long cooking at a low temperature renders the flesh tender and preserves the natural flavour. This object can also be obtained by the process of roasting and also by that of *stewing*, which has the great advantage of rendering the fibre very tender and preserving all the salts and other ingredients, if the stewed meat is taken together with the juice. The process of ordinary boiling is less to be recommended, because a great portion of the salts and extractive matters passes into the water in which the meat is boiled, unless the boiling is done very carefully as just stated. For gouty persons, however, to whom the extractive matters of meat are injurious, tender boiled meat is preferable to roast.

Salt beef, which is a favourite article of food with many people, cannot be recommended; it contains too large a quantity of common salt while it is deprived of most of its original salts important for the organism (potash), and the fibres are less tender than in stewed meat. The frequent occurrence of scurvy amongst sailors on long sea voyages in former years was probably due to the large proportion of salt meat in their diet

without the addition of vegetable substances rich in potash and vegetable acids.

It is necessary to render the food not only as *easily digestible* but also as *palatable* as possible, since the act of eating ought not to be a mere duty, but also a source of pleasure. The enjoyment of food causes an increased flow of saliva and gastric juices, and thus greatly assists the digestion. Delicate persons with poor appetites and convalescents from acute diseases ought to be indulged with articles of food which they like and which are cooked according to their taste as far as the condition of their digestive organs allows this to be done.

In urging the necessity of careful preparation and palatableness of food for delicate persons, we must, however, not fall into the other extreme, against which Metchnikoff justly protests: "I shall content myself with saying that most of the delicate dishes provided in the homes, hotels, and restaurants of the rich stimulate the organs of digestion and secretion in a harmful way. It would be true progress to abandon cuisine, and to go back to the simple dishes of our ancestors" [76].

For most persons, excepting the strongest, it is desirable that they should avoid exertion of

mind and body before, during, and soon after the principal meals, so that the stomach should receive as well the blood as the nerve power necessary for the digestive processes.

Quantity of Food.—The public often ask for strict rules about the quantity and quality of food. It is, as already mentioned, impossible to give such in a satisfactory way for people in general, since there are great differences in the requirement of different persons according to constitution, age, height, size and weight of body, physical and mental exercise, proportion of muscle to fat and bone, meteorological surroundings, climate, season, and other matters.

It must also be taken into consideration whether the food is taken in a finely divided or in a coarsely divided state. We may, for instance, mention that lentils or dried peas, or barley or rice, when cooked entire are not so thoroughly taken up from the intestines as when finely ground, that a larger portion of the former passes away with the fæces than of the latter.

Rules can only be good when they are adapted to the individual case under given circumstances. Much has been written about the exact quantity of food required under different circumstances. There is a great difference in the views of

Voit and the older authorities and more recent observers (Chittenden, Fletcher, &c.).

We will, however, mention a rough estimation of the daily rations which we have found satisfactory by prolonged observation and experiments made fifty-eight years ago on six men in good health, between 22 and 35 years of age, 5 ft. 7 in. to 5 ft. 9 in. in height, weighing between 140 lb. and 156 lb. These men did every day mental work between six and eight hours, and walked between 4 to 6 English miles. They carried out this way of living during three to six months, with intervals of several days every three or four weeks. They maintained perfect health during the period of experiment, and did not vary more than 1 to 2 kilos, or 2 lb. to 4 lb., in weight from the beginning to the end. They were medical students and young doctors at Bonn.

The rations consisted of about :—

Milk, 30 oz.

Cooked meat, 6 to 8 oz.

Cooked green vegetables and fruit, 16 oz.

Bread, 16 oz.

Potatoes, 6 oz.

Butter, 1 to 2 oz.

Water, about 50 oz.

The water was consumed partly as pure water, partly as coffee, tea, wine or beer (rather less than a pint of either, not of both).

In this list eggs, fish, poultry, game and cheese may be substituted for butcher's meat, taking into consideration that 1 oz. of cheese contains about three times as much nitrogenous substance as the same weight of cooked meat. Lentils, white beans, dry peas, mushrooms, and even asparagus must only be sparingly contained in the allowance of vegetables, since they contain a very much larger amount of proteids and also purin bodies ; none was consumed by the six experimenters. Farinaceous puddings may take the place of bread or potatoes.

Further experience has shown me that the rations mentioned are *more than sufficient* for healthy adults in the middle ages of life, of average weight, doing a moderate amount of physical or mental work. Thus, for instance, I have suggested to many adults, men as well as women, a daily diet consisting of about $1\frac{1}{2}$ to 2 pints of milk, 2 to 4 oz. of meat, or, instead of meat, 1 to 2 oz. of cheese, 10 to 15 oz. of bread, 10 to 16 oz. of green vegetables, 4 oz. of potatoes, or 1 oz. of rice, 6 to 8 oz.

of fruit, ½ pint to 1 pint of weak tea, or coffee, or cocoa. Almost all felt perfectly well with this diet, and were able to do much work, mental and physical. Some took as a change instead of tea, or coffee, or occasionally in addition to it, half a pint of light wine or beer. Some, who were too stout, lost at first 5 to 10 lb. and even more, but when they had descended to their normal weight, they scarcely changed afterwards. Others, who were too thin, gained weight and then kept to it.

There are, however, morbid conditions, such as tuberculosis, in which a larger amount of food is required, especially of milk, butter and meat; and others suffering from neurasthenia or having an abnormally low blood-pressure ought not to be debarred from roast meats, meat extracts, gravies, &c., which act in them as cardiac stimulants. During the period of growth and development girls as well as boys, occupied with lessons and active games, or other forms of physical exercise, require more food for the same weight than adults. On the other hand, persons approaching the period of old age, say from 45 or 50 to 70 years of age, ought to be satisfied with barely three-quarters of the rations mentioned, and

after 70 with still less. We can speak, however, only of a rule which allows many exceptions, due either to peculiarities of constitution, or to habit, or to special occupation, or to increased or diminished physical or mental exercise. Thus, for instance, soldiers or labourers on fatigue duty or extra work require more than the average; even old men doing an unusual amount of labour are through this enabled to consume more than those at only ordinary work. On the other side, persons doing comparatively little work require for the same body-weight rather less than the more active ones.

It is often said that persons doing a large amount of brain-work require a large amount of food and stimulants; but careful observation does not prove this to be the case. I have known many hard brain-workers who did their work best when they ate and drank very little. Dr. Keith, in his "Plea for a Simpler Life" [64], mentions that Sir Isaac Newton, Napoleon, and Wellington took scarcely any food while they were engaged in great problems. Several of my own friends occupied during long periods in arduous literary work took during such periods much less food than at periods of

leisure, since they had found that they worked much better with little than with much food.

The proportion of the different kinds of food ought to be arranged according to the peculiarities of the body. Persons with a large mass of muscle have a greater waste of nitrogenous matter than persons with small muscles; the former require a larger amount of nitrogenous food than the latter in order to maintain the equilibrium. The degree of activity of the nervous system has likewise to be taken into account in determining the amount of food required, and still more so the habitual energy of breathing, in which different persons greatly differ. The shape of the body, too, has to be considered, for a long and thin body loses for the same weight more heat than a round and fat one. The amount and nature of clothing exercises likewise influence on the amount of heat lost by the body. In cold climates and cold weather more food is, by most men, required, especially of fat and carbohydrates, than in warm climates and warm weather; also the manner in which the food is taken influences the amount required. If the food is thoroughly masticated and insalivated, as already said, a lesser amount is required than if the food is swallowed without proper mastication.

The distribution of the food consumed during twenty-four hours can be varied considerably according to constitution, state of health, occupation, social custom and personal habits. Some strong persons can take all their food at one meal, others require only two, but the majority feel best with three, and some do not feel well with less than five ; the latter is especially the case during convalescence from acute disease and in neurasthenics and weakly subjects. Every physician, however, who has occupied himself much with derangements of the digestion and assimilation, has met with many cases where the reduction of meals from four or five to two has effected a complete cure without any medicine, either only breakfast and dinner or lunch and dinner according to circumstances. Too many meals interfere in some persons with the secretion of the digestive juices and lead occasionally to a kind of semi-starvation. For the majority of persons it is best to take the two principal meals without, or with very little, fluid, and to take a tumblerful of water, hot or cold according to circumstances, an hour before or after meals, or only night and morning. Some persons maintain that there ought to be no regular hours for meals, but that food

ought only to be taken when there is a feeling of hunger. This may be satisfactory for independent people who live alone or need only think of themselves, but those occupied in offices or manufactories, in the Navy or Army, or in schools, or who live in families, must take their meals according to convenience, at more or less fixed times.

Alcohol. — On the much-debated and all-important question of *alcohol*, I will try to be as short as possible. It cannot be denied that alcohol causes to many people transitory enjoyment, by its taste and local stimulation in the cavity of the mouth, and by its exhilarating effect ; but it is nevertheless true, as Sir Frederick Treves [124] says, that it is a poison which ought to be avoided by everybody, excepting in the smallest quantities ; there can be no doubt that total abstinence from alcoholic beverages would greatly promote the health of the human race. *Alcohol is not necessary* to healthy persons, and most of them would be better without it. Many diseases of the liver, the kidneys, the brain, the blood-vessels (arterio-sclerosis) and other organs are, no doubt, produced by the abuse of alcohol ; many promising lives are destroyed by it ; it is the most frequent cause

of *crime* and of the ruin, not only of the drinkers themselves, but of their families and their progeny. It is, as Lord Brougham said, "the mother of want and the nurse of crime"; it is the greatest of all preventable evils affecting the public health. A large percentage of epileptics, imbeciles, idiots, criminals, persons suffering from weak and early loss of memory and other mental deficiencies, melancholia, &c., is the progeny of intemperate persons. The mind is perverted by it, the love of home and family and the sense of veracity and morality are destroyed. The great and early mortality amongst public-house keepers is well known, and is so general amongst all those who are engaged in the liquor traffic that insurance offices either decline their lives, or take them only exceptionally, and then only at very high premiums. The records of insurance offices further show that the lives of total abstainers are longer than those of non-abstainers. Quite recently Sir T. P. Whitaker [138], in a carefully arranged paper read before the Life Assurance Medical Officers' Association (on January 6, 1904), has shown that, other things being equal, "the abstainers from alcoholic beverages have a much lower mortality than the

non-abstainers and the general average lives including abstainers and non-abstainers." It is important to notice that in this statement the term "non-abstainers" includes only moderate drinkers, for the intemperate are altogether excluded from life assurance. Sir T. P. Whitaker is fully entitled to the inference that abstinence from alcoholic beverages is conducive to health and longevity. The tendency to dipsomania, to alcoholism in general, and to all its painful effects on mind and body is distinctly inheritable, and the descendants of inebriate parents ought, therefore, entirely to abstain from alcoholic stimulants. Many people assert that alcohol assists the digestion; but this is the case only in exceptional instances, and even in these, better means of cure, dietetic, hygienic, and pharmaceutical, can be substituted, without the danger of acquiring the habit of taking larger instead of the originally recommended small quantities.

Alcohol is also regarded by some men of science as a valuable article of food, as an economiser of albuminous substances, but in truth it possesses this virtue only in a very small degree, and the injurious effects infinitely outweigh this slight and exceptional advantage. Alcohol has

further been praised as a producer of warmth; but its warming effect is only transitory and is followed by the opposite, even by death on long, cold journeys.

The regular use of alcoholic stimulants by *young persons* is especially dangerous, and ought to be counteracted at school as well as at home, since it stunts complete development and leads often to the habit of taking in adult life more than is conducive to happiness and a healthy old age, and in not a few to excessive drinking and to all its deleterious effects on mind and morals.

Alcohol, like other poisons, can be used as a *medicine* temporarily in various states of exhaustion; on this point I cannot fully enter at present, but I must state that it has been greatly abused in the last century, and that even now it is often too indiscriminately and too loosely recommended. Above all things the exact quantity ought to be mentioned, the times when it is to be taken and how long it is to be continued, for otherwise the inclination to take too much and to continue it for many months and years may be fostered and the habit of drinking to excess may be created. At the and of exhausting diseases, such as severe enteric

fever, influenza, bronchitis, &c., when the nutrition of the heart has been much impaired, the pulse has become very rapid and weak, small doses of alcoholic stimulants frequently repeated are sometimes necessary and most beneficial, but such cases form the exception, not the rule ; and the allowance of alcoholic stimulants must be withdrawn as soon as the necessity ceases. It may here also be pointed out that the arrangement which still exists in some hospitals, convalescent homes, and sanatoria, to give a certain amount of alcoholic stimulants as part of the daily diet, is reprehensible, and that the use of alcohol in such institutions ought to be restricted to those for whom it is really necessary.

It is the habit with some persons of judging the influence of alcoholic stimulants on the constitution merely by the amount of alcohol which they contain. This, however, is not correct. The other constituents of these beverages ought likewise to be taken into consideration. The fermentation of the malt and sugar by which the alcohol is produced is in many liquids combined with the production of other substances. The so-called "spirits" of which brandy, whisky and gin are the ordinary types,

most nearly approach in their influence on the body that of pure diluted alcohol; but they also contain various by-products of fermentation, and occasionally other additions which produce special effects. They are almost free from acidity and are through this more easily borne by many persons than wines; but it is important that they should be well seasoned, and recommended only with the safeguard, previously mentioned [p. 113]. The different kinds of *wine* contain, in addition to alcohol, varying quantities of sugar, vegetable acids, ethers, essential oils, extractives, mineral matters, carbonic acids, &c., on which the effects of wine on the organism depend. It is impossible to enter adequately on this large subject. Alcoholic fluids containing a considerable amount of sugar, dextrin, hop extract, albuminous matter, salts, vegetable acids, and free carbonic acid and other substances, such as the different kinds of beer, have not the same effects on the digestive organs, the nervous system and the organs of circulation as fluids which are more or less pure, more or less diluted solutions of alcohol, such as those just mentioned. *Beer*, owing partly to the purin bodies which it contains (Walker-Hall [127]), disposes persons who take it regularly

to rheumatic and gouty complaints, and by the saccharine substances to stoutness and the disadvantages and dangers attending it. The difference in the composition of different kinds of beer and in their action on the body is considerable.

Professor Baeumler [9] further directs attention to the fact that persons consuming large quantities of beer mechanically overtax their blood-vessels by keeping them in a state of distension, which gradually leads to disease of the small arteries and later on also of the heart, the work of which becomes additionally more and more increased by the morbid state of the blood-vessels. My own experience amply corroborates Baeumler's view. Between 1850 and 1870 many young Germans engaged in the sugar-baking trade in the East End of London, came to the German Hospital suffering from various diseases, due partly to the excessive heat to which they were exposed from morning till night, partly and even more commonly so to the almost incredible amount of small beer (eight to twelve gallons per day) which they took to quench their thirst; dilatation of the heart and hydræmia very frequently occurred, and in one man, scarcely 30 years of age,

extensive atheroma of arteries, especially those of the brain. Ebstein in his excellent treatise on the prolongation of life [33] likewise points out the injuriousness of excessive beer-drinking.

Sometimes we succeed in combating the alcoholic habit by substituting for the usual alcoholic stimulants non-alcoholic beverages, such as non-alcoholic beer, lemonade, ginger beer, soda water, effervescing mineral waters, non-alcoholic grape juice, other fruit juices and fruit syrups with water. The rough cider, too, though not quite free from alcohol, may be taken by many persons in fair health, in limited quantities, without harm.

In some men I have been able to diminish the craving for alcoholic stimulants by greatly reducing flesh foods, especially salt foods and salt itself; in others by abstinence from tobacco. Again, in others by inducing them to take no fluid at all at meals, but to wait till an hour after meals, when they were less inclined to drink, sometimes forgot it altogether and gradually lost the habit of regularly taking stimulants.

A very prevalent idea with regard to alcohol is that it is most useful to *aged people*, in fact, that "wine is the milk of old people," that it does for them what milk does for children.

This doctrine is not in harmony with careful observation and is dangerous, in so far as it induces some old people to take alcohol in rather large quantities with injurious effects; almost all old people who have been accustomed in their younger days to much wine, and have taken it without apparent harm, find out for themselves that they cannot any longer take the same quantity without suffering for it.

Alcohol habitually taken in any large quantity injures, in most persons, the arteries and capillaries, the brain cells and nerve-fibres. It is well known that alcohol interferes with the cell-growth, especially in the liver, and partly through this, deteriorates the metabolism and the transformation of the purin bodies into urea. It diminishes the resisting power of the organism against chills, microbes and other causes of disease, and this resisting power is one of the great agents in the prolongation of life, and ought to be strengthened in every possible way, not weakened as it is by alcohol. We hear often that alcohol is not injurious if taken only in *moderation*, but it is the interpretation of this term which is fraught with so much danger. Many persons consider themselves moderate, if they never become drunk; some take five or

six glasses of sherry or port in the twenty-four hours, or two to three pints of beer, or three or four glasses of brandy or whisky, and consider themselves moderate. This is a very dangerous kind of moderation to the majority of people. An occasional, but rare, inebriation with intermediate abstemiousnsss is much less injurious than the regular use of the amount of stimulants just mentioned. Most persons who take more alcohol than is compatible with their health do not feel any disadvantage from it for months and even years, and often not till actual changes in the heart and blood-vessels, or in the nervous system, have been produced. *The slow and insidious manner in which the regular drinking of so-called moderate, but in reality immoderate, quantities acts, is one of the causes of the frequency and danger of this error.* The fourth part of the quantity mentioned above is what we could call moderation, permissible to the majority of persons. It is a common fallacy to think that alcohol by its action on the brain enables the mind to work more quickly, and the body to undergo greater fatigue. Sir Victor Horsley [56] has forcibly shown that there is no foundation whatever for this view, and refers to Professor Kraepelin's scientific experiments,

proving that alcohol even in small quantities interferes with the highest functions of the brain, that it abrogates the controlling power of the brain and cerebellum. The increased action of the brain which is produced in some persons by alcohol is only of very short duration, and is rapidly followed by impaired and deranged action. Another fallacy is that alcohol enables man to undertake a larger amount of physical work. I have repeatedly asked a number of men engaged in physical labour, and from an overwhelming majority of intelligent labourers I have received the answer that they can do more and better work without than with alcohol. I have received a similar answer from great wrestlers, quite in accordance with Dr. Mehler's researches on this subject [74], and in my long continued intercourse with Alpine climbers, the experience, with scarcely any exception was, that alcohol did not increase, but impaired their power of climbing; and almost all my companions in the Alps gave up the use of wine and stimulants altogether, excepting in the smallest quantities, and this only after the day's work. I have stated above the quantity which may be considered as moderate, and which has a beneficial action on some old people in certain

morbid affections, for instance, chronic bronchitis, as Dr. Savill [109] found in the aged inmates of a workhouse infirmary. Here, again, habit is to be consulted, and old persons accustomed for many years to a certain, originally unnecessary, amount of alcohol ought not to be deprived of it all at once, but only by degrees. For a careful consideration of the question of alcohol I refer to the chapter on stimulants in Sir Lauder Brunton's volume on "Disorders of Assimilation," &c. [14].

It is well known that alcohol exercises on some persons a much more injurious action than on others. It would lead too far to enter fully into this subject; but I must allude to its connection with neurotic affections, especially epilepsy, dipsomania and neurasthenia. Alcohol is frequently the cause of epilepsy, and it greatly aggravates the disease when it already exists; it ought to be entirely abstained from by persons affected with, or hereditarily disposed to this disease. The same is the case with dipsomania, which is in many cases of epileptic nature. The connection of alcohol with neurasthenia is more complicated; in the majority of cases of neurasthenia in which I have observed it combined with abuse of

alcohol, other injurious influences were present besides alcohol, especially excessive smoking, continued mental worry and mental over-exertion, particularly when of an unsuccessful nature. Persons under the influence of worry, or unsuccessful work, often endeavour to remove their depression by alcoholic stimulants, which for the moment drown the sense of trouble and have an exhilarating effect, but are mostly followed next day by greater depression, the feeling of hopelessness, and diminished power of working. Stimulants ought never to be resorted to under such circumstances ; change of place and temporary cessation of work, if they are possible, and especially open-air exercise, are infinitely more promising, while alcohol ought to be entirely, or almost entirely, avoided.

Persons with small amounts of albumin in the urine, combined with signs of arteriosclerosis, can mostly by great restriction in alcohol and meat prolong their lives considerably. I have had under my observation many such persons for ten and twenty years and more who enjoyed almost perfect health while they lived entirely on milk, vegetables, bread, light puddings and fruit. The majority of them, however, are disinclined to do so, and

are inclined to misinterpret the advice of their doctors, if not given precisely, in favour of their own inclinations. It has repeatedly occurred to me, that when I told such persons that great restriction was necessary, they answered that Doctor X. considered such restriction quite unnecessary, that he said they were perfectly safe with only "a few glasses" of wine at lunch and dinner, and a moderate quantity of meat. They felt perfect security after this advice, and took their "few glasses," and died within two or three years, while they might have lived much longer with abstinence from alcohol and great restriction in meat food. Their feeling of "security" always reminded me strongly of the words of Hecate in "Macbeth," which are so often applicable in life :—

> "And you all know, security
> Is mortal's greatest enemy."

Sir Isambard Owen has given a careful analysis of the results of the Collective Investigation Returns, comprising 4,284 persons, and shows that the average duration of life was greatest in the total abstainers and very moderate drinkers, and that only few hard drinkers were amongst the long-lived (*British Medical Journal*, June 23, 1888, p. 1312).

Before leaving the subject of alcohol, it may be useful again to allude to the erroneous idea entertained by many persons when giving up the use of alcohol, that they may eat as much as they like, and may drink at meals as much common water or "table waters" as they desire. This misconception is, as I have already said, fraught with great danger, leading, as it does, in many cases to obesity, in others to weakness of the heart, to degeneration of the blood-vessels (arterio-sclerosis), to dropsy, to gout, and in all to premature death; the effect is much more injurious than the moderate use of alcohol at meals.

IX.—Tea, Coffee, Cocoa.

Amongst the food accessories, *tea* is regarded by the majority of people as an agreeable, useful and harmless stimulant. When taken in moderate quantity and strength it exercises a pleasant effect on the nervous system, especially in physical or mental fatigue, and is not injurious to the majority; but in some persons, particularly amongst those affected with dyspepsia and heart weakness, it produces development of gas and through this distension of the

stomach and disturbance of the heart and the nervous system. The habit, which exists especially amongst some of the poorer classes, to take three to five meals of strong tea and this generally not infused but boiled, with inadequate food, is no doubt injurious; it causes deterioration of the digestive organs, imperfect nutrition of the heart, degeneration of the small blood-vessels, anæmia, malnutrition of the whole body, and lowering of the nervous system, as occasionally shown by trembling of the hands and arms, effects which in most persons develop themselves only slowly. The change which many people have made especially amongst the labouring classes, in substituting tea and bread or potatoes for porridge and milk has exercised injurious effects, and must be strongly condemned. I have repeatedly seen alarming symptoms in the functions of the nervous system and the heart amongst children, produced entirely by the regular use of strong tea, symptoms which disappeared in the course of a few weeks after the removal of strong tea from the diet list, in favour of milk foods. The slow and insidious action of tea renders the abuse more common. The fact that tea, especially strong tea, retards digestion, renders the habit

of taking it as part of the principal meals (*high teas*) to some people rather injurious. When, however, great authorities condemn tea entirely as a poison, and class it together with the eating of large quantities of meat or the immoderate consumption of alcoholic stimulants as a most potent producer of gout and diseases of the heart and blood-vessels, and of the nervous system, we are not prepared to accept their view, provided the consumption of it is moderate and the making of it judicious. It is true that the tea-leaves (Haig [48 and 49] and Hutchison [59]) contain a certain amount of purin (methyl-purin), but if the quantity of tea consumed during twenty-four hours does not exceed the infusion of 40 to 80 grains, and if it is not allowed to stand long, it can scarcely be regarded as a serious danger, barring a small number of exceptional persons. We have not seen much real gout amongst great tea drinkers if they were at the same time moderate with regard to meat and alcohol. Tea, Sir Wm. Roberts says, is an inhibitor of salivary digestion, probably through the tannin contained in it [103]. Black teas agree with most persons better than green teas, and good qualities of Chinese teas better than Indian teas in the same

quantity. The latter ought to be taken at all events in smaller quantities than the former, or mixed with them in the proportion of one part of Indian to two or three of Chinese. Tea ought not to be boiled, but only infused with boiling water, and the infusion ought not to stand longer than one or two to four minutes, or at the outside, five. Strong tea, especially when taken on an empty stomach, causes irritation of the mucous membrane of the stomach ; but this disadvantage is avoided by the addition of one part of milk to two or three of tea. The habit of taking a cup of tea an hour or two hours before breakfast is beneficial to persons who wake very early, or do some work before breakfast, but the tea ought to be weak and mixed with milk. Taken in this way it sustains the nervous system and aids the removal of waste products ; but a tumbler full of hot water is to many quite as beneficial or even more so, and to vigorous gouty people, cold water is preferable. Those who condemn tea do not seem to consider that many persons who take tea as a stimulant save themselves through this from the abuse of alcoholic stimulants, which is infinitely more injurious than even rather excessive tea drinking. We may further add that the Japanese

take tea four or five times a day, and certainly are not as much injured by this habit as many Europeans are by alcohol. Finally, we must not forget that the abuse of alcohol deranges the moral condition of the mind and is the most frequent cause of crime, which no one can say of tea drinking, by which at all events only the tea-drinker himself is injured and not others.

Coffee contains, in addition to caffein, which has the same properties of thein, a volatile oil developed by the process of roasting, some cellulose and extractive material (Parkes [96], Koenig [67] and Hutchison [59]). The infusion acts on most people in the same way as tea, but in some cases it causes indigestion and tendency to piles when they take it habitually, while they can take tea without harm. Many, on the other hand, of those in whom tea produces flatulence and faintness, bear coffee quite well. Coffee likewise has an inhibitory effect on stomach digestion, and strong black coffee after meals ought therefore to be avoided by dyspeptics with slow digestion. Parkes had a high opinion of the value of coffee for soldiers undergoing fatigue, and in severe Alpine climbing I have found coffee, on others as well as myself, rather more effective than tea, although the

latter is likewise very useful. This effect is due principally to the *caffein* and partly to the *volatile oil* which stimulate the brain as well as the heart. The relief of fatigue and exhaustion which is produced by coffee and tea is, however, due to some degree at all events, to the vehicle in which they are taken, viz., hot or cold water, with or without milk ; for caffein when taken alone in doses of one or several grains by my companions and myself in long mountain tours had never as strong an effect on us as a good cup of tea or coffee, especially when taken hot. The fact that hot water alone under such circumstances removes much of the sense of fatigue, shows that the fluid has a great share in the action of one or two cups of tea or coffee. It is the fluid part which clears the tissues from the *waste* products. *Kola*, had more effect than caffein alone, but not so much as hot coffee or tea.

This property, however, of enabling persons to bear extra fatigue, which tea shares with coffee, leads occasionally into danger. We have repeatedly observed that under their influence not only physical, but also, and perhaps more frequently, mental over-exertion was persisted in for weeks and months, until it led to exhaus-

tion of the nervous system, which sometimes lasted through life. Working for scholarships, for instance, and for competitive examinations, has in this way caused sometimes sad failures in life.

To the use of coffee similar objections are being made as to that of tea, with regard to uric acid and troubles connected with it. It is impossible for me properly to discuss them here; but I may say that my line of argument would be about the same as that on tea, and my advice is, likewise, moderation. The habit of German ladies of taking much coffee in the afternoon has often been mentioned as a cause of many of their troubles, though probably the rich and sweet cakes taken with the coffee have something to answer for.

Cocoa (Hutchison [59]) is different in composition and action from either tea or coffee, although theobromin is chemically almost identical with thein and caffein. The beans contain a large proportion of fat, in addition to other non-nitrogenous and nitrogenous substances. The cocoa prepared from cocoa shells and nibs is better borne by most persons than that prepared from the finely powdered kernel, which disagrees with some on account of the

large amount of fat. The ordinary chocolate is mostly mixed with much sugar, which is a disadvantage to some dyspeptics. Cocoa and chocolate are much more articles of food than tea and coffee, and have great sustaining power in fatiguing climbs and other exertions. To many persons the use of cocoa is preferable to that of strong tea and coffee provided they can digest the fat contained in cocoa, or take it prepared from cocoa nibs. As cocoa is mostly taken with much milk, it becomes a real meal. An instructive chapter on tea, coffee and cocoa is contributed to the "Book of Health," by Sir Lauder Brunton, whose views are also given in his "Disorders of Assimilation and Digestion" [14].

We are often asked whether to give the preference to tea or coffee or cocoa in daily use. It is as impossible to give a general answer, as it is with ordinary articles of food. The personal element must mostly guide us. Where tea produces flatulence, and disorders of the action of the heart, or trembling, or sleeplessness, it must either be avoided entirely or greatly restricted, and coffee or cocoa may be substituted, whichever agrees best. Many persons bear all three equally well, and can suit

their taste or convenience. The rule of moderation applies to these food accessories as much as to the ordinary articles of food. There are a few exceptional persons who cannot take either coffee or tea or cocoa, and must be satisfied at breakfast with milk or porridge or similiar dishes or water.

X.—Tobacco.

Tobacco is to many persons a means of enjoyment and is well borne by them if they take it with great moderation, for instance, only one medium-sized cigar after dinner or three to four cigarettes or one or two small pipes in the twenty-four hours; it soothes nervous irritability, and often makes men look more contentedly on their work and troubles. Some persons have an unlimited tolerance of tobacco, and seem not to be injured by immoderate smoking. On the other hand, excessive smoking is decidedly injurious to the majority of people by affecting the heart, the small blood-vessels, the digestion, the nervous system, and the throat. In many cases diminution of the amount of smoking, or taking a milder kind of tobacco, remedies the bad effects; in some, however, the use of tobacco has

to be given up entirely. Smoking with an empty stomach is more injurious than smoking after meals. Boys and girls, before they are grown up, ought not to be permitted to smoke, as it prevents perfect development. There are good observers, amongst them Professor Lazarus, of Berlin, who regard excessive smoking as one of the principal causes of arterio-sclerosis, and when we consider the effect of tobacco on the heart in some people, it appears natural that the smaller blood-vessels are likewise injuriously influenced by it. Sir Lauder Brunton states that Boveri and Rickett produced atheroma in animals by intravascular injections of nicotine. In this connection we may refer also to a paper by Dr. Michels and Dr. Parkes Weber "On Arteritis Obliterans" [79 and 130]. The patients were Russian and Roumanian Jews, between 30 and 40 years of age, who were free from other morbid complications, but had in common: (1) that they smoked every day many cigarettes; (2) that they had poor food, in quality, and probably insufficient in quantity; and (3) that they consumed a large quantity of strong tea. It is to the immoderate smoking that I am inclined to attribute the disease of the arteries, though possibly one of

the other points, viz., abuse of strong tea, may have produced a predisposition. I may add, however, that tea can probably be excluded, as Professor Israel, of Berlin, has communicated other cases of this disease occurring in Eastern Jews in the prime of life, who lived in Eastern Europe, where tea-drinking is not the custom amongst the poorer classes.

I scarcely need here mention the *smoking of opium*, since it is indulged in only quite exceptionally in Europe and America. It is generally acknowledged to be a most injurious habit which lowers the smoker physically as well as mentally and morally.

Snuff is out of fashion at present ; but to some people suffering from chronic catarrh of the nose, with insufficient secretion of mucus, a pinch, taken once or twice a day, is useful by increasing the discharge and rendering the breathing through the nose more easy, and also by maintaining to a certain degree the sense of smell ; it seems to act by its stimulation as a species of gymnastics on the capillaries of the Schneiderian membrane. Many old doctors maintained that snuff-taking was a good practice against some forms of frontal headache and blear-eyes, and this not without reason.

XI.—Action of the Bowels.

An important matter with regard to the digestive system is the *action of the bowels*. There are great differences in this respect with different persons; many only feel well if they have one or two evacuations daily, and even more, and they mostly have them without being obliged to pay any attention to the nature of their food; others have a motion only every second and even third day, without suffering in health. On the other hand, there are many persons who have great difficulty in this function; they go for three and four days and longer; some do so without feeling inconvenience, but in the majority, in course of time the health is disturbed by this habitual constipation, especially by interfering with the portal circulation, by causing piles, and by the absorption of ptomaines; auto-intoxication manifesting itself in many ways, such as headaches, drowsiness, lassitude, unfitness for mental work, some forms of neurasthenia, and of chronic anæmia. *Constipation* may also cause organic disease of the intestines; the irritation which the hard fæcal matters exercise on the mucous membrane, especially in the lower region of the bowels, from the beginning

of sigmoid flexure to the anus is, in some persons, the probable cause of cancer. A great point is to accustom the bowels to a regular action at a certain time of the day, a habit which ought to be cultivated from childhood; the morning, if possible, excepting in persons affected with piles, to whom the evacuation of the bowels at bedtime is more useful, since by rest in the recumbent position after the motion the lower part of the bowel returns to its natural position, and the hæmorrhoidal vessels become relieved. The quantity and quality of food are of great importance to persons with sluggish bowels. A diet consisting in a great part of flesh food, eggs, cheese and farinaceous matter, is in many persons attended with constipation, while the diminution of these substances and the substitution of fruit and green vegetables leads to regularity of the bowels. The reason is that of flesh food, cheese and eggs the greatest part is absorbed in the upper portion of the intestines, and only a small quantity remains for the formation of fæces, insufficient to stimulate the peristaltic action of the bowels; while green vegetables and fruit having a large proportion of vegetable cellulose, which usually is not absorbed in the intestines,

lead to a larger quantity of fæcal matter, sufficient to promote peristaltic action and regular evacuations. With many people, however, this change of diet alone is insufficient to make the bowels act regularly. They require substances which cause a greater amount of local mechanical stimulation, such as is produced by the bran of brown or whole-meal bread, in addition to the fibres of green vegetables and fruit. Sir Lauder Brunton explained this in a practical lecture on constipation some years ago. The best brown bread, in my experience, is the whole-meal bread recommended by Sir Henry Thompson, which is a modification of the ordinary brown bread, or Graham bread ; and for travelling, Spiking's or Hill's whole-meal biscuits may be substituted. The best qualities of Smyrna figs are likewise useful, partly no doubt by the seeds they contain, but partly also by the other portion of the pulp. One or two fair-sized raw apples at breakfast are of great assistance to many persons. Cooked fruit is less active, although it is likewise useful ; a disadvantage in cooked fruit and compots is the customary addition of much sugar, which ought to be avoided.

Quite lately Dr. Schmidt [111] and Dr. Neville

Wood [142] have explained the occurrence of constipation in many persons, by the peculiarity of their digesting a great part of the cellulose contained in the food, and through this producing only a scanty amount of fæcal matter. To prevent this they recommend such persons suffering from constipation to take once or twice a day a substance which is not absorbable by the intestines, and forms a coating round the food on its passage through the bowels, thus preventing the absorption of the cellulose and rendering at the same time the fæcal matter softer. Such substances are fluid paraffin and agar-agar. Honey regularly used at breakfast, with or without butter, acts on many persons as a gentle aperient, but there are others who cannot bear it, as it causes with them attacks of colicky pains and diarrhœa.

There are many people who think that it is better to take only the nourishing parts of food, which are in their opinion more digestible, and save their digestive organs the labour of extracting them ; they prefer meat extracts to meat, fruit jellies to the whole fruit, the finest flour to the entire wheat meal ; but this is for most persons a great mistake, not only on account of the reason previously given, viz.,

the slight stimulation caused by the vegetable fibres, and other solid parts contained in the coarse meal and bran, but also because the stomach and intestines ought to be kept at work like all other organs of the body, provided they are free from ulceration, catarrhal affection ; or other disease. Furthermore, the entire natural substances are more useful than the extracts ; the entire meat is more nourishing than ordinary extracts of meat, which do not make muscle though they exercise some nourishing action ; the very fine white bread is rather inferior in its nutritious qualities to the wheaten bread made from the entire flour, the whole-meal bread or any good household bread, excepting some persons for whom it is necessary to avoid food containing purin as much as possible, and some others in whom the presence of much cellulose causes the development of gases. For these the finest white bread is preferable, since it is almost free from purin, while the whole-meal bread contains a certain amount of it.

If the arrangement of food, or the addition of some lubricating matter mentioned, is not sufficient to produce regular action of the bowels, massage of the abdominal organs is in many people a satisfactory measure, and almost

every individual can learn to practise this on himself. Another help, and a very useful one, not only with regard to the motion of the bowels, is the voluntary and systematic contraction of the muscles of the abdominal wall, the *abdominal pressure* (*Bauch Presse* of the Germans). By slowly and thoroughly contracting the abdominal muscles from above downward fifty or sixty times, and by keeping them in contraction during full and prolonged expiration, not only the intestines, but also the liver, the bowels, the blood-vessels, and all the organs within the abdominal cavity are compressed, the entire abdominal circulation is activated, the blood squeezed out of the veins and moved on towards the heart, which is strengthened by the extra work which it has to perform, as well as the abdominal muscles themselves. A glass of hot or cold water, or of some aerated table water like Seltzer or Apollinaris or Giesshübler, or a cup of weak tea taken about one or two hours before breakfast, has often the desired effect; in others a ride on horseback before breakfast, or a brisk walk. A wet bandage round the stomach and loins, worn during the night, is likewise often a successful measure. If by all these aids the

regular action of the bowels cannot be obtained, and if the health of the individual suffers in consequence, mild aperients become to some persons a necessity, especially to gouty people, as the tendency to imperfect removal of excretory matters is mostly part of their constitution, and may lead to various deviations from health, and ultimately shorten life. Many people, however, always take aperients without requiring them, and live in constant fear of constipation—a kind of hypochondriasis. They ought to bear in mind what I have already alluded to, that to many persons it is sufficient to have a motion only every other day, and even more rarely. It is further important to consider that the amount and nature of food and the way of taking it exercise great influence on the frequency or rarity and on the abundance or paucity of motions. If a large quantity of food containing much insoluble vegetable fibre is consumed, a greater amount of substance must be evacuated by the bowels; but if only a moderate amount of food is taken, the greatest part of which can be dissolved and absorbed in the intestines, only a small amount remains for evacuation through the stools, and the motions may be less frequent and less bulky. The way

in which the food is taken exercises likewise great influence; by the process of cooking the fibrous parts of the food are softened, the saliva and gastric juice are allowed to act on it, and absorption is promoted. Equally important and in some respects more so is thorough mastication, by which, combined with the admixture of saliva in the mouth, a much larger amount of nourishing material becomes absorbable and is absorbed in the intestines, a smaller quantity of the original food substance remains, the evacuations must be diminished in quantity and need not occur every day (Dr. van Someren [126] and Horace Fletcher [40]).

XII.—The Nervous System.

Equally important with the organs of circulation and digestion is *the nervous system*, which, we may say, governs all the other systems. We must therefore prevent its degeneration as long as possible; we must nourish it and keep it in action. The state of the blood-vessels and the circulation are again all important. Degeneration of the blood-vessels of the brain, and the impairment of the brain structure and functions consequent on it, form a frequent cause of premature decay and death; and the

tendency to this degeneration is in many families hereditary; but this premature decay is to a great degree preventable by moderation in food and stimulants, by regular physical exercise, and by judiciously arranged mental work and occupation. I have often witnessed this, and in a very striking way, in a family whose male members had for several generations died between 56 and 64 from apoplexy, or paralysis, or other early decay of the brain. Of five brothers in this family who came under my observation when between 25 and 40 years of age, two carried out the advice to lead an active life, mentally and physically, coupled with moderation in everything, and lived to beyond 70 and 73 years, and died not from degeneration of the brain, but from heart affection and pneumonia; while the three others, with less active and less temperate habits, and too much sleep, died between 60 and 64 from paralysis and apoplexy. I could adduce many similar experiences in other families, but this one may suffice.

The Brain.

The *brain* profits like all the other organs of the body by physical exercise, in so far as

through the increased action of the heart more blood is carried to it, and the nerve-cells as well as the arterioles and capillaries are kept in a healthy condition. Exercise, however, produces another and more immediate influence on the nutrition of the brain. As every voluntary movement is due to an impulse from certain portions of the brain, this impulse, we may assume, causes an increased afflux of blood, through which the nerve-cells as well as the small blood-vessels themselves are nourished and kept in working condition, counteracting premature decay. The brain often decays from want of physical exercise or mental work. We have frequent opportunities of witnessing this. Many men retire rather too early from business; others, especially officers in the navy or army and civil servants, are obliged to do so by the regulations. Amongst these men we see not rarely weariness, dejection, and an inclination to give up occupation and active habits, to remain longer in bed, to play cards by day and night, to smoke immoderately and sit longer over their meals, and in consequence sickness of different kinds is developed, and also premature decay of the brain functions. Such men ought to find occupation for their brains, and

take regular bodily exercise. They ought to seek some objects of interest in art or in literature, in studying the habits of insects or birds, in history, geography, geology, zoology, botany, in gardening or agriculture, in travelling, or in adopting and educating a child, and in other philanthropic matters, &c.; they ought to cultivate a hobby, for instance, in collecting prints, autographs, antiquities, or coins, to induce them to study history, antiquity and mythology; even the collecting of postage stamps, in default of something else, can be used as a source of mental occupation. The cultivation of a hobby ought to be commenced while people are still at active work, since the inclination and the aptitude to being something new disappears not rarely long before 60 or 65, when they have to retire from their work. Many old people derive great benefit from chess and other intellectual games, also from games at cards or dominoes, especially when the eyesight for reading fails, provided over-excitement or passion is avoided. The families or companions of old people ought therefore to play with them, or otherwise occupy them, instead of allowing them to go to sleep for several hours during the day or the

long evenings. Amongst the classes of people who die earlier than they ought to do from imperfect brain work, are some who had lived a healthy life up to 50 and 60, but then began to fail from want of occupation or activity. I have observed this, for instance, amongst farmers, who, when they ceased to be able to take the long walks and rides necessary to superintend their farms, allowed their work to be done by their sons, indulged, however, in the comparatively large amount of food to which they had been accustomed, spent the greater part of the day during the long winters indoors, became stiff in their limbs, sleepy and indolent, and died between 66 and 72. This may be called a respectable age, but it is not the age which they would probably have attained, if they had sufficiently occupied their minds, diminished the amount of food, and kept up out-of-door life and exercise. Similar observations I have made amongst well-to-do tradesmen and other classes, to which I have already alluded. A great point is to keep up *variety in mental occupations*, and to keep awake the interest in many things so as to prevent mental torpor, which is akin to ossification of cartilages or arteries.

Another advantage of regular mental occupation is that it prevents us from turning our attention too much to our own feelings and failings, to our mental and physical troubles. Many persons are apt to pay too much attention to slight ailments, and imagine them to be the beginning of serious disease and suffering, become through this mentally depressed and unhappy, and at last imagine that they are the subjects of serious incurable disease. These morbid *imaginations* sometimes give rise to real disease of mind or body. The most effective remedy, preventive as well as curative, of such morbid imaginings and their grave effects, is constant occupation combined with open-air exercise, and none of the many remedies constantly advertised is generally required. Great moderation in eating and drinking must be added, as many forms of mental depression and morbid imaginings depend on dyspeptic conditions. All mental occupation leads to increase of flow of blood to the brain, activity of the small blood-vessels and nutrition of the nerve-cells. I have already mentioned Mosso's experiment (p. 27) [81]. I could produce the most remarkable proofs of the influence of mental activity on the condition of the heart, the digestion and the whole body.

I cannot resist mentioning a very striking case which I had the opportunity of watching from day to day, as the subject was an intimate friend of mine. A man of great energy and intelligence, who was the leading spirit in a well-known hospital, began to get languid and to lose his interest in his work at the age of 76. The action of his heart became weak and very irregular, he lost the expression of intelligence peculiar to him, the saliva ran constantly from his mouth, and a viscid and acrid fluid from his swollen eyes; the action of the bowels and the bladder became extremely sluggish; œdema of the legs, and at last effusion into the pleural cavities, developed themselves in his eighty-second year, when suddenly the arrangements which he had created at the hospital were in danger of being overturned. This caused violent excitement in him; he began at first to dictate and soon to write letters, he held meetings, and succeeded in saving his arrangements and his influence. Marvellous was the improvement manifesting itself from day to day without any medicine. The pleural effusion and œdema disappeared, the heart became almost regular, the eyes and mouth returned to their natural conditions, the puffiness of the face

subsided, and the intelligent expression came back. He remained in this improved condition over a year, when he died of pneumonia, from a deleterious meteorological change, or influenza. It was the work of the brain and the joy at his success which caused this astonishing improvement. Wonderful is the effect of success, and equally so that of joy ; it shows the immense power of the mental condition over the whole organism. The opposite conditions of the mind, such as grief and loss of hope, cause in some people the greatest mental and physical depression, total indifference for their surroundings, combined with at first functional, afterwards organic changes, especially dilatation of the heart, and death from what may truly be called a "*broken heart.*" Diminished respiration, weakening of the action of the heart, and imperfect supply of blood to the brain, probably have a great share in these conditions of depression. Sometimes, but not always, we are able to produce a favourable turning in such cases by awakening an interest in near relatives or friends, or by some other powerful mental influence, which is followed by arousing the depressed functions of the brain, the heart, and the rest of the body. Of many cases of this

kind which have occurred to me, I will narrate only one : A lady, 70 years of age, lost suddenly from acute disease her husband, a very distinguished physician, whom she had adored, and with whom she had shared every pleasure and every sorrow throughout their long and happy union. She was highly cultivated, very active, and took a lively interest in all her surroundings. Immediately after the unexpected death of her husband she became mentally depressed and perfectly helpless, while formerly she had been full of resources. The condition might be called "*mental paralysis*," or acute melancholia. It was almost impossible to induce her to take food, she nearly always sat in a corner of the room with her head bent down, frequently sighing, and took scarcely any notice of the members of her family, of whom she had always been very fond. Within less than three weeks the heart, which had been quite sound, had become dilated, the pulse had become weak and irregular, and a loud systolic mitral bruit had developed. The legs had become œdematous. The intellectual and sympathetic physiognomy had turned into an expression of apathy and almost stupor. This state continued and increased for some weeks ; she

became greatly emaciated and was expected shortly to die, when as a last experiment an urgent message was sent to her from a daughter who had not been able to leave her bed for several years, and had entirely depended on her. The daughter implored her to see her once more before she died; the mother was carried to her, and her maternal interest and affection were roused by the daughter's helplessness and grief and attachment. She took some food and stimulant while with her, and revived from that moment, was daily carried to this invalid daughter, whose joy at her mother's arrival seemed to act as a powerful stimulus on the latter, who gradually regained also her interest in other members of the family. The aged lady recovered her general health in the course of three months, although the heart remained somewhat dilated and irregular; she became again the centre and soul of her large family, and retained her faculties until her death, in her eighty-sixth year.

Equally injurious as grief and sorrow is worry, by which the equanimity is destroyed, and the joyful performance of the daily work and duty is rendered impossible. Worry is doubly injurious if caused by one's own faults,

either of commission or of omission. The habit of some persons to make worries is most injurious, and ought to be counteracted from an early period by all possible means.

It may not be quite easy to explain the physical mode of action of happiness and allied mental conditions on the one side, and dejection and unhappiness on the other, but if we consider the immediate effects which in most persons emotions produce in the action of the heart and blood-vessels, it becomes more intelligible. The palpitation of the heart and the flushing of the face under the influence of anger, joy, or shame, the paleness and feeling of coldness and shivering from fear, grief and anguish, clearly show the intimate connection between mind and heart, which is so constant that both words are, in common language, often used in the same sense. Both happiness and unhappiness act on the heart and circulation, and the vaso-motor system, the former stimulating, the latter depressing, but the mind is no doubt first influenced, and through it the respiration and the entire circulation from the heart to the smallest blood-vessels. On watching persons under despondency and grief, I have often found their breathing superficial and irregular, interrupted occasionally by a sigh, and

their pulse weaker, sometimes irregular and less frequent from imperfect action of heart, while under the influence of joyful news the breathing became regular and deeper, and the pulse fuller and regular, rising within half an hour or less from 50 to 70 and 75, its habitual rate of frequency. Evidently the centre of the pneumogastric nerve is influenced by these opposite forms of emotion. It is often impossible to remove sorrow, grief, mental anxiety, and depression by friendly encouragement, but we must endeavour under such circumstances to counteract these injurious agencies by physical means. Exercise, active or passive (in carriage or bath-chair), in the open air is one of the most powerful agencies, and rarely fails gradually to exert its beneficial influence.

There can be no doubt that *pleasure* is often a source of *happiness*, but it is by no means identical with happiness, and the habit of hunting after pleasure is a frequent source of unhappiness, and ultimately even of illness. The seeking of pleasure must, therefore, be limited in a judicious manner, and pleasures which are lasting must be preferred to pleasures of an exciting, momentary, or transitory nature. A different matter from pleasure is *cheerfulness*, and in

order to promote *cheerfulness* we must cultivate *contentedness* with the circumstances in which we are placed. It is, further, of great importance to educate the *sense of duty* with regard to one's position in life and to one's surroundings. A person who does his duty and, through this, is satisfied with himself, in other words, has a good *conscience*, is, other matters being satisfactory, happy, and even if the cirstances are not to his liking, he is able to keep his equanimity, to bear them well, and to make the best of the situation. On the other hand, a man who has reason to be dissatisfied with himself, or has a bad conscience, is unhappy, looks at the circumstances surrounding him in a mistrusting and despondent manner, and is less able to extricate himself out of a difficulty ; he often becomes depressed, his resisting power is lowered, and he is easily attacked by disease. The sense of duty ought, therefore, to be cultivated from an early age through life. The head of the family, for instance, who neglects the happiness of his wife and the training of his children for his personal enjoyment, and a wife who shirks her duty of bearing children and of nursing them for frivolous motives, fine clothes and social excitement, often

prepare for themselves worry, disease and premature death. In several instances of my experience it has happened that parents who, in the earlier years of their married lives had, by their own will, limited, for their convenience, their progeny to one child, lost this only child after it had grown up. It had been the bond of union between them and the centre of their happiness. The death of this only child caused them the greatest unhappiness; in one case deep melancholy of the wife, in another estrangement between husband and wife for the remainder of their lives, in another suicide. Again and again Goethe's words came before my mind :—

"Denn alle Schuld raecht sich auf Erden."
("For vengeance follows on the guilty deed.")
Free translation.

although not all "guilty deeds" are guilty in the eye of the law.

On the other hand, those who bear sacrifices for home and family, for the alleviation and improvement of the condition of the sick and helpless with whom they come in contact, earn mental satisfaction and happiness, which act like sunshine on the whole body, and thus become means of prolongation of life and of a happy old

age. A further point of *self-education* connected with the sense of duty is the restraint of our passions ; not only must we check our anger if any thing displeases us, but we must also conquer undue ambition,[1] vanity, avarice, jealousy, illicit sexual desires, which often become, as you know, the cause of bodily and mental disease, premature death, or "miserable" old age. Another part of self-education is the duty of combating *self-indulgence* with regard to food, drink, sexual pleasures and to idleness. Self-indulgence leads to moral and physical weakness, want of resisting power to disease, and mental depression.

We also must endeavour to promote cheerfulness by the arrangement of our whole manner of living, as far as lies in our power, without neglecting our duty. We must endeavour to cultivate the sense of beauty for Nature and art ; much can be done in this way, for instance, by

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[1] "Ambition" is not to be absolutely condemned; a certain amount of ambition is to many persons useful as a stimulant to learning and progress, it is almost needful to the soldier ; but "undue ambition" often leads to injustice towards others and to crime.

> "I charge thee, fling away ambition :
> By that sin fell the angels."
>
> "King Henry VIII., Act III."

flowers, by pictures and drawings, a home, in cottages, public schools, hospitals and sick rooms.

"A thing of beauty is a joy for ever."

We must cultivate restfulness, equanimity, and thoroughness, and must avoid too great multifariousness of work which leads to haste and hurry. Habits of haste and hurry prevent mental satisfaction, over-excite the heart, and gradually injure its nutrition and structure (dilatation with or without hypertrophy). While well-regulated work, adapted to the powers, strengthens the brain and heart, ill-regulated or ambitious work, exceeding the mental power, deranges the brain and heart, and often leads to premature breakdown in either the one or the other or in both. Unfortunately such misjudgment of one's powers is not rarely the cause of failure in life.

A potent enemy of cheerfulness is *nervousness*, which shows itself in many different ways, and must be fought with all means in our power, especially by judicious reasoning and regular occupation combined with open-air life.

A further powerful agent in health matters is *the will*. We must develop it from youth and cultivate it throughout life. An effective influ-

ence in this respect is exercised by our endeavouring to carry out in our daily life what we think good for us and right towards others in great as well as in small matters. We have mentioned already Dr. Austin's remarks on the advantages of severe climbing tours in strengthening our will, but our persevering in our daily walks even in disagreeable weather, is one of the many instances in this direction, and the practice of moderation in sensual enjoyment is another. A large proportion of those whose lives I have been able to prolong, exercised their strong will in carrying out the precepts which I gave them, although they appeared to them at first tedious and difficult. *I will not decay early*, they said, *I will maintain my powers and faculties* as long as possible. And not only is a strong will a great aid in attaining longevity by maintaining health and preventing disease, but it is also a powerful agent in overcoming disease. This is generally acknowledged with regard to pulmonary tuberculosis, but I have also seen many, and amongst them some marvellous cases, in other diseases. A man, for instance, above 60, who had suffered for more than eighteen months from a weak and dilated heart, from cirrhosis of the liver, œdema

of the legs, and ascites, and had been tapped seven times, was scarcely ever free from pain and from a sense of exhaustion ; he was justly refused by a Life Assurance Society, and was told that his chances of recovery were doubtful. At first he was much depressed by this pessimistic prognosis, but on the following day, after having thoroughly considered his position with me, he said that he must live on account of his large family, that he would not die and would do everything in his power to prevent death. He tried, and fairly succeeded in disregarding pain, he began to carry out all our rules, however difficult it was to him, with regard to food, open-air life, different kinds of exercise, and change of climate ; he regained his health within two years and remained well up to a considerable age. Even in children the will exercises sometimes a remarkable influence on the course of disease. Thus I still see before me a pale and breathless child of 7 years of age who had pleuro-pneumonia, and was suspected of having tubercles in the lungs. After a consultation between three physicians the mother had been told that there was only a very slight chance of recovery. When I afterwards came into the sick room, I found the mother unable

to suppress her tears, and the child almost breathless, exclaiming: "Don't cry, mummy dear, I shall get well again, I will not die." An improvement set in almost from that hour; slight at first, it became more decided after some days, leading gradually to perfect recovery. This child gained with advancing years many other advantages from a strong will. Such occurrences, I know, may be regarded as coincidences only, and not as due to the will; but as I have observed several cases of a similar nature, I am convinced that the will of the patient has had a great share in the successful issue. The will is, indeed, a great power in disease as well as in other events of life.

These considerations bring us to the borders of *mental diseases*, which often, though not always, shorten life. In many cases there is a hereditary tendency, but this can mostly be counteracted successfully by promoting the general health, by strengthening the balance of the mind, by healthy occupation and exercise, by enlightened mental surroundings, by great moderation, by cultivating contentedness, and by governing the passions, while at the same time all exciting causes must be kept off as far as possible. While I write this a very suggestive

paper by Sir Samuel Wilks comes before me, "On the Correction of Hereditary Tendencies" (*Lancet*, October, 1903, p. 1151). He occupied himself with the hereditary tendency to vice, but his suggestions apply also to other forms of mental irregularities; he especially points out as means of cure, change of mental surroundings, from the houses of vicious parents or relatives to healthy surroundings or schools, where the qualities of self-respect, integrity, independence, and a just dealing with others are brought out. Lord Bacon, in his "Advancement of Learning," speaks of particular remedies "which learning doth minister to all the diseases of the mind."

Before leaving the mental condition and the influence of mental work, I must again express my conviction against the doctrine that under ordinary conditions work wears out the organs sooner than idleness or great restriction in work. It certainly is wrong with regard to healthy brains, if the work is well arranged and is not "overwork." Judiciously arranged mental work in itself, with fair intervals of rest, does not wear out but strengthens the brain in the same way as the power of the heart and the blood-vessels and muscles is maintained by ade-

quate physical exercise. When Sir William Gowers [47] in a lecture "full of wisdom" on the nervous system in old age, speaks of the necessity of *rest* in old age, he evidently does not mean to prohibit regular mental occupation, but only "overwork." The mental faculties ought to be exercised during the greater part of the day and the whole year, holidays included, but there ought to be a change in the nature of the work, so that one sphere is in a comparative state of rest while the other is employed. Dr. Pollock [101] says very well: "Sameness begets weariness, causes the mind to grow old and accelerates bodily decay." In the majority of people who practise their mental faculties judiciously, these are retained longer in fair energy than the functions of the muscular and digestive systems; perhaps, as Sir Crichton-Browne points outs [28 and 29], because the frontal lobes on which they depend, attain their highest development later in life. We find, at all events, statesmen, judges, orators, doing almost their best work after 50 and 60. We have fortunately many instances of great brain-workers attaining considerable ages and maintaining their faculties to the end, in science, in arts, in politics, in the law and divinity, and

also in medicine. Hufeland himself, although he rather supports the wearing-out theory, was a hard worker, and lived to 74. Cicero says "the intellectual powers remain in the old, provided study and application are kept up, and old age need not be inactive, indolent and drowsy." We have striking instances in painters, in Giovanni Bellini, in Titian, Franz Hals, and in Sidney Cooper; we have amongst other brain-workers, Sophocles, who is said to have written tragedies at 90 and more, Plato, Galen, Cato (Censorious), Cicero, Michael Angelo, Heberden, Wesley, John Howard, Benjamin Franklin, Goethe, Samuel Rogers, Chevreuil, Victor Hugo, Kant, Voltaire, Sir Henry Holland, the physician, Sir Moses Montefiore, the philanthropist; William I. of Germany, Moltke, Bismarck, Dr. Holyoke, an American physician (died at the age of 100); Manzoni, Leopold von Ranke, Mommsen, Gladstone, Lord Masham, the great inventor in modern industries; Mrs. Elizabeth Hanbury, Mrs. Neave, of Guernsey, Madam Viardot, the celebrated singer; Sir Henry Pitman, the Emeritus Registrar of our own College, who is alive at 99; Tolstoi has passed 85; Sir Manuel Garcia, the inventor of the laryngoscope, who celebrated his hundredth birthday

in the early part of 1905 ; Baron de Waldeck, who died in Paris in 1875, aged 109 ; Elise Averdieck, of Hamburg, who died in her hundredth year, after a most active and useful life as a teacher and deaconess, and many others who contributed through this to the pleasure and benefit of others and probably to their own longevity. We have, on the other hand, good reason to assume that neglect of the mental faculties, idleness, excessive amount of sleep, lead to premature decay of the brain functions and to shortening of life. What we said of the muscular and circulatory systems applies with still greater force to the brain, viz., that few people only die of mental overwork, compared to the large number of those who shorten their lives by over-rest. There are, we all know, cases of real over-exertion of the mental faculties, and through this injury to health and life, but these are comparatively rare ; and amongst them are many of misdirected brain-work, of persons who undertake tasks which are beyond their powers.

We need not conceal from ourselves that we do not retain in old age the same rapidity and force of thought, and the same memory which we enjoyed in youth and manhood ; but we

must not allow ourselves to become depressed by this or to give up mental work. We must endeavour to retain our mental equanimity and do as much useful work as we can by which that feeling of contentedness is produced which exercises the most beneficial influence on the whole organism. Nothing is more injurious to old persons than the idea that they are useless, that they cannot any more do anything either for themselves or for others, and that they must die soon. I have often seen people of advanced age rapidly decaying, when through some unhappy influence they allowed themselves to be seized by such an idea ; but I have also had repeatedly the happiness to see such despairing persons recover strength and activity and happiness, when we succeeded in reawakening self-confidence and hope. This fact cannot be strongly enough impressed on the aged themselves and on the friends surrounding them. I may refer to the case mentioned at p. 149. *Pessimism* is always to be condemned ; it is depressing and prevents our making the best of our position. It is quite right to acquire a full insight into the dangers and disadvantages of our condition, but we must at the same time diligently search for the means to remove or at

all events to mitigate them. We are not in favour of blind optimism, but of realism, and this realism not rarely leads to victory.

Many people seem to have been startled by a statement in Professor Osler's Valedictory Address at Johns Hopkins University [93] about the comparative uselessness of men above 60, and that all the effective and vitalizing work of the world is done between 25 and 40. His partly jocose remarks seem to have been misinterpreted. I understand Osler's remarks much in the same way as Sir Samuel Wilks does in his philosophical article "De Senectute" [142]. He thinks that the principal activity, we may call it the creative period, ceases in the middle of life, viz., about 50, that, however, judgment and ability to do useful work may last to much more advanced life. To use the words of Sir Samuel Wilks: Men (older than 50) "may still continue to take their appropriate share in the affairs of life. The work which they then do need not be original and new, implying a retention of the same mental activity as they had previously possessed, but rather the turning to account the knowledge which they had previously gained, and so utilizing their experiences for the benefit of others as did the Nestors of old" (*Lancet*, 1905, vol. ii., p. 1606).

XIII.—Sleep.

Under the head of the nervous system we must pay some attention *to sleep*, that most wonderful function of our organism. Dr. G. Oliver points out that during sleep the arterial pressure falls, the venous rises, and that the tissues are irrigated with lymph, which leads to their restoration and nutrition. The amount of sleep required differs very much in different people and at different ages, and even in the same persons at different times and under different circumstances. Children and young persons at school require much more than adults. Sleep promotes with them nutrition and growth; it is to them the "great nourisher in life's feast." Most adults do not require more than five and a half to seven hours, but some take nine hours and over. Much depends on the nature of occupation and on habit, and there are in this matter, too, good and bad habits. Sleeping for one or many months too little, say under five or six hours in children between 8 and 14 years of age, and four hours in adults, causes in many persons impairment of digestion, sanguification and nutrition, emaciation, anæmia, mental irritability, neuralgia, and other troubles of the nervous system. This is

easily understood when we take Oliver's experience just mentioned into consideration, from which we see that too little sleep gives not time enough for the process of nutrition of the tissues. Oliver's experience also shows why during active growth much more sleep is required than in the later stages of life, when the body is thoroughly developed, and why the curtailing of sleep in children and growing persons is so much more injurious than in adult life. Dr. T. D. Acland has quite lately judiciously discussed this subject [1A] The habit of sleeping too little is, however, less frequent than that of sleeping too much. There are some hard brain-workers who never sleep more than five hours and even less, and enjoy good health with this small amount up to old age, if they live otherwise correctly. There are many persons who worry themselves if they sleep less than seven hours and if they wake several times during the night. They mostly do themselves more harm by worrying about the supposed too short hours of sleep, than by the small amount of sleep they get ; and if they can be persuaded that they are not injured by the shorter hours, that rest in bed by itself leads to restoration of the body, they

mostly begin to sleep better. Other persons on waking during the night, immediately turn their thoughts to their occupations or worries, and as everything looks blacker during the night than in broad daylight, they dread this so much that they take alcoholic drinks or sleeping drugs either on going to bed or during the night as soon as they wake up. This is a very bad habit and ought never to be resorted to excepting under the well-considered advice of the doctor. The frequent use of anodynes and sleeping remedies (narcotics, hypnotics, soporiferous substances) weakens the heart, the nervous system, often also the digestion and the resisting power. Among the means frequently used is a dose of alcohol (Cognac, whisky, rum) at bedtime or on waking during the night. Although we are aware that a small quantity of alcohol, say a dessertspoonful or a tablespoonful of whisky or Cognac in as much milk or water often produces sleep, it ought never to be allowed to become a habit, and its use ought to be restricted to rare exceptions like that of other somnorifics, such as chloral and opiates. The tendency to sleep badly can often be corrected by taking a slight meal on going to bed, or on waking during the night, such as milk, a plain

biscuit, or some light farinaceous food, but not alcohol. In some persons a late dinner or supper or an injudicious article of food, or coffee or tea at a late hour, form the causes of imperfect sleep, and must be avoided. In other persons, insufficient bodily exercise is the cause; in others exciting mental work at late hours. In every case one must endeavour to find out the cause and try to remove it. In some cases a warm bath at bedtime, in others a cold bath, and again in others a wet bandage round the stomach, furnish good remedies against imperfect sleep. Much sleep, viz., over eight hours—I speak here of adults—is mostly more injurious than too little, especially in persons of full habits, by causing diminution of nervous energy, or degeneration of the small arteries or capillaries of the brain, and in consequence apoplexy or premature decay of mental faculties. Dr. Oliver's experience just quoted explains this deterioration, which is often manifested by the appearance of plethora and by obesity. Immanuel Kant, who was not only a great philosopher but had also very judicious views about health and most matters of life, says that much sleep exhausts the energy and shortens life [63].

Sir John Sinclair [114], in his excellent and

most diligently compiled work says: "It is proper to add, that nothing is more pernicious than too much sleep. It brings on a sluggishness and dulness of all the animal functions, and materially tends to weaken the body. It blunts and destroys the senses, and renders both the body and the mind unfit for action. From the slowness of the circulation which it occasions, there necessarily follows great corpulency, a bloated habit of body, and a tendency to dropsy, lethargy, apoplexy, and other disorders."

The time for sleep is the night, and sleep during the day, which is so necessary for infants, ought not to be indulged in by healthy persons in middle life and only very moderately by old people, barring exceptions, as for instance after illness, or exhausting work. It is a bad habit to transform the night into day and the day into night, to do mental or social work after midnight and to sleep in the morning until 9 or 10 and even later. With few exceptions the long-lived reported on and analyzed by the "Collective Investigation Committee" (Humphry, "Old Age") rose early and went to bed early, and my own observations are entirely in accordance with this.

At the risk of being blamed by those who

maintain that a certain number of hours of sleep, say six to eight, is absolutely necessary, and that it must be taken by day if it cannot be taken at night, I may say that I have always recommended men of work, physical or mental, to rise at the same early hour, even if they had gone to bed later than usual, or had not slept well. There are, I need not say, a few necessary exceptions to this rule, such as men in the House of Commons, if the sittings last till 2 or 3 or 4 a.m., or medical men who have spent the greater part of the night at the bedside of a patient, or delicate ladies who have been, owing to our bad habits, at dances till long after midnight, or workers on morning newspapers. It is at present in England the habit of most men occupied with literary work to do it during the late evening hours ; they say that they cannot collect their thoughts and bring them into proper shape in the morning, but can do so in the late hours of the evening, and better and better during the small hours of the morning. I acknowledge that it is so, but I maintain that this is only the consequence of a bad habit, and that for those who accustom themselves to it, the morning work is the best, and that this is also more in accordance with the laws of health. Many

people, it is true, cannot work well for several hours in the early morning with an empty stomach ; but by taking a cup of milk, or of weak tea with milk and with a piece of bread or a biscuit, they can do their mental work, or take early walks with great advantage. John Wesley, the well-known divine, it is stated, rose for sixty years every morning at 4 o'clock, and never slept more than six hours. I could give numerous instances of great mental workers who from an early period of life were in the habit of rising always between 5 and 6 o'clock, even if they had been obliged to remain up till after midnight once or twice a week, and who lived and retained their working power in spite of these short hours of sleep to the age of 75 to 80, and even longer. Several judges of my acquaintance, while on duty, rise at 4 or 5 and prepare themselves for their work ; and one of them is now alive, though lately retired, and enjoys good health at 88.[1]

[1] This refers to Lord Brampton who died in 1907, at the age of 90, after a very short illness, and was living when the above was written.

XIV.—The Skin.

An important organ, by which the general health and the duration of life are influenced, is the *skin*, one of the various functions of which is the removal of excretory matters. This function, which it performs jointly with other organs, is apt to become defective in old people. The skin of old people is mostly drier than in earlier life, partly no doubt from the obliteration of some of the capillaries. All active exercises help in keeping up the circulation in, and the functions of, the skin, but one of the most powerful means is the *bath*. Many persons with an active circulation can use cold baths from early life to very old age; others with poor reaction, especially weakly rheumatic subjects, do better with a hot bath; again, others begin best with a hot bath and then let in cold water and sluice themselves, head included, thoroughly with cold water, or take a cold shower bath at the end. By exposing the skin and its blood-vessels to an alternation of heat and cold, we enable them to react more quickly to alternations of external temperature and thus prevent chills. The hot bath has, in addition to its local effects, an immediate influence on the

distribution of blood through the different parts of the body. The heat of the water attracts a large amount of blood to the skin, and diminishes the amount contained in the internal organs. It ought, therefore, not to be taken soon after a principal meal, when the stomach requires a larger amount of blood. This influence on the distribution of blood the hot water bath shares with the hot air bath, the vapour bath and the electric bath. The active rubbing and drying with a rough towel after the bath does not only dry and massage the skin, but obliges the bather to make many movements with the arms and the muscles of the trunk which he would not do otherwise. Thus the bath acts as a kind of gymnastics to the skin itself and induces also gymnastics of the arms. The bath, either cold from the beginning, or first hot and then cold, helps to preserve the elasticity of the blood-vessels of the skin, strengthens the heart, and also assists in maintaining the energy of the nervous system, including even the character, by the shock which it applies to the whole body, and the resolution required to take the cold bath in cold weather. The Japanese have a very high opinion of the usefulness of the daily bath; we

are informed by travellers in Japan that every hamlet has its public baths, hot and cold, the former generally preferred.

With the ordinary bath we can conveniently combine an *air bath* by keeping the body uncovered for several minutes after the drying and rubbing process has been finished, while the skin is in a state of turger or glow. This exposure of the whole body to the action of the air increases the tonic influence of the bath. Various gymnastic exercises can be advantageously combined with this air bath after the water bath. The air bath alone during half an hour and even several hours, if used with judgment, improves the condition of the skin, and through it the nervous system and the metabolism. Those who have time and opportunity can, in addition, take a *sun bath*, the action of which is allied to the hot air bath, by exposing the naked or nearly naked body during half an hour and longer to the active rays of the sun. The light and heat of the sun, however, exercise a more powerful influence than the hot air bath or ordinary air bath alone on the general metabolism, which is especially beneficial in chronic rheumatic ailments. The cures with electric light baths, and hot sand baths are based on similar

principles. It is easily understood that the air bath alone without heat abstracts warmth from the body according to the external temperature and the degree of movement of the air, and that the duration of the air bath must be regulated according to these circumstances and the condition of the individual. The latter remark applies also to the sun bath, the electric bath, and all kinds of baths.

A kind of local air bath is supplied by walking and driving whenever possible with the head uncovered. Many chills which are frequently caused by cold draughts on the head are through this avoided. The founder of the Bluecoat School deserves praise for the judicious law to keep the heads of the boys uncovered in all weathers.

If a full bath cannot be managed, a hip bath combined with sluicing the head thoroughly with cold water may be substituted as second best; and if this, too, is impossible, the whole body ought to be rubbed thoroughly with a wet towel once or twice a day for some minutes, and the head bathed with tepid or cold water and afterwards thoroughly rubbed dry.

For good advice on the cultivation of the

skin and hair we may refer to Sir Malcolm Morris in the "Book of Health" [80].

In connection with the skin we must say a few words about the *hair*, which is not a mere appendix or ornament, but also an organ of protection. The hair undergoes, with the advance of age, considerable changes, which are especially noticeable in the hair of the head, including the beard, and which Metchnikoff ascribes to the action of the makrophages. There is a wide difference in different persons with regard to the quantity and nature of the hair and the changes occurring in it during life. There are whole families in the members of which the hair begins to turn grey already at 20 or soon after, while in other families the hair retains its original colour up to 60 or 70 or even 80 or the end of life. Similar is the difference with regard to the *loss* of hair which commences in some families before 25, while members of other families retain their hair up to the most advanced age. The mere change of colour in itself exercises, especially when it is due to a family peculiarity, no influence on health, but it is sometimes connected with permanent or transitory changes in more vital parts of the body ; the rapid change from the natural

colour to greyness or whiteness, when it is not the effect of acute disease, is not rarely caused by a deterioration of the whole constitution, and thus requires the serious attention of the doctor.

The *loss of hair* renders some people more liable to the injurious effects of sudden changes of temperature, draughts, &c. In many instances we are able to prevent or at all events to slacken the process of loss of hair, and to some degree also the change of colour, by always keeping the head cool and mostly uncovered, and sponging it regularly with cold water ; but a still more beneficial influence is exercised by daily *massage of the head*, which ought to consist not in mere rubbing of the hair and skin of the head, but in actively and rapidly moving the scalp to and from the bone, combined with a certain amount of pressure. By this kind of massage the nutrition of the entire skin is promoted, including the nerves, the capillaries, the rete mucosum, the hair follicles, the sudoriparous and sebiparous glands. This massage, when properly carried out, exercises also a beneficial influence, though perhaps only to a slight degree, on the nutrition of the skull itself, and may thus somewhat counteract the tendency to atrophy of the parietal

walls. We have further succeeded in many persons not only in preventing the loss of hair, but also in checking certain forms of headache by this daily massage of the scalp, which may conveniently be practised after or before the bathing of the head.

XV.—Importance of the Glandular Organs.

Considerable additions to our knowledge have been made during the last twenty-five years by the attention paid to the functions of *various glandular organs*, and especially the so-called *ductless glands*. What we know as yet is still very imperfect, but clinical observation and experiment have already clearly demonstrated that these organs exercise vast influence on the development, on the metabolism, and on the health of the whole organism. This is particularly the case with *the thyroid and parathyroid glands*. The diseases and the extirpation of these organs produce remarkable changes in the whole body, especially in the functions of the nervous, circulatory and cutaneous systems. As some morbid symptoms observed in old age seem to depend on pathological changes in these glands (Horsley [54 and 55], Ewald [35 and 36], Lorand [72] and

others) we must endeavour to maintain them as long as possible in an effective state and avoid their atrophy. This consideration, and especially Kocher's observations on the removal of goitre, led me to begin many years ago regularly to massage my own thyroid and parathyroid glands, together with the larynx and the anterior part of the neck (the latter with the intention to maintain a healthy condition of the blood-vessels and nerves of this region), and to advise many of my patients to do so. This practice, I think, has been attended with distinct benefit in several cases which had manifested symptoms akin to those of myxœdema, such as puffiness of the face and hands, rapid falling out of hair, great dryness of the skin and mental hebetude. The massage of the thyroid and parathyroid region was gradually followed by the disappearance of these symptoms, and this without the assistance of thyroid extract. The involuntary muscular twitchings of the face and neck and actual convulsions which occur in some old people may possibly be due to senile changes in the parathyroid glands, and these, too, I have seen checked more or less by massage of the laryngeal region.

We are not able to massage all the lymphatic

and other glands of the body as thoroughly as the thyroid and parathyroid, because most of the others do not lie so near to the surface. The glands situated in the abdominal cavity—the mesenteric glands, the spleen, the liver, the pancreas, the kidneys and suprarenal glands—can to some degree be influenced by massage of the abdomen, but not sufficiently. Some beneficial influence also is effected by the walking exercises, by the regular practice of abdominal pressure (p. 141), and also by the respiratory movements which have been previously mentioned, when combined with thorough compression of the abdomen. More amenable to this mechanical treatment are the parotid and the submaxillary glands, which in some persons of advanced age lose their natural energy and secrete a viscid fluid instead of healthy saliva.

As the human organism is one whole, in which every single organ is more or less intimately connected with the rest, the health of the whole organism depends to some degree on that of every single part. Each single part ought, therefore, to be attended to for the benefit of the whole. It is, however, not in our power to do this efficiently. Thus the *special senses* which exercise great influence on

the brain by the impressions which they convey to it, are apt to decay with advancing years, and our power to prevent this is very limited. By carrying out the rules for maintaining the energy of the circulation and nutrition of every single part of the body and preventing diseases, we exercise also some beneficial influence on the special senses; but still they are apt to become old and blunted. Massage of the eyes, the ears, and the nose can do a certain amount of good, mostly that of the eyes; and by using them judiciously and avoiding overstraining them, we can prolong the energy of their functions and thus prevent, or at all events postpone, one of the greatest inconveniences naturally connected with old age.

XVI.—Prevention of Disease.

I have said before that *prevention of disease* is one of the means of prolonging life (p. 18 and p. 93). A frequent source of disease is infection. This is generally known, but the duty of avoiding exposure to infection is often neglected, even by most intelligent persons. I cannot enter here on the duty of the State and of the community to combat the spreading of infectious

diseases ; this is being more and more recognized and acted upon, but also every single individual ought to consider it his duty not to expose himself to infection, and, if himself infected, to avoid every possibility of carrying infection to others. Sir Lauder Brunton, in his interesting and suggestive address on "Longevity and the Means of Attaining It" [15], justly directs attention to the great infectiousness of common colds and the duty of evading as far as possible the communication of them to others, especially to those who are weak either from disease or from old age ; for a so-called common cold, which most people consider a trifling matter, may under such circumstances become the cause of death. I have myself seen this from a common cold, and more frequently from influenza, which had been regarded as a small matter. Sir Lauder Brunton also points out the duty of disinfecting oneself after contact with cases of infectious disease, before visiting others, especially weak or diseased people.

One of the most important measures towards the prevention of disease and of injurious habits, and also towards promoting healthful influences, is *education*. We all must hail the steps which are being taken in schools to promote a general

knowledge of hygienic influences such as food, exercise, and good air, but we must add to them the duty of imparting some elementary knowledge about prevention of disease and of spreading infectious diseases. A most necessary point in education is the teaching of temperance, especially with regard to the consumption of alcoholic beverages, and the fearful consequences of intemperance, not only to the intemperate person himself but to the happiness and health of his family and the tendency to commission of crime.

Amongst the important matters into which I am unable properly to enter is the *clothing*, which ought to cover the body without being too tight, and ought to be varied according to the different meteorological conditions. It is essential to the maintenance of health, especially in very young children, old people, and all those whose vitality is lowered, to keep the skin warm; to the neglect of this rule many illnesses must be attributed. This is shown by every-day experience, and explained by Pasteur's experiments on fowls in relation to anthrax (p. 191). The clothing, however, ought not only to keep the body warm, but it ought to be arranged in such a way that

it allows free movement to every part of the body, that it does not by pressure hinder the action of the organs of the chest and abdomen, as tight and badly arranged corsets do, or of the feet by badly fitting boots, or of the veins of the legs as is done by tight garters, or of those of neck and face by tight collars, &c. Sir Frederick Treves has given valuable advice in his article "On the Influence of Dress on Health" in the "Book of Health" [123].

An equally and even more important subject is the *house* or the rooms we live in, which ought to be light, airy, and well ventilated, and ought to have a sunny aspect (*cf.* p. 19, footnote). On this we may refer to an article by Sir Shirley Murphy, "Health at Home" [82], contained likewise in the "Book of Health."

Of great influence on the condition of the body is *climate*. This vast subject, too, we cannot adequately discuss. We must mention, however, that a regular "*change*" for six to eight weeks every year from one part of the country to another, or to the seaside, or to the Continent, to different elevations above the sea, is a great help to mind and body, and through this, a powerful agent in the prolongation of life. The exact choice depends on the condi-

tion of the individual; but a necessary condition in this choice ought to be that the locality selected enables the aged person to be long in the open air and to take regular exercise. On some persons a stay at the seaside, or yachting, or a longer sea voyage, exercises the best influence; on others a stay in a warm and dry climate, such as Egypt; on others a stay in mountainons districts at various elevations, combined with moderate climbing; for others, again, travel from one place of interest to another is preferable to a long stay at the same place.

Travelling is, in fact, a great promoter of longevity, especially by preventing premature senile decay. I am inclined to ascribe the benefit of travelling partly to the circumstance that the traveller is forced to change more or less his habits while travelling; partly to the influence on the mind, to the diversion of his thoughts from himself and the daily worries to new things and matters of general interest.

Old people whose mental activity begins to be stagnant ought to go to localities where their attention is stimulated by art, by history, by scenery, and by the manners of the people, such as Egypt, Rome, Naples, Palermo, Florence,

Venice, Athens, Constantinople, Vienna, Munich, Berlin, Paris, &c., provided judicious care is taken to avoid chills and other injurious influences, and provided a moderate amount of resisting power is left.

It ought to go without saying that in travelling it is necessary to avoid draughts and dust in railway carriages; and that at most foreign places one has to be on one's guard against the risks of infection from drinking water, from food, and from unhealthy habitations.

With increasing years the resisting power of the organism decreases, in some more and in others less, in some earlier, in others later. While in youth and in the prime of life the cold, the dampness, the high winds, the fogs and mists are fairly well borne, they cause in many old people, especially those who neglect regular open-air exercise, and also in persons weakened through acute disease (such as influenza, rheumatic fever, pneumonia, &c.), catarrh, bronchitis, rheumatism, mental depression and other ailments, and through these lead to premature senile decay and death. Warming the dwelling-rooms, the passages of the house, the water-closets, and adopting warmer clothing are useful, but are often insufficient to

counteract the inclemencies ; it is therefore prudent for many of those who have lost much of their resisting power, to spend the colder months in milder climates, where their accomodating powers are less tried, such as the south and south-west of England and Ireland, and still more so the Riviera, especially the drier, the more quiet and more elevated region of Grasse, where, owing to the greater dryness of the air and the large proportion of sunshine, chronic rheumatism, a frequent trouble of the aged, is much relieved, where the appetite, the inclination and power to take active exercise are increased, and through this the muscular and circulatory system are maintained in a fairly vigorous condition ; Venie shares to some degree these advantages. In the south-west of France, Pau and Arcachon have advantages, while Biarritz is rather too windy for the aged. In Spain, Malaga offers a fairly high temperature. Egypt, Algiers, Madeira, Teneriffe, and Corfu can only be recommended to those who, in spite of advanced years, have remained good travellers, and especially good sailors. The large amount of sunshine in some of these localities, the longer duration of daylight during the winter months, and the flowers, cheer the mind and render it

more hopeful, and hope and cheerfulness exercise, we repeat, a most beneficial influence on the whole body. The first Lord Brougham showed his wisdom in this matter by spending the winters of his later life at Cannes, where he enjoyed much better health and prolonged his life considerably.

With regard to the injuriousness of *cold*, *i.e.*, low temperature of the air, slight, when combined with stillness of air, but great when combined with wind, Sir Lauder Brunton directs attention [16] to an ingenious experiment by Pasteur, "who discovered that fowls, the natural temperature of whose body is nearly 104° F., are immune from anthrax, but if they are made to stand with their legs in cold water until their temperature is sufficiently lowered, they become susceptible to the disease." We know that we often carry with us in the mouth, in the nose, and in other parts of the body, the germs of diseases, without becoming infected by these diseases while we are in robust health, but when our vitality is lowered by exposure to cold, we become apt to take the disease. Our experience of every day shows this especially with regard to pneumonia, influenza—so-called

"colds," &c. Pasteur's experiments clearly give the explanation. To pneumonia the aged are especially liable, and this disease is often fatal, and the anti-pneumonia serums are often without avail.

XVII.—Recapitulation.

There are some other subjects which deserve discussion, but I have already transgressed the limits of time, and I trust that if the suggestions I have ventured to make are acted upon, with adaptation to the different conditions of persons and surroundings, the life of the individual will be prolonged, and that in the course of generations a habit of living judiciously will be created and transmitted from parents to children, and that the duration of human life will gradually be raised in a much larger number of cases to its normal term, viz., about 100 years; and I further hope with Sir Crichton-Browne, Professor Metchnikoff, Sir Lauder Brunton and others that not only the duration of life will be extended, but that also its usefulness will be prolonged, its happiness increased and terminated by old age and death without suffering.

I will close this discourse by summing up some of the most important points more fully discussed before :—

(1) To maintain the vigour of all the organs, the general vitality and resisting power of the body by regular daily walks, rides, respiratory and other exercises.

(2) To practise moderation in eating, drinking, and all bodily enjoyment.

(3) To endeavour to obtain abundance of pure air in the house, and to spend three or four or as many hours as possible every day in the open air.

(4) To counteract the inherited tendencies to various diseases.

(5) To create, as far as possible, the habit of going early to bed, and of rising early, and to restrict the hours of sleep, in adult life, to six, or seven, or exceptionally eight.

(6) To promote a healthy condition of the skin by daily baths or ablutions.

(7) To keep the mental faculties in regular occupation by appropriate work.

(8) To cultivate sympathy, equanimity, contentedness, cheerfulness and hopefulness, and the great power of the will towards pursuing the path of duty and controlling anger, vanity, envy, jealousy, and all other passions.

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