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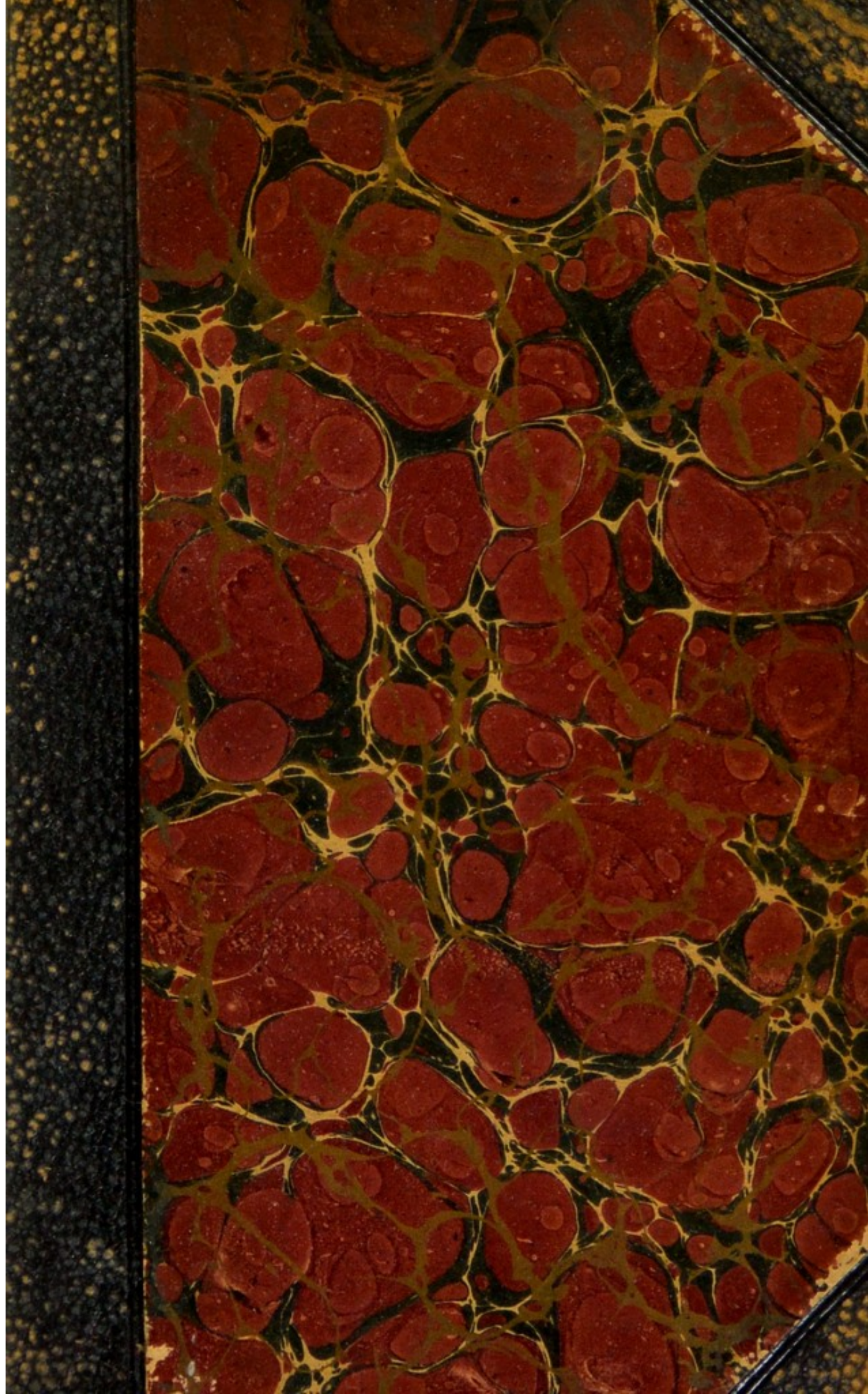
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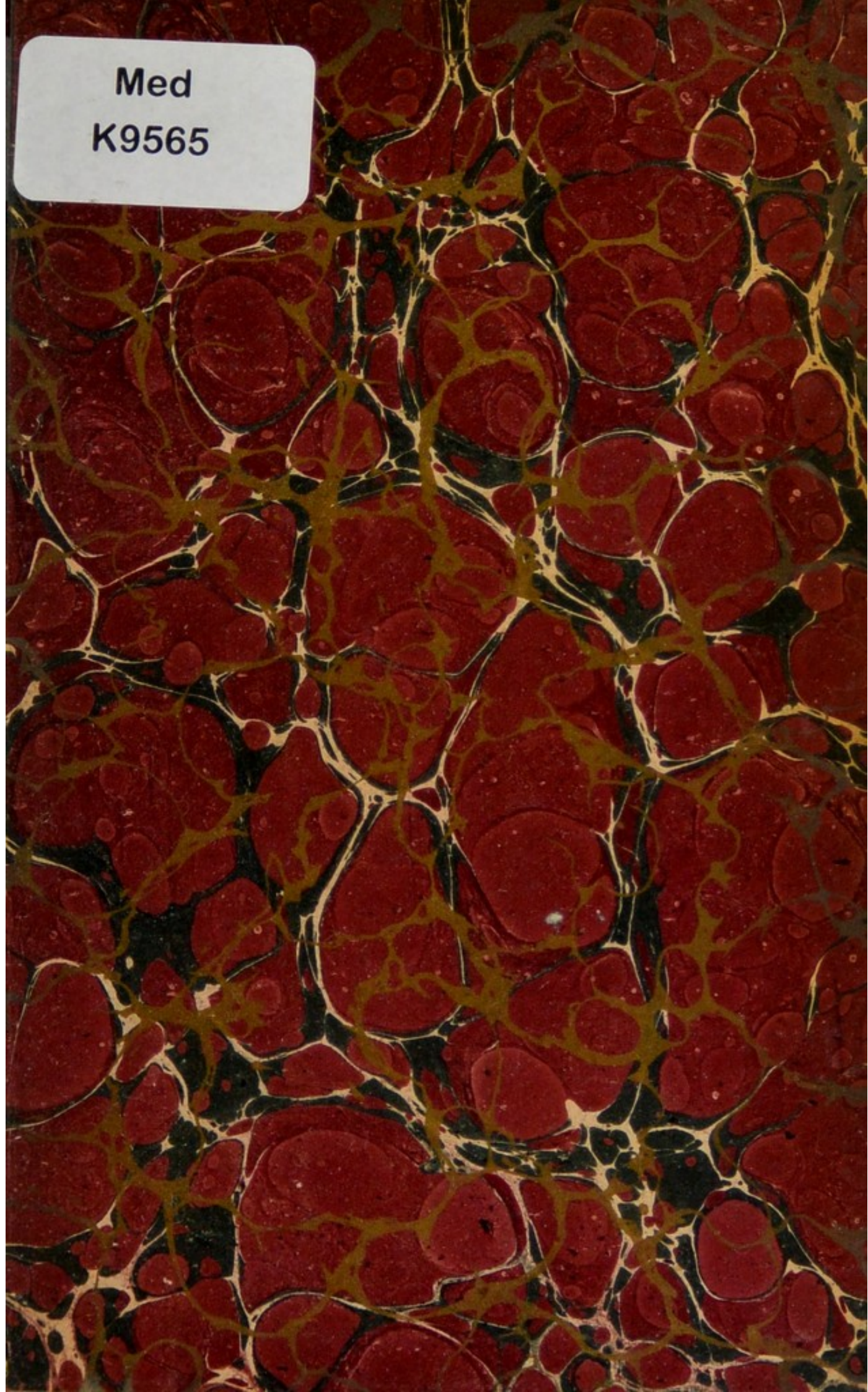
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To a Mother Article,
with the regards of
Lewis R. S. Tomalin.

"The first wealth is Health."—EMERSON.

HEALTH-CULTURE

BY

GUSTAV JAEGER, M.D., STUTTGART,

Professor of Zoology and Physiology.

Translated and Edited by

LEWIS R. S. TOMALIN.

ABRIDGED AND REVISED EDITION.

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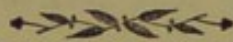
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PREFACE.



"**P**HYSICIAN, heal thyself!" This inward monition first started me on the special path of investigation which has led to the results recorded in these pages. In my youth I was an active, vigorous athlete, but before I was thirty an injury to the leg, accompanied by blood poisoning and followed by varicose veins, rendered all strenuous exertion painful, and condemned me in an ever-increasing degree to a sedentary life. As a consequence, I gradually grew fat and scant of breath; my digestion was disturbed; I suffered from hemorrhoids, and was troubled with a tendency to chill diseases. While my health was in this state I was appointed to lecture on anthropology, in addition to my course on zoology, at the Royal Polytechnic School, Stuttgart. Conformably to my invariable rule to proceed not merely theoretically, but also practically, in whatever I undertake, I determined to choose for my lectures on anthropology the subject of "Health Culture." But here it seemed to me, sick man as I was, that my lecturing on health was as though a bald-headed person should extol the virtues of a patent "hair restorer," and this feeling inspired my endeavour to heal myself with the energy requisite to the success which I have achieved.

My success, however, was not attained all at once, and the various short essays, printed in their chronological order, which appeared in the earlier editions of this work, afford to some extent a chart of the route by which I gradually arrived at the reforms embodied in my Sanitary Woollen System.

Since these essays were written, the popularity of my reforms has advanced with giant strides, and the experience of many thousands of wool wearers in every country and climate under the sun has added new and valuable information as to the hygienic worth of my System, which has the happy faculty of attracting the enthusiastic interest—I had almost said affection—of those who adopt it.

The present book is practically divided into two parts, the first containing a detailed description of my Clothing and Bedding Reform, and the second, various short essays dealing in a popular manner with questions of hygiene which are of general interest.

The Company which represents my System in the British Empire, has received many gratifying testimonials, but, I would draw especial attention to the experiences of Mr. Stanley, in Africa, and of Miss Marsden, in Siberia. They will be found on pages 158-159 of this volume, and they afford striking evidence in favour of my contention that the Sanitary Woollen Clothing is eminently adapted for wearing in hot countries, as well as in cold, and, *à fortiori*, in our changeable European climates.

G. JAEGER, M.D.

CONTENTS.

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CHAPTER	PAGE
1 THE SANITARY WOOLLEN SYSTEM	7
2 THE STOCKING (OR SOCK)	12
3 THE BOOT AND SHOE	14
4 THE TROUSERS OR BREECHES.—I.	19
5 THE TROUSERS OR BREECHES.—II.	25
6 THE UNDERCLOTHING	29
7 THE COAT	33
8 THE WAISTCOAT AND OVERCOAT	38
9 THE HEAD-COVERING	41
10 THE COLLAR AND CUFFS	45
11 THE HANDKERCHIEF	48
12 WOMEN'S CLOTHING	49
13 THE CORSET	52
14 THE TREATMENT OF INFANTS	53
15 SUMMER AND WINTER CLOTHING	58
16 THE SOLDIER'S UNIFORM	60
17 SANITARY BEDDING AND BEDROOMS	75
18 THE OPEN BEDROOM WINDOW	81
19 THE CLEANLINESS OF THE SANITARY WOOLLEN SYSTEM	83
20 THE CLEANSING OF THE OUTER CLOTHING AND BEDDING	84
21 SANITARY COLOURS OR DYES	88
22 TECHNICAL DIFFICULTIES	93
23 THE RANGE OF THE SANITARY WOOLLEN SYSTEM .	98
24 EFFECTS OF EXCESS OF FAT AND WATER IN THE TISSUES	102
25 THE CAUSES OF DISEASE, AND DISEASE GERMS .	107

CHAPTER	PAGE
26 THE SPECIFIC GRAVITY OF THE BODY	119
27 BATHING AND TREATMENT OF THE SKIN	128
28 THE AIR IN ROOMS	131
29 HOSPITAL CLOTHING AND BEDDING	141
30 THE PLATINUM DEODORIZER	147
31 TROPICAL CLOTHING	150
32 CAMEL HAIR	159
33 GIRDED LOINS	161
34 WOOLLEN CLOTHING FIRE-PROOF	168
35 THE ADULTERATION OF WOOL WITH COTTON	169
36 EATING AND DRINKING	170
37 HEALTH RECUPERATION	178
38 HYDROPHOBIA AND THE SWEATING TREATMENT	183
39 NORMAL DURATION OF HUMAN LIFE	187

I.—THE SANITARY WOOLLEN SYSTEM.

WHEN I determined, as mentioned in the Preface to this Edition, to study the subject of Health Culture with the view to restore my own health, the comparison which, as a zoologist, I naturally instituted between the average health of civilised man and that of the animals was very much to the advantage of the latter.

Animals suffer in a greatly less degree than man from a variety of diseases which affect the organs of respiration and digestion, and are usually free from such complaints as gout, rheumatism, corpulence, &c. Yet they are in general much more exposed than man to the influences of wet, cold, and climatic changes. In the course of my inquiry into the reasons for this comparative immunity of the animals from the common ailments of man, the following considerations were impressed upon my mind :—

Nature has clothed the animals. Man clothes himself.

Animal Wool, which Nature has created to clothe an animal body, is the "survival of the fittest" clothing material.

Vegetable fibre (linen and cotton) is not a *natural* clothing material, and is only used as such by Man.

Here I had obtained an important clue to the problem which I had set myself to solve, and the further I

investigated and experimented, the more clearly I realised the infinite divergence between materials of animal and vegetable fibre in respect of the two primary services which clothing should render to the body, viz :—

To keep the skin *uniformly* warm.

To allow a free outlet for the exhalation of watery vapour from the pores.

That the vegetable fibre of linen and cotton cannot maintain uniform warmth of the skin is theoretically evident from its readiness to conduct heat, and practically my readers know that it sets up a feeling of chill directly it becomes damp upon the skin.

That linen and cotton hinder, instead of assisting, the passage of the exhalation from the pores into the outer air is equally well known in practice, especially to everyone who has worn flannels for athletic exercise, and has contrasted the difference in this respect of animal wool. The linen or cotton shirt quickly becomes saturated with perspiration, and clings to the skin, keeping it wet and chilled, thus repressing the exhalation ; while the perspiration passes freely away through pure, porous wool, leaving the skin warm and comparatively dry.

Before I had fully recognised the hygienic value of covering the body solely with material of animal wool, I had arrived at the conviction that much of my own chronic ill-health, and of that of mankind in general, was due to the effects of an accumulation of fat and water in the tissues, as set forth in chapter 24 of this work. This I at first endeavoured to combat, both in my own person and in my recommendations to others, by strenuous bodily exercise, with a view to cause the pores of the skin to exhale more freely, and thus, as it were, to drain the tissues and harden them. I found, however, that the effects were at best temporary. Every forcible remedy

adopted produced a slight diminution in the measurement round the body, but as soon as I ceased the special cure I returned to my former size. Moreover, the strenuous exercise treatment is impracticable in the case of the weakly, the old, and of those who are engaged in sedentary pursuits.

When, however, I recognised that it was possible so to assimilate human clothing to that with which Nature has endowed the animals, as to render it—

Pervious to the skin's exhalation,
Non-conductive of heat, *i.e.*, not chilling,
Closed against draught of air, *i.e.*, protective against local chill,

I had discovered the reforms in Clothing and Bedding which are comprised in my Sanitary Woollen System, and I had provided means whereby the tissues may be automatically drained, and *kept drained*, of the excess of fat and water which does so much mischief when its excretion is repressed by covering the body with unsanitary materials.

It is most important to bear in mind that it is not enough to wear wool next to the skin, and any other material over it. If at any point underclothing, or lining, or padding, or stiffening, of vegetable fibre, or of silk, intervene between the body and the outer atmosphere, an obstacle is set up to the free passage of the exhalation from the skin, with the result that the exhalation settles in the vegetable fibre, which consequently becomes malodorous, and prejudicial to the health. Moreover, not only is the health prejudiced by even a partial use of unsanitary material, but the feeling of lightness and comfort which ensues when the exhalation from the pores can get freely away—preventing the oppressive sensation of heat due to its retention—is sacrificed when,

for instance, the woollen shirt is covered by a waistcoat which is lined and backed with impervious cotton material.

All material, therefore, manufactured of or adulterated with vegetable fibre should be discarded, whether in the form of underclothing, or of linings or pockets, &c., in the outer Clothing. The same principle holds good for the Bedding, as is explained in the chapter devoted to that subject.

Having thus shortly indicated the general lines on which I base my Sanitary Woollen System, I will, before entering on the explanatory details contained in the following pages, make a few observations which will serve as guidance to those who wish to make trial of its benefits in their own person.

The most favourable season for adopting the System is spring or early summer (April to June), but this does not imply that a beginning may not be made at another time of the year.

As regards the bedding, the first and chief step costs nothing. All covering other than wool should be promptly discarded. The cotton counterpane and the linen sheet are practically impenetrable obstacles to the escape of the exhalation from the pores constantly given off by the sleeper. Sleeping between the blankets will be found, after a very little time, to be much more comfortable and refreshing than between sheets of vegetable fibre. The whole question of sanitary sleeping arrangements is dealt with in Chapter XVII., to which I refer the reader.

The opinion is sometimes expressed that the Sanitary Woollen System is very expensive; this is a mistaken notion. Nearly everybody wears woollen outer-clothing, and this can be easily improved. By simply removing the faulty lining and padding from the woollen outer-

clothing,* quite a respectable beginning is made towards adopting the System ; and as no woollen lining need be substituted the coat being left unlined, the question of cost does not arise. The old apparel can thus be altered and worn out ; and although this plan does not secure the whole benefits of the System, yet, as compared with the previous clothing, no little progress will have been made.

The Sanitary Woollen System does not develop its full effect at once, but requires time. Absolutely permanent health is no more to be expected of the Sanitary Woollen System than is perpetual existence ; on the other hand, the wide experience now obtained justifies the assurance that disturbances to health are much less frequent, and when an illness is through some cause contracted, it passes off much more rapidly, and very seldom merges into chronic disease. Moreover, and this is the main point, the feeling of health, buoyancy, and vigour usually attained is such as is almost wholly unknown to those who are not sanitarily clothed.

I will now discuss the separate articles of clothing, etc., in connection with my System, in their order, proceeding from the foot to the head. I shall mainly deal with men's clothing, as most requiring reform, and will afterwards mention ladies' and children's clothing, in so far as it differs from men's.

* I recommend my readers to perform this instructive operation for themselves, as their eyes will then be opened to the unsanitary nature of ordinary outer-clothing ; the commonest rubbish of vegetable fibre is usually employed for padding, and even for stiffening and lining. After a coat has been worn some time, these materials become a perfect Augean stable of evil odours, which are inhaled by the wearer whenever they are given off, as may be easily proved by damping the material and then passing a warm iron over it.

II.—THE STOCKING (OR SOCK).

THE proper covering of the foot is of great hygienic importance. This is expressed in the general dread of cold feet—*i.e.*, of the withdrawal of blood from the feet—and is fully justified by the part played by the feet in the distribution of blood in the body. The first consideration in properly clothing the foot is the stocking (or sock).*

The material should consist of undyed wool, or, if dyed, the sole should be of Natural colour. Having regard to the great importance of the flow of blood in the skin of the foot, no other material is suitable, and precisely those who are otherwise Woolleners should least of all wear stockings of vegetable material; it is also evident that the considerable exhalation from the foot renders inferior dye in the stocking especially injurious, as ample experience has fully established. It is further important that the stocking be roomy (compare what is said on this point with respect to the shoe), soft, and pervious. In order to maintain these qualities in the stocking, it is necessary that the instructions as to washing (see remarks on this subject) be carefully observed. A woollen stocking which is wrongly handled shrinks, and when made of strong wool becomes as hard as a board and an instrument of torture for the foot, especially for the toes. Under such conditions the skin must necessarily suffer from perspiration, pressure, and evil odour. I particularly recommend those who have sensitive feet, and indeed everybody, to use the toed-stockings—*i.e.*, stockings provided with a separate receptacle for each toe, like the fingers of a

* The stockings may be long or short, but in the former case they should never be kept in place by tightly fitting garters, stocking suspenders should be used.

glove. The objectionable condition of the skin between the toes, which no amount of cleanliness and care can wholly avert, and which frequently causes soft corns, and even sores, is due to the inability of the perspiration to escape when the surfaces are in contact. The interposition, in the five-toed socks, of a layer of woollen material between each toe absorbs the perspiration and rapidly effects a remarkable change. The skin between the toes becomes dry and wholesome, soft corns disappear, and the squeezed, crippled appearance of the toes greatly alters for the better. The toed-socks are especially recommended to persons who suffer from perspiring feet, and their value has been gratefully recognised by many people.

I take this opportunity to interpolate a few words respecting the treatment of perspiring feet. Whoever suffers from this troublesome complaint should wear sanitary stockings and shoes, and should from time to time wash the feet in cool water, afterwards rubbing in an unguent. Of course the stockings must be frequently washed, which if done at not too high a temperature, and without rubbing, so far from injuring them, improves the texture of knitted material. In the shoes should be movable woollen soles, which may be occasionally washed. So long as these are free from odour the foot is also free, and the stocking. This method involves no suppression of the perspiration, which would be distinctly injurious, but causes it to more freely evaporate, so that it does not become mal-odorous, while the skin is so strengthened that the corroding action ceases.

III.—THE BOOT AND SHOE.

THE disregard of sanitary considerations in the material and construction of ordinary clothing is especially remarkable in the matter of the covering of the feet. It is true that remonstrances have at times been made against the senseless fashion of narrow pointed boots, which so squeeze and distort the foot as in some cases to force one toe over the others ; and high heels have been freely denounced. But the efforts of reformers of our boots and shoes have been almost exclusively devoted to the *shape* : the *material* has escaped their observation. Yet it is to the material of the boot that much of the misery which so many victims suffer with their feet is due, as a very little consideration of the matter will serve to show. The feet are as sensitive, as much composed of flesh, blood, and porous skin as any other part of the body ; but who would dream of clothing any other portion of his frame in impervious leather, which is frequently saturated with the moisture exhaled from the skin, and is never washed ? The burning, swelling, and other uncomfortable sensations of the feet in summer, and their icy chilliness in winter, proceed from the same cause—viz., the improper material with which they are covered. Imprisoned in impervious boots and shoes made wholly of leather, usually lined with cotton material, the feet cannot, so to speak, *breathe*, but remain bathed in the exhalation and moisture which they so freely secrete through the pores, and which cannot escape. Hence the mal-odorousness of the ordinary boot, which amounts to a positive nuisance in cases of people who are said to suffer from “perspiring feet,” notwithstanding every precaution of cleanliness. Obviously no boot, however anatomically correct its shape, can claim to

be really sanitary or hygienic unless it permits the foot to "breathe."

In this respect wool is the most suitable material, in so far as it can be used, and boots made entirely of wool are absolutely the healthiest of foot coverings. That such entirely woollen boots are possible, not merely for indoor wear, but for walking, is proved by the fact that in many Slavonic countries and in China such shoes are continually worn through dirt and dust, in summer and in winter. In view, however, of the objection that boots made entirely of wool will not satisfy modern requirements as regards elegance and solidity, it is interesting to consider how far other materials may be used conjointly with wool in making boots which deserve the title of Sanitary. The disadvantage of buckskin leather for this purpose is that it soon becomes dirty; but unlike wool from which dirt can be brushed, buckskin leather can only be cleaned by washing, which, if done carelessly, renders the leather afterwards hard and stiff. The moccasins of the Indians in North America are made entirely of buckskin leather, and to this fact may perhaps be attributed in some degree the swiftness of foot for which they are remarkable.

The material which best satisfies all requirements is tanned leather, although as ordinarily used, it is impervious to the exhalation of the foot, and becomes malodorous.

Tanned leather can be improved by washing out the residue of the tan with soda. To make the shoe as healthy as possible, and yet in harmony with modern requirements as to shape and durability, wool and leather may be used conjointly, so that the sole and golosh are made of tanned leather, while the upper parts and the linings, as well as the inner soles, are of woollen material. Woollen stockinet or diagonal cloth is very suitable, both for out-

door boots and for house shoes and slippers. The use of the woollen movable soles already referred to is very strongly to be recommended ; and these should at times be changed so that they may be purified and freshened by exposure to sun and air.

The boots should be shaped to prevent the toes from being squeezed together ; it is especially important that the big toe is not pressed against its neighbour, but is encouraged to lie in a straight line drawn from the heel to the root of the great toe. The heel of the boot should be low and broad. If there are no special reasons to the contrary, arising from road or weather, low shoes should be worn, as they afford additional facility for the exhalation of the foot to escape, and at the same time strengthen the ankle, by depriving it of an artificial support which in reality interferes with its free action.

Very pleasing styles of boots and shoes, suited to different requirements or tastes and conditions of road or weather, can be made in accordance with the above principles. Slippers for indoor use, low shoes, to lace or button, for summer and dry weather (these can be made either entirely of cloth or with a leather golosh) ; boots of cloth, to lace or button, with or without leather golosh, and with thick soles for very wet weather, shooting, etc. A change of shoes is desirable, even from an economical standpoint, and it is certainly best to have a variety corresponding to and fulfilling various needs, from a shooting boot to a ball shoe.

It should be remarked, however, that woollen boots and shoes without any leather golosh are perfectly suitable and safe for wet weather ; in some countries woollen shoes are always worn, and I have tested them myself thoroughly ; the wetting of the wool does not chill the feet, the heat of which promptly evaporates the moisture

from the covering, which therefore soon dries. Those, however, who for various reasons may deem woollen boots unsuitable will derive great advantage both in health and comfort from adopting shoes with woollen upper parts and linings, and leather golosh and sole. None but the best blacking should be used to the golosh, and the leather should from time to time be treated with the special dressing, which preserves it, and prevents it from becoming hard and stiff.

It is quite a mistake to suppose that the woollen cloth (or cloth and leather) boot with woollen lining is "hot." If the feet can exhale through their covering they will keep comfortably cool; while the non-conductive nature of wool retains the natural heat of the foot in cold weather, and protects against that direst of discomforts—cold feet. It is of great importance that the cloth and lining material should be either undyed, or be treated only with dyes of a harmless nature.

A notable feature in the sanitarily-constructed boot is the construction for ventilating the sole of the foot. The woollen inner-sole rests on a *perforated* leather inner-sole, beneath which a piece of pure woollen felt extends the entire length of the boot: through this woollen material the exhaled vapour can pass away, by means of an outlet to the open air provided in the heel of the boot.

CHILDREN'S BOOTS AND SHOES.

Attention should be called to the fact, that in the infant's or child's foot the bones chiefly consist of gristle; hence the necessity of properly fitting boots and shoes at a period when the development of the foot may easily be stunted or distorted. There are groups of muscles in the leg, opposed to each other in their action upon the foot; in infancy the muscles are not yet under control, and the

muscular movement necessary in walking is only attained after long practice. The tendons or leaders of the legs and feet consist of strong, tough, white fibres (similar to those found in the leg of a fowl), which are connected with the muscular fibres at one end and the bones at the other. The objects of boots and shoes are twofold—(1) to protect the foot from injury in walking, (2) to protect it from the inclemency of the weather, and it should be clearly understood that only the sole of the foot requires protection, and that leather is not necessary for the lower part of the boot. Boot and shoes made with cloth uppers and a leather or kid golosh are most suitable for children's use; and it is absolutely necessary to allow perfect freedom of action to each and every one of the many parts which go to make up the human foot. A glance at Fig. No. 1, of a normal or natural shaped foot, will suffice to show that boots and shoes with pointed toes are an abomination, false in theory, false practically, and destructive not only of the ease and comfort of those that wear them, but sooner or later of their walking powers.

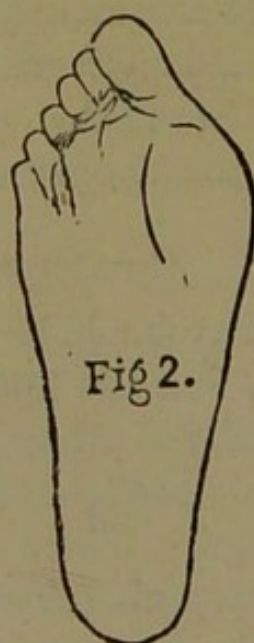
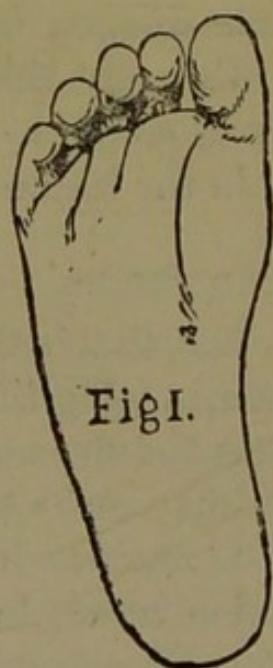


Fig. No. 2 shows the injurious effect of pointed toes, or of badly fitting boots or shoes ; the great toe is diverted from its natural direction, rendering it almost useless as the chief member of the human foot.

The usefulness of the great toe and thumb may be gathered from the fact mentioned in the Bible, that the Jewish warriors used to cut off the thumbs and great toes of their prisoners, in order to render them unfit for further service. (*Judges*, Chap. i., verses 6-7.) The importance of putting children's feet in boots and shoes that are really sanitary, both in point of construction and of porous, yielding material, cannot be exaggerated, and I strongly commend the subject to the consideration of parents who desire a better fate for their children's feet than the partial crippling which probably they themselves have suffered from.

IV.—TROUSERS OR BREECHES.—I.

THE indignant contempt which I have long felt for the mode in which men are condemned by modern artificiality to clothe their legs has been accentuated by reading a pathetic account of a ball which was given by students at the Tübingen University. It appears that a large number of the ladies present were forced to sit inactive, not because there was a lack of men, but because the men lacked inclination to dance. The contrast between the general inclination of maidens to dance and the frequent disinclination of the other sex, must have some other and deeper foundation than that modern young men are wanting in the necessary good will and sense of duty. I am strengthened in this belief by observing the effort which it costs even the ardent and practised male dancer to keep pace in point of endurance with ladies who are fond of dancing. I maintain

that, given equally good constitution and health, every lady can wear out her partner, and the reason of this (for men) ignominious fact, is that the costume of males is much more prejudicial to the physical energy and power of performance, and therefore much less healthy than that of females. It completely reverses in this respect the normal relation between the stronger and the weaker sex, and I propose in the following comparison between male and female costume to make this clear.

To commence with the colour : the contrast, particularly in dancing assemblies, is most pronounced. The female dress is of white or some other light colour, while the men adopt the laming, energy-destroying hue of mourning : thus the costumes of the two sexes are as opposed and as little in harmony as black and white. There are, however, different grades of male dancers, and the odds are great that if one be found who dances gaily through the whole programme without sign of fatigue, he is a soldier, clothed in his indigo-blue, red, or white uniform.

The second reason I consider to be the manner of clothing the legs, and this is very important. The long dress reaching nearly to the ground, undoubtedly constitutes an impediment to movement which places women at a disadvantage compared with men ; and if, notwithstanding, the former are more active dancers, the importance of properly clothing the legs becomes additionally clear.

Apart from the petticoats, the female lower limbs are clothed in drawers terminating at the knee, close-fitting stockings, and low shoes, in fact just as the male legs were clothed up to the present century, and are still clothed in the Tyrol and in the higher parts of Bavaria ; and as has of late years again come into vogue for tourists, cyclists, and others who strenuously exercise their legs. Those who adopt this costume are well aware that it imparts to the

legs very different powers to those conferred by the modern trouser.

Let us briefly examine the history of the trouser.

We know from pictorial representations of the time of Charlemagne that the covering of the legs was then wide, but was bandaged round the leg from below up to the knee, thus preventing the current of air which ascends the open channel of the modern trousers, with most prejudicial effect to the legs.

To this costume, which is found at the present day among the Italian Pifferari, succeeded the tight hose of stockinet, fitting closely to the entire leg, like an elongated stocking, and forming a main feature of the beautiful costumes of the Middle Ages. These are the costumes which now-a-days we can only platonically admire and envy, when we see them in the theatre or the circus, where the foot athletes *par excellence*—the rope dancer and the acrobat—wear them ; but we draw them from their hiding places again whenever, as on the occasion of historical processions, fancy-dress balls, &c., we are possessed with a thorough spirit of festivity and joy in life, and try to feel that we are indeed made in God's own image, in contrast to our miserable every-day condition, in which we appear as an artificial product of the tailor's cunning. The joy in life and pleasure in the dance which characterised the whole mediæval existence, are inseparable from the dress of those times. One must see the Czardas dancer of Hungary, who still wears the mediæval tight hose, if one would realise how, in the Middle Ages, the drinking-cups came to bear the device :

"Tanzen und springen gefällt von allen Dingen."

(To dance and to spring is the pleasantest thing.)

When the 'Thirty Years' War suddenly extinguished the joyousness of the Middle Ages, the tight stockinet

hose had come to be divided into two parts, knee breeches (*culotte*) and stockings. This was, hygienically, a retrogression, because the knee breeches soon came to be worn wide, and in consequence were unsatisfactory; moreover, the garter and the overlapping of breeches and stocking impeded the equable distribution of blood in the leg. Still, the wearer of the *culotte* was much more hygienically clothed than the *sans-culotte*, who first appeared at the time of the French Revolution. This title was given to the men who discarded the *culotte*, then in general use, in favour of the stereotype trousers of the stage fool—Pierrot, or Pantalone, as he was called in France or Italy—and hence the term pantaloons for trousers, which endures to the present day.

Is it not an ignominy, particularly to the Germans, that they should have sacrificed their noble mediæval costume to the *sans-culottism* which sprang from the eccentricity of the French Revolution? After the adoption of the *sans-culotte* trouser the mode of shoeing the feet quickly became spoiled. Until then the low, light shoe was generally worn, and although it was of leather, it gave considerable opportunity to the foot to exhale; but such shoes soon proved incompatible with the trumpet-shaped trouser. It was found that the current of air drawn up the trouser legs chilled the ankles and knees, and to remedy this the boots were made to reach higher and higher, until they covered the calf inside the trouser, thus depriving the foot of all facility to exhale, with great detriment to its condition and capability. Nor is this all; as not even the high boots could altogether prevent the disagreeable draught of air, drawers were invented, constituting an additional impediment to the exhaling function of the skin, and causing decreased strength and shapeliness of limb. To the mediæval dancing and

springing succeeded a dull inertness, and the form of "God's image" came too often to resemble that of a toad with protruding stomach and rickety legs.

This alteration in the shape of the body occasioned a fresh departure. At the beginning of this century the pantaloons were still quite narrow, but the protruding stomachs and weedy legs made such trousers impossible, and thus arose the present loose shape in which, despite the drawers, there is frequently a chilling current of air.

Women have kept apart from this senseless fashion, remaining true to the culotte, the long stockings, and the light, low shoes, or at least the laced shoe; and thus notwithstanding their long dresses, they can dance with the endurance of a Tyrolese.

It is interesting to complete the comparison between the modern dress of men and women. Women have a further advantage, in that they make a practice of girding the loins. (See "Girded Loins," Chap. 33.) Moreover, the female outerdress usually fits closely, so that no current of air can circulate; the sleeves are generally narrow, and when fashion has occasionally misled women to adopt wide sleeves they have always quickly reverted to narrow sleeves again.

Another advantage is the thinner, and therefore more pervious, fabrics used for women's dresses compared with the stuffs, often of almost elephantine thickness, worn by men. The frequently excessive thickness of men's tailoring materials cannot be sufficiently reprehended; it finds ready support from some cloth-makers, for the thicker the material the more shoddy can be worked up in it. This is a point on which I lay great stress in regard to the Sanitary Woollen Outerclathing, and I take the opportunity to ask adherents of my System to support me in my contention—which is in their own interest—by energetically refusing these elephant hides, and insisting on having porous

materials. Female clothing is thus hygienically better than that of men, and that it is much more tasteful than the latter, which at the present time seems to have reached the acme of tastelessness, cannot be disputed. What I, however, wish to lay particular stress on is, that woman is the mistress of fashion, while man is its slave. Woman never submits long to a fashion, but throws it on one side when it ceases to please or suit her. Man, on the contrary, declares every divergence from the once dominant fashion as "impossible." How much has been written by men against the swallow-tail coat and the tall hat ! Yet to every suggestion that they should give practical expression to these views, the answer is, "It can't be done ; it really can't be done."

Artists are unanimous in condemning the modern male costume, which they never paint unless historical truth requires ; they confine themselves to painting antique or Renaissance, or culottist costumes, the last-named being drawn either from the previous century or from the modern wearers of the culotte, *i.e.*, they paint the national costumes of the mountain dwellers. If, however, an artist were urged to break with the modern trouser costume in his own person and to adopt that which he paints, I believe that he would rather be bled to death.*

* A singularly close confirmation of these remarks was afforded in LORD SALISBURY'S speech at the Royal Academy Banquet, on 30th April, 1887, where he said: "Then consider the costume of the period. Dresses seem to have been selected by the existing English generation with a special desire to flout and gibe at and repudiate all possibility of compliance with any sense of beauty. I am taxing my memory, but I cannot remember any sculptor who has been bold enough to give a life statue of any English notability in the evening dress of the period. (Laughter). I am quite sure that if that man exists he must be strongly tempted to commit suicide the moment his work appears. (Laughter.)"—ED.

In these later days the tendency to the Renaissance may be traced through all industry and handiwork, and in the style of architecture, of furniture, of ornament, of art in general. In the midst of this revival of taste, man in his black coat, tall hat, and elephant-leg trousers stands wholly incongruous, and rendered more hideous by the contrast with his surroundings.

If we thoroughly realise the actual facts, and then consider that this figure of woe claims to be the "lord of creation," we shall be in doubt whether to weep or to laugh. I almost despair of the men, and therefore close these remarks with an earnest appeal to the ladies, in the hope that they may succeed in inducing their mankind to adopt a more sensible, healthy, and tasteful costume.

V.—TROUSERS OR BREECHES.—II.

IF the relevancy to Health-Culture of the æsthetic considerations adduced in the last chapter be questioned, I would say that the connection between them is much closer than is generally supposed; although a more practical reply would, perhaps, be, that attention is often more easily won to æsthetic objections to dress than to those which are based on the laws of hygiene. But the case of that unæsthetic monstrosity, the modern trousers, is still worse when viewed from the sanitary standpoint. By leaving the legs too cold, causing a faulty distribution of the blood, and, consequently, an unequal nourishment of different parts of the body, the modern trousers are largely responsible for the sparrow-like legs and protruding stomachs, which are so common with men, and for the frequent inability or disinclination to walk, run, or jump; further, they are a cause of the hemorrhoids

which set in when the first vigour of youth has passed away, and which are not only exceedingly troublesome, but also a source of weakness. In the reform of men's clothing, the abolition of the roomy trouser should play a principal part, and the greatest energy should be directed to effecting this abolition.

As regards the material of which the outer leg-covering should be made, it of course follows from what has already been stated, that wool must be employed, and in the first rank stands undyed wool; in the second, wool dyed with indigo. It is manifestly especially important that the breeches, which both above and below are in contact with portions of the body which freely exhale, should strictly conform to the Sanitary Woollen System.

The hygienically correct ideal would be breeches of stockinet cloth, fitting closely to the shape of the leg, such as were worn in the Middle Ages, not flapping about the boot (or shoe), but, on the contrary, enclosed by it. This form is much preferable to knee breeches, because at the point where the breeches and stockings meet, there is, in comparison with the other portions of the leg, an unequal distribution of blood. If the lower end of the knee breeches is fastened tightly, the blood is congested; while if the end is left loose, it becomes an air-shaft. It is also important that the breeches should so close in front as to provide a twofold covering for the stomach and abdomen, to ensure the proper distribution of the blood (see page 33). This is valuable for persons who are sensitive in that quarter, or whose digestion is disordered; and it renders good service in dispersing superfluous fat in the region of the abdomen.

The sorry shape, unworthy to be presented to public view, of the legs of the majority of men of the present day will be quoted as an argument against the adoption

of a closely-fitting leg covering. To this objection I reply, first, that the legs would greatly improve if encased in hygienically correct covering ; second, that if close-fitting breeches came to be generally worn, the eye, which, by continually looking on the elephantine trouser, has been perverted into demanding an exaggerated thickness of leg, will become more moderate in its requirement in this respect.

Until public opinion is educated to make this most desirable reform, it is necessary to consider by what expedients the present form of trousers may be rendered as little unsanitary as possible. One such expedient is the trousers worn by officers of the army, which fit closely to the leg as far as the calf, and are fastened by straps under the boot. Another plan is to sew webbings inside the legs of the ordinary wide trousers, fitting closely to the limb, and *preventing upward draught of air*. This simple invention is of great practical use and cannot be too strongly urged upon the attention of trouser-wearers. Many men never wear drawers ; others abandon them in hot weather, or when playing cricket, &c., in flannels. To each and all of these I give the warning that they are running a great risk, especially in a climate which is liable to rapid changes in degrees of temperature and humidity. The loose trouser affords practically no protection to the skin against sudden chill ; but, when webbings (invisible externally) are inserted, this serious danger is entirely obviated. Of course, no expedient is equal to the simple close-fitting breeches, whereby the entire leg is clothed in a manner which is hygienically correct ; moreover, the loose trouser-end, flapping about over the shoe or boot, constitutes a trap for dust and mud, which, from the point of view of cleanliness, must be condemned.

Porous stockinet cloth, or knitted material, is hygienically best for trousers, but one disadvantage of this material must be mentioned, for which there is fortunately a remedy. Stockinet cloth acquires a shiny surface where it is exposed to wear, and is apt to warp, particularly at the knees. Both these inconveniences can be remedied in the simplest manner, by drawing the garment, when it has been worn for some weeks, through lukewarm water, and brushing up the shiny places, while it is still damp, so that the nap of the wool is restored from its compressed state. This causes the meshes to close together, and the unduly distended parts to contract; the garment becomes firmer, more wear-resisting, and again presents a good appearance. This manipulation is further a gain in the direction of cleanliness, and should never be omitted with trousers of stockinet or knitted material.

A very important feature in the trousers is the waistband, which is usually lined with stout cotton material, to strengthen the resistance of the woollen cloth to the strain of the braces. The introduction of vegetable fibre material, with all its objections, is particularly unsanitary and dangerous at this point, where the watery vapour exhaled by the skin should evaporate as readily as possible, and where the clammy chilliness of the ordinary trouser waistband, damp with perspiration, must produce injurious effects.

The necessary resistance to the strain on the woollen cloth can be perfectly well supplied by the Sanitary stiffening canvas, made of pure wool; and there is not a shadow of excuse for the presence of cotton material in trouser-waistbands.

Trouser-pockets should be made of the Sanitary woollen pocketing material, which is especially strong and durable.

The discomfort of the mal-odorous, discoloured cotton pocket is only fully realized by those who have tried the woollen substitute; and indeed, so soon as the attention is awakened to the incomparable advantages of animal over Vegetable fibre in clothing, cotton pockets become intolerable, being felt, when all else is wool, to be almost as impervious and oppressive as a piece of mackintosh.

The trousers may be kept in place by the Sanitary woollen Belts or Braces, or may be so constructed as to be solely supported by the hips. As unsanitary Braces speedily become mal-odorous through the exhalation and perspiration of the body, and are a distinct source of discomfort to those who are otherwise clothed in wool. Sanitary woollen Braces are constructed which possess the hygienic advantage of remaining free from odour, and are not felt to be oppressive and heating when worn over the woollen underclothing.

VI.—THE UNDERCLOTHING.

WHEN I evolved my Sanitary Woollen System the first article to which I turned my attention was the Shirt. None is of more importance, and none stood in greater need of reformation. The Woollen Shirt of that period was made of rough, generally dyed, flannel which, when washed, became more or less like a board; and it was so constructed as to admit a chilling current of cold air to the chest. The number of friends which the Sanitary Woollen Shirt has won for itself renders its recommendation almost superfluous; but the completeness of this work, requires that some space be devoted to it.

The material, as has been already set forth in detail, must only consist of animal fibre. Sheep's wool is especially suitable for Shirts; camel hair is much less

durable, owing to the excessive shortness of the staple. Very important in connection with the Shirt is the question of dye. Varied experience has led to the Sanitary Woollen Underclothing being manufactured chiefly of blended natural-coloured brown and white wools (*i.e.*, undyed and unbleached.)*

As regards the nature of the web, I decided for several reasons, after careful and repeated trials, on Stockinet, which is more porous than flannel, although it must not be too porous and light, like many of the goods made in imitation of the Sanitary Woollen Underclothing, as then it shrinks very much. It is also more supple than flannel, and therefore more durable, and is more agreeable to the skin as it does not become knotty, while it is much less liable to shrink. The Stockinet is manufactured in different weights, suitable for summer or winter wear, from very fine and soft pure woollen yarns. The double thickness at the breast (compare page 33) is an important feature in the Shirt. This should not be considered as the mere riding of a hobby. As long as the coat is worn buttoned up and double-breasted, the double thickness of the shirt over the breast could perhaps be dispensed with; but the situation is completely changed directly the coat is removed or even unbuttoned. The necessity to remove the coat does not only arise when the weather is sultry, or in the case of strenuous bodily exertion, gymnastics, &c., but daily on going to bed; and when in bed the body, unless completely enveloped in the bed coverings is practically without a coat. In a day or night-shirt of ordinary construction, *i.e.*, which is not of double thickness over the breast, and which opens in the front, the

* Natural coloured woollen garments have distinctly less tendency to shrink than when the material has been chemically treated, either by dyeing or by bleaching with sulphur.

body is unsanitarily clothed, and a chill may cause the blood to recede from the skin, establishing a condition under which more or less severe illness may ensue. The Sanitary Woollen Shirt is closed by buttoning on the shoulder. It could not close on the breast for sanitary and technical reasons, while the plan of closing at the back has been rejected because of its inconvenience.

In the Sanitary Woollen Shirt the body is correctly clothed, even without the coat, and is sufficiently protected under very trying conditions, as I have established by several venturous experiments.

I also adopted this construction in the clothing of ladies and girls, as the female outer dress is so greatly subject to fashion, that the principle of double thickness over the chest can sometimes only be carried out by means of the undergarment ; in connection with this I may mention that a special garment is constructed for mothers who are nursing.

PANTS OR DRAWERS.—The ideal leg-covering—of knitted undyed wool, fitting closely to the limbs, and capable of being frequently washed—would dispense with the necessity for any undergarment. With the modern loose trousers of dyed materials the case is different. The looseness of the covering necessitates a protection underneath against the chilling effect of cold draught up the trouser-leg ; and as the ordinary dyed trousers cannot be constantly washed, there is good reason for the general use of drawers by men. These, however, should be as porous as possible, to lessen the hindrance to the action of the skin which the double covering of trousers and drawers necessarily involves. An excellent feature in the Sanitary Woollen Drawers is the double thickness provided over the abdomen, which is thus especially protected from chill. The desire to get rid of the superfluous

layers of clothing at the points where the pants or drawers overlap the shirt or chemise, led me to cause a Combination of Shirt (or Chemise) and Drawers, *in one piece*, to be constructed ; and as it was impracticable to make such a garment to button on the shoulder, like the shirt, a somewhat different plan had to be devised, retaining the principle of double thickness over the chest. This garment possesses the special advantage for men who ride, that there is no loose shirt to ruck up, subjecting the wearer to much discomfort, and even to danger of chill.

The remarks respecting material, web, and colour of the Shirt apply equally to the Pants (Drawers) and Combinations. In both of the latter the middle line of the stomach should be doubly covered, as explained on page 33.

I must here refer to the objection which is sometimes made that the Sanitary Woollen System is enervating ; woollen clothing can only have this effect when it is either impervious in itself or is worn under outerclothing of impervious materials. In such case wool certainly enervates, and entails other injurious consequences, as will appear from the following.

The woollen shirt induces a stronger suffusion of blood in the skin, and thereby enhances the skin's exhalation ; but when this settles in the unsanitary linings of the outerclothing, rendering them damp and mal-odorous, the atmosphere of the clothing acquires a high degree of dampness, and an offensive condition. The skin is, as it were, surrounded by a damp atmosphere, which enervates it and makes it very susceptible. This sets up a greater pressure of blood to certain parts, increasing the sensibility of the skin, and therefore, its irritability. All this is changed when the outerclothing is wholly of porous wool : the exhalation then passes freely away, and the skin remains dry and hardens ; for desiccation implies

hardening, and saturation implies enervation. These are the reasons why my system of pure woollen clothing has achieved such brilliant success with children and young people, promoting health and preventing disease, so that I can conscientiously declare the charge of enervating—which fully deserves to be considered, when the outer-clothing is of mixed material—to be unfounded when the outer-clothing is wholly of wool.

VII.—THE COAT.

I WISH to lay great stress upon a particular feature which should characterise the Sanitary Woollen Clothing, as my own personal experience in the matter has been truly astonishing. It was first suggested to me by the excellent results which I have found in practice from the application of a poultice two hand-breadths wide to the front middle line of the body, from the pit of the neck to below the navel. The remarkable effect thus exercised on the blood-pressure is due to the terminal convergence in this region of the blood-vessels in the trunk of the body, and to the considerable enlargement of their areas, consequent upon the stimulating action of the poultice. This is tantamount to expansion of the minute blood-vessels on the surface of the skin; and as upon their size depends the measure of evaporation, it follows that their expansion will cause the skin to perform its secretory function with greater freedom and rapidity.

This shows that particular attention should be paid to the middle line of chest and stomach—that is to say, the clothes should keep this part *warmer* than the other surfaces of the body, which is easily effected by means of a double-breasted coat. The two sides of the coat are made to overlap, whereby the middle line is covered twice as

thickly as any other part of the body. This plan for maintaining extra warmth operates similarly to the strip of poultice. The double covering secures a more abundant blood-supply on the surface of the skin, and the cutaneous exhalation thereby produced can easily escape where the coat is only of one thickness.

As the principle of extra warmth over the *front* middle line of the trunk has been contested, and it has been argued that extra warmth is more necessary at the *back*, I will here repeat the practical grounds for my favouring the *front* line theory. Everybody knows that if his finger ends be chilly, the whole arm is cold, however well it may be clothed. If, however, he succeed in warming his fingers, by means of gloves, or by putting his hand in his pocket, or by rubbing the hands, the chilly feeling vanishes from the entire arm, without the latter being rubbed or its covering increased. Hence may be deduced the rule: In order to suffuse the skin with blood, and thereby to warm a whole region of the body, it is not necessary to increase the covering of this whole region, or to submit it to the action of a factor which is calculated to expand the blood-vessels. It suffices to bring such agencies to bear on the place where the large vessels, which supply the whole region with blood, terminate, because the stimulus to expansion in the chief vessel is transmitted only in a retrograde direction towards the heart, benefiting all the branch vessels in its course, while there is no transmission in the opposite direction. Secondly, it is not only unnecessary, but it is objectionable to clothe the entire region equally, because this impedes the passage of the exhalation from the skin. This law of the suffusion of the skin with blood is expressed in the ancient popular rule of health, to keep the hands and feet warm, and in the well-known danger of

allowing the feet to become cold; and no one will dispute its truth in respect of the members of the body.

If, however, it be contended that this law is applicable to the limbs but not to the trunk, I reply that the front middle line of the latter, and especially the navel, are precisely what the ends of the fingers and toes are to the members, namely, the termini of the chief blood vessels. In this front middle line terminate all the intercostal and transverse vessels of the *parietes* of the abdomen, and, in addition, at the navel, the two epigastric and two internal mammary arteries. That the above-mentioned law holds good for the abdominal region is recognised by the common use of bandages to excite warmth, as well as by the application of hot cloths and of friction to the navel, as the best means in cases of colic to withdraw the blood from the intestines, and to obtain relief by an outbreak of perspiration. It would not occur to anybody to apply these measures to the back of the trunk.

There remains the region of the chest, and I recommend doubters to try (as I have done in numerous cases) the effect on fever patients of applying a poultice two hand-breadths wide to the middle line of the chest. As proof that my recommendation on this point is confirmed by extensive practical experience, I may quote the fact that the official statistics of the Württemberg army corps, which is clothed in the double-breasted coat, show an annual loss through death and disablement of 164 men per 10,000, while the remaining German army corps, which are clothed in the single-breasted coat, show a loss of 322 men per 10,000. To this I would add that when the Württemberg army corps were attached to the North German Army, it was suggested that the former should adopt the single-breasted coat. In order to decide as to the desirability of such a change, comparative experiments

were instituted, which resulted so much in favour of the double-breasted coat, that not only was this retained by the Württembergers, but the Prussian uniform was made more nearly akin to the double-breasted coat, by extending the flap on one side, a method which, however, only partially attains its object. Lastly, the use of a "chest-warmer" is generally recognised by doctors, and is in many districts a regular article of clothing.

The ground which I take on this question has been assailed with arguments derived from the habits of the animal world, a field in which, as a zoologist, I am very pleased to meet objections. Nature invariably provides those parts of animals with the thickest covering which are most exposed to external influences. This region is certainly the back, in the case of quadrupeds, but in the case of bipeds—the birds—it is the breast and abdomen. As human beings are not quadrupeds, the most suitable example in this case is the bird. And how does the quadruped act when it feels cold? It does not lie on its back, but rolls itself together, and covers breast and belly with its limbs, in order to maintain its front warm. Man himself instinctively does the same thing, covering together in the cold, and covering his front as much as possible with the arms and legs. If people feel cold in bed they do the same thing, or lie on the stomach, when they feel the cold much less than if lying on the back. Again, it has been pointed out that people usually stand with their backs towards the fire or the sun, but this is due to the objection commonly felt to the fire or the sun blazing in the face. When Wool-wearers feel cold at the back, it is because they have not followed my directions in the matter of the coat. The human body, especially with corpulent people, is naturally somewhat convex in front, and concave at the back, so that the clothing in

front is more or less pressed against the body, preventing any ascending current of air, which, on the other hand, is facilitated by the conformation of the back. If, therefore, the clothing is not made so as to fit closely to the shape of the back—or if, when the fit is deficient, my recommendation is neglected to wear a band or belt round the coat, whereby the latter is fastened closely round the waist—a channel is formed for an ascending current of air between the body and the clothing, causing the chilly feeling at the back.

In conclusion may be enumerated the features which should characterise the ideal hygienic coat :—

1. Absolute freedom from linen or cotton.
2. Double thickness of material along the middle line of the trunk.
3. The material should be either undyed or dyed with a fast dye.
4. The coat should be as far as possible without lining, especially in the portion covering the breast, as otherwise there will be too many layers of material one above the other, impeding the exhalation.
5. The coat should fit closely to the shape, and the sleeves should be narrowed towards the wrists, or closed by webbings, to prevent the injurious effects of a current of air ascending between the coat sleeve and the shirt.
6. Stockinet cloth, or knitted material, is more suitable for a coat than a closer web, as it facilitates the necessary close fit, and offers least impediment to the passage of the skin's exhalation.
7. A stand-up coat collar would be better than the lay-down form, and it would be well to dispense with the coat-collar altogether, as it is a useless encumbrance.
8. The coat should at all times *be kept buttoned up*. Those to whom this may seem irksome will find it so, it

at all, only at the very first. In no other way can a sudden lowering of the temperature of some part of the body—*i.e.*, the contraction of a chill—be effectually guarded against. The desire to have the coat loose, or open, arises from the retention of the skin's exhalation, due to the impervious nature of the garment. The feeling of oppression thus caused wholly ceases when the clothing is of porous woollen materials *throughout*, as I recommend.

9. The pockets should be so arranged, and so used, as to cause the minimum of impediment to the passage of the exhalation from the skin. They must of course be made of woollen material. Pockets in the breast of the coat should, if possible, be avoided, and are least objectionable in the tails of the coat.

VIII.—THE WAISTCOAT AND OVERCOAT.

I CONSIDER that a waistcoat underneath the coat is not only superfluous, but hygienically objectionable. A common argument in favour of the waistcoat is, that it enables the wearer to throw open his coat at times, and that this is decidedly an advantage. I admit the advantage when the coat is unsanitarily made, and the unsanitary lining becomes saturated with perspiration and malodorous. When, however, it is made according to my recommendations, of porous material, I have never felt any necessity for opening it, even in the greatest heat, and when I was most freely perspiring. All that I at times need in this direction is, on strenuous walking excursions, to *remove the coat altogether*, and enable the perspiration in shirt and coat to evaporate with perfect freedom. This is hygienically a much more correct proceeding, and, even in a draught, is less dangerous

than simply throwing open the coat, and thus destroying the equability of temperature, with the consequent risk of contracting a chill.

Further, it is clear that when no waistcoat is worn the instances in which a desire for relief is felt will be much rarer, because this desire is only due to the insufficient escape of the exhalation, which is caused by wearing too many layers of material on the body, or too thick a cloth. Whoever wears a waistcoat underneath his coat provides an additional obstacle to the passage of the exhalation from the skin, and is thereby frequently incommoded ; while he only secures the small advantage of being at times able to throw open his coat without looking peculiar. It is customary to play billiards in the shirt sleeves, and the waistcoat is worn to conceal the braces. It is obvious that in such a game as billiards the braces would be better replaced by a belt, and in any case there is no practical objection to a man playing billiards without a waistcoat, which is an ugly garment, especially when viewed from behind. In all these matters, we are too much the victims of habit and fashion. If we would only think for ourselves, and apply the logical conclusions, we should be freed from a slavery to whose irksomeness we are partly insensible, because we have grown up in it.

To those, however, who prefer to follow the fashion of wearing a waistcoat, I recommend that it be made as porous as possible, so as to facilitate the passage of the exhalation from the skin, *i.e.*, no cotton lining or back.

It is instructive to consider the manner in which the garment named waistcoat originated. In the Middle Ages, when in my opinion men's dress was at once most hygienic and most pleasing to the eye, a man wore, apart from the shoes and hat, only three garments, viz : close-fitting coat and leg-covering, with a sleeveless mantle in

case of severe weather. To these was subsequently added the shirt as underclothing. The first change took place when the mantle was reduced to the proportions of a cape, still without sleeves. Next, sleeves were added, and so the garment was converted into the coat which is now worn over the waistcoat. The close fitting coat was degraded to what is now called a waistcoat, and hence for a long time continued to be of the original length, *i.e.*, it retained the skirt, or flap, which afterwards disappeared from it, as did also the sleeves of the original coat. We should endeavour to procure a return to the old costume. For a man's clothing, shirt, breeches, and close fitting coat are really sufficient, and only when it is necessary to protect these garments from rain, or when extra defence against wind and weather is required, is a cloak or overcoat needed. When the waistcoat is dispensed with, the convenience of a watch pocket and a pocket for silver can easily be provided in that part of the double-breasted coat which is covered by the portion which buttons over, and this form of Sanitary double-breasted jacket or coat will be found most comfortable and protective.

To go the whole winter and half of the spring and autumn in an overcoat weighing ten or fifteen pounds, with the arm threefold encased, is the height of absurdity. People who have become really healthy under the Sanitary Woollen System require the heavy and expensive overcoat as little as the waistcoat, and even my Russian friends assure me that, whereas in severe frosts they formerly buried themselves over the ears in a fur cloak, they now find that an autumn overcoat is ample protection.

I will sum up the matter thus : Those who wear shirts of linen, and cotton material in waistcoat and coat, require a heavy coat in winter to counteract the chilling effect of

the vegetable fibre. But those who discard from their clothing all chilling material, *i.e.*, linen and cotton, require no overcoat under ordinary conditions.

IX.—THE HEAD-COVERING.

IT is a well-known fact, which has never been satisfactorily cleared up, that baldness is much more common among men than among women. Let me try to explain this phenomenon. Some people fancy that the competition of the beard is precarious to the hair of the head, and to a certain extent abstracts from the latter its due nourishment. This somewhat crude suggestion is refuted by the long beards and luxuriant heads of hair which characterised our ancestors. Another notion, that the more strenuous head-work which falls to the share of the male sex is responsible for the loss of the hair, may not be absolutely negatived, as undoubtedly among those who live by manual labour there is relatively less baldness than among brainworkers. But this cannot be the sole nor even the chief reason, otherwise the proportion of baldness among governesses, schoolmistresses, &c., would be greater than among manual labourers, which is by no means the case. Yet another conjecture is, that the unnatural custom of cutting men's hair, first adopted when nature was abandoned in favour of the fashions of civilisation, is to blame for this evil. Undoubtedly cutting the hair has an influence on it, but whether this influence is wholly unfavourable will seem very dubious to anyone who reflects how frequently the hair is prevented by being cut from falling out, and how, on the other hand, the practice of wearing the hair long has been suspected, not altogether unjustly, of being, at least partly, the cause of baldness. Another theory accounts

for baldness as the result of dissolute habits, especially of excessive indulgence in alcoholic stimulants, and undoubtedly in this respect the male sex compares disadvantageously with the female sex. It cannot indeed be denied that the pleasures of drinking are apt to decimate the hairs of the head, as also that care and worry have the same tendency. But to generalise from this would be a grave injustice to many most respectable possessors of bald heads. Further, it is of course clear that certain diseases will account for baldness in individual cases, but not for the above-named fact that baldness is relatively more common among men than among women. Lastly, that baldness may be inherited is as certain as that this in no way accounts for the disproportionately large number of bald men as compared with women; for the sisters of the hereditary victims to baldness can usually show an excellent growth of hair, notwithstanding that they must have equally inherited the tendency to baldness.

The most natural cause, which suggests itself most readily—not indeed the sole cause, but the chief one—of the phenomenon in question is simply the difference between the male and the female head-covering, and here three points have to be considered.

1. The female head-covering is, as a rule, far lighter, more airy, and more porous than the usually almost waterproof and exceedingly absurd male head-coverings, such as the stiff felt hats and high hats, with the strip of leather which encircles the forehead and effectually retains the perspiration.

2. Women rest the hat or bonnet on the head in such a manner that the air can freely circulate between, while men irrationally force their heads into their hats, which press on the skin of the brow, so that no circulation of air

or escape of the skin's exhalation is possible : this, and the compression round the skin of the head, must injure the growth of the hair.

3. The conditions under which women live are usually more favourable, inasmuch as they have less occasion than men to make use of unsanitary head-covering, their occupation keeping them to a greater extent indoors. Usage and custom permit women, especially in some countries, to dispense to a certain extent with a covering to the head when out of doors; and the much greater abundance of hair on a woman's head enables her to enjoy the luxury of being with an uncovered head in the open air, which is denied to the unsanitarily clothed man, easily susceptible to cold.

The question now arises whether a head-covering cannot be devised which shall do no injury to the growth of the hair, or to the head.

The best head-covering would certainly be—none at all. But usage, and in many cases weather conditions, render this impracticable; and as both usage and the weather conditions must be reckoned with, the problem to be solved is the construction of a head-covering which will approach as closely as possible the ideal of the natural head-covering; and this has been done.

Three points require to be considered with the hat:

1. It must consist exclusively of animal fibre ; all cotton or linen lining must be excluded, as well as the usual strip of leather which encircles the forehead. The latter may be replaced by a strip of felt, or, better still, the hat may remain completely unfurnished, like the Turkish fez.

2. Not only are the hard hats, now in such general use, bad because the pores of the material are closed, impeding the passage of the exhalation from the head;

but the material used in stiffening them has sometimes an injurious effect. Of course, soft hats cannot be worn in all cases, and on ceremonial occasions the hard hat may be chosen; but ordinarily the hygienically superior soft hat should be worn.

3. The question of colour or dye must not be lost sight of. The Natural coloured (*i.e.*, undyed) hat is greatly to be preferred to one that is dyed.

Camel hair is admirably suited for felt hats, and hats of this material are highly to be recommended. Sanitary Woollen caps are also manufactured of pure woollen cloth or flannel, lined, if at all, with pure woollen material.

It is obvious that the use of pure woollen hats and caps cannot be too strongly recommended to those who are already bald, or are threatened with baldness, or who suffer from perspiration, or from pains in the head. Persons who are becoming "thin on the top" may by this means, if taken in time, still save their hair, and avoid the alternatives of baldness or of wearing a wig, either of which is objectionable, both on hygienic and æsthetic grounds.

To those whose baldness is past praying for, in addition to the Sanitary Woollen hat may be recommended the comfort to be procured in cold weather by wearing a pure woollen indoor cap. The slow heat-conducting property of animal fibre, whether in the form of the natural hair or of a pure woollen cap, checks the too rapid escape of warmth from the head, and excludes the access of chilling draught to the skull. At night a cap of the Sanitary Woollen stockinet or knitted material may be worn with advantage by those who are deficient in the natural protection to the head afforded by abundant hair, or who suffer from toothache, for which such a cap often proves an effectual remedy.

X.—THE SANITARY WOOLLEN COLLAR AND CUFFS.

A SMALL, but by no means unimportant, item in men's clothing is the shirt collar, which, however, is really more an ornament than a protection to the throat. The throat is best left uncovered, and a shirt collar is therefore a superfluity.

But as a matter of custom the shirt-collar cannot be dispensed with, and if the throat is to be to some extent clothed, it should be sanitarily clothed. For not only its close connection with the respiratory passages, but also the delicate nature of the throat itself, renders this imperative, and the unsanitary shirt-collar is a common source of difficulty in swallowing, of swollen tonsils, laryngeal catarrh, constant hoarseness, and even of lung affections.

The shirt-collar should therefore be of pure animal wool.

In this matter my experience has been somewhat singular. I had never paid much attention to the subject, although I have had considerable trouble with the throat at one time or another in my life ; but when I discovered the Sanitary Woollen System I assumed that the throat required no special care, and I therefore discontinued wearing a neckerchief. Nor did I make any difference on account of sundry ailments of the throat from which I had occasionally suffered considerable inconvenience ; because such affections recurred at much greater intervals, and were milder in character than formerly, except a particularly obstinate cold caught one spring. Over this I pondered a good deal, for it permanently injured my voice and thereby greatly interfered with my chief pleasure—sitting down at home to the piano and singing

a song. Since the spring the voice had retained a persistent hoarseness, the higher notes became impossible at times, and it frequently broke down altogether.

My attention was first directed to the subject of the clothing of the neck when I discovered that, in contradistinction to the Sanitary Woollen Shirt, my linen collar very soon became mal-odorous. From that moment I regarded the linen collar as an unclean thing, and considered how it could be replaced by a woollen substitute.

Frequent inquiries which I received encouraged me in the prosecution of my purpose; but I regarded the whole thing as rather insignificant, and when I first put on my woollen neck-covering, consisting of a cloth cravat and a white cashmere collar, I felt disposed to laugh at myself for riding a hobby, and was pleased to find that the contrivance did not look unsightly. Of course I at once felt the comfort of the wool, but I did not foresee anything more.

On the very next day, however, I felt that the condition of my throat had much improved, and from time to time I expectorated loose phlegm without cough or effort of any kind. When, some days after, I first attempted to sing again, my daughter remarked that my voice sounded plainer and clearer than ever. I had noticed it myself, without attaching any particular importance to the change, because formerly it occasionally varied from better to worse. A few days later I again tried, and my voice was, at the first song, as clear as it had ever been after a quarter of an hour's preliminary practice.

The cleansing or clearing of the throat by the secretion of mucus continued, and there was no further disturbance, the voice remaining uniformly good, whereas in former days even prior to that excessively bad cold, it was constantly uneven.

Perspiration is freely exuded at the point where the collar touches the neck, and the linen collar, which readily takes up moisture, whether of perspiration or of the atmosphere, becomes in consequence damp and chilly, and a common source of throat disorders. It is therefore of the highest importance to clothe the neck with material, such as animal wool, which will not set up a chill ; and this is recognised by the frequent use of woollen wraps and comforters which now, however, may be dispensed with by adopting the Sanitary Woollen Collar and Cravat ; and I strongly recommend everyone in the interest of his throat to make the change.

The Sanitary Woollen Collar is made of finest white or natural-coloured wool ; the former usually loses some of its whiteness in washing, and, unless sulphured, acquires a creamy tinge. This is in itself no disadvantage, as the soft yellowish collar is æsthetically superior to the stiff white collar, as every artist will admit ; but practically it is an obstacle to the more general adoption of the Sanitary Woollen Collar by the large majority who have not yet emancipated themselves from the slavery of fashion and habit.

A more serious consideration is the tendency of the Woollen Collar to shrink, although this is minimised in the manufacture, and may be counteracted by careful washing, especially by buttoning the collar round a wooden board, cut to the requisite size, during the process of drying, and ironing while still damp.

In any case, the owner of a Sanitary Woollen Collar which has shrunk by repeated washing to impracticable dimensions, has the consolation that he has derived from it an important hygienic advantage, and although the collar may be of no more use to him, it may serve for younger members of the family.

CUFFS are not requisite from a hygienic point of view, but if they are worn it is desirable that they should be of wool, as the chilling effect of cuffs of vegetable material undoubtedly disturbs the proper distribution of blood in the arm.

XI.—THE SANITARY WOOLLEN HANDKERCHIEF, AND CATARRHAL INFECTION.

IT is an old rule that catarrh will be sooner cured if the handkerchief be changed as often as practicable. This must be due to the presence of harmful conditions in the used handkerchief, and experience has shown that woollen handkerchiefs are in this respect far superior to linen ones. Whoever uses the former, notices at once how much pleasanter and warmer to the touch it feels than the ordinary handkerchief of vegetable fibre. The greater porosity inherent to the nature of the woollen fibre enhances the capacity for absorption of moisture, which again is more equably evaporated.

Coarse material must be avoided in woollen as in linen handkerchiefs, or its use would be felt to be irritating to a sensitive skin. The fine, pure woollen Batiste material of which the Sanitary Woollen Handkerchiefs are made is beautifully soft and free from irritating effect, and forms altogether a most agreeable contrast to even the finest linen handkerchief, which quickly becomes wet, chilly, and generally disagreeable.

From a hygienic point of view, the Sanitary Woollen Handkerchief has very great advantages, assisting to regulate the nasal secretion and diminishing the tendency to, and the duration of, nasal catarrh.

The Sanitary Woollen Handkerchief should be carefully washed, and pains should be taken not to damage the

porous nature of the web by rough treatment, such as violent rubbing, which causes the delicate material to felt.

The most obstinate colds have been known to disappear almost with suddenness, when the linen handkerchief has been exchanged for the woollen, as the catarrhal infection which lurks in the former is not retained by the latter.

The idea of using woollen material for this purpose is to many people repellent, from its strangeness, and from an erroneous notion that the woollen handkerchiefs must be rough and disagreeable. They are, on the contrary, beautifully soft and smooth, and whoever has once become accustomed to the warm, comfortable, agreeable woollen handkerchief, will never revert to its antithesis of linen.

The woollen handkerchief possesses the further advantage that it is much more agreeable for removing the perspiration, as it remains longer dry than the handkerchief of vegetable fibre, which at once becomes soaked through like a sponge.

XII.—WOMEN'S CLOTHING.

I HAVE several times been reproached for attending too exclusively to Men's clothing, and neglecting that of Women. This has been partly due to the more conservative and reserved attitude at first assumed by women towards my endeavours at reform—from this point of view I should be very glad if the reproach were uttered more frequently—and partly because women's clothing is in many respects hygienically superior to men's, although it by no means follows that it is hygienically perfect.

Women who desire to be sanitarily clothed will find that under my Sanitary Woollen system they can provide themselves with every article of attire from top to

toe, and it is in this order of sequence that I now propose to consider Women's clothing.

As regards the hat (see also chapter 9), the materials employed should consist only of woollen cloth, or felt, or horsehair. With these materials, and with feathers, and ornaments derived from the animal or mineral kingdoms, hats may be made which are both hygienically and æsthetically irreproachable, while avoiding unsanitary materials, and injurious dyes.

No fault can be found with the form of the collars usually worn by women, but these should be of wool, for instance of cashmere, or of woollen lace.

The sanitarily clothed woman need not be afraid of wearing low-necked dresses on occasion, as the neck is not very sensitive, and is much more hardened to resist the effects of exposure than in the case of those who are unsanitarily clothed. It should, however, be a strict rule that the neck of the dress should be equally low behind as in front, so that the proper distribution of the blood suffer no interruption, as it must do if the dress be only cut low in front.

Respecting the upper half of women's dress, as far as the waist, the principles generally adopted of closely-fitting garments, made of light materials, in as few layers as possible, are correct; the materials and linings should, of course, be pure woollen, and, especially the linings, should be undyed or fast-dyed. Further there should be double thickness of covering down the front middle line of the trunk, not only as regards the underclothing, but also the dress. The popularity of stockinet bodices is an instinctive step in the right direction, as pure woollen stockinet cloth is quite the most sanitary dress material.

I entirely approve of the close-fitting sleeves usual in women's dress. When the sleeves of the dress are short,

the necessary warmth should be maintained by long gloves of woollen or undyed leather material, which also men would do well to wear drawn over the coat-sleeves, excluding ingress of cold draught.

As regards the outerclothing of women, from the waist downwards, the following considerations, in addition to that of pure woollen material, should be observed: 1. The dress should not be too long; all so-called national costumes have rightly, in every country and at every period, been short in length. 2. The folds at the waist should not exceed moderate bounds, as otherwise dresses of woollen material become too heavy, and hamper the movement of the limbs, besides constituting an impediment to the passage of the exhalation from the skin. 3. The decoration should consist less in layers of material, in folds, or in drapings, and more in embroidery, lacing, trimming, and introduction of vari-coloured stripes of woollen material.

The girding of the loins by corset and belt, as generally practised by women, is hygienically correct, provided that it be done on the principles laid down in Chapter 13.

A serious fault in women's clothing is the too great number of layers of material over the lower portion of the trunk. At this point the lower part of the bodice, the upper part of the skirt, the corset, the petticoat, the chemise, and the drawers, all overlap one another, forming at least a six-fold layer over the body, which in this region is kept much too warm, with inevitable prejudice to the proper distribution of blood and to the necessary facility for passage of the exhalation from the skin. To remedy this, bodice and skirt should not overlap, and the best plan is to sew the latter to the lower edge of a stockinet bodice. Further, the petticoat, either by using

tapes or suspenders, or by providing oval interstices in the material, should be made, so far as it extends over the corset, as light as possible. Lastly, if the combination garment (see page 32) be substituted for the chemise and drawers, the number of layers may be diminished by one half.

As regards the stocking, what has already been said in Chapter 2 is here applicable. Women should especially note that the garter is objectionable, as causing a congestion of the blood, which, even without this accessory, requires to be carefully avoided under certain conditions. It is better to wear long stockings, and to keep them in position by suspenders.

In the matter of the Shoe, women have long been better off than men, as they usually wear shoes of much lighter and more porous materials. Due attention should be paid to considerations of woollen material and sanitary dye (see Chapter 3).

XIII.—THE SANITARY WOOLLEN CORSET.

IN connection with the reference in the last chapter to girding the loins, I will make a few remarks on the subject of ladies' corsets. If the views of some leading authorities on health-culture are correct, there is nothing more prejudicial to the health than the corset. Indeed, their attack on the corset comprises pretty well all that they have to say respecting ladies' clothing, and it is usually enforced by dreadful representations and models of the distortion of the liver which is caused by tight lacing. This may be true, but it is not the whole truth.

The fault does not consist in the wearing of a corset, but in the material of which it is made. This is usually

substantial (possibly even pasted) linen cloth, and (1) concentrates, in an intensified degree, the disadvantages of clothing made from vegetable fibre; (2) is, as a rule, laced too tightly, because the great enervation of the body which ensues induces a feeling of want of support and a tendency to unshapely increase of bulk, only to be restrained by the use of force, under which the internal organs suffer.

Ladies, however, who have adopted, and especially those who have grown up under, the Sanitary Woollen System, and who wear the Sanitary Woollen Corset, need to use no force in order to preserve the shape; their compact, firm figures will not require support. They do not, therefore, lace too tightly, and in the Sanitary Woollen Corset they have all the advantages of girded loins without the disadvantages.

It is with the corset as with the boot. Hygienic science has hitherto treated the evil as one of mechanical conditions and of space, while it is really due to the use of unsanitary material.

XIV.—THE TREATMENT OF INFANTS.

THE frequent complaints of the great mortality among infants would much diminish if children were from their birth clothed and bedded in wool. The fearfully high statistics of deaths of children are doubtless in part due to other factors, such as the inability of their mothers to suckle them, bad food, etc.; but it has been proved that children brought up in the wool, even when their nourishment is artificial, thrive splendidly. The great mortality among children may be considered largely due to the fact that a number of them succumb to the faulty

conditions which ensue from the employment of vegetable fibre in clothing and bedding.

It is a common mistake to bathe infants with too great frequency, and excess in this respect may sometimes account for the delicacy and ill-health of well-to-do people's children, who receive only too much attention, contrasted with the thriving, if grimy, condition of children whose ablutions are comparatively neglected.

This must not be understood as a defence of dirty habits, but rather as a plea for more respect for the nature of the human body, which, whether infant or adult, is constantly treated by rule of thumb, under the guidance of fashion or tradition, and with insufficient regard to the constitution, especially to the skin and its functions.

The too frequent immersion in water of the tender unprotected body of an infant; the application of soap which may or may not contain injurious ingredients; the chances of contracting a chill; and the subsequent putting the dry clothes over the dried skin, may seriously affect the distribution of the blood, and thereby endanger the child's well-being. This is especially the case with infants brought up in the Sanitary Woollen System, who remain cleaner and more free from offensive odour than children in unsanitary clothing, and whose skin, on the other hand, being already in full activity, requires no additional stimulant. Removal of dirt where such is apparent is quite sufficient without constantly bathing the entire body, which latter operation should be undertaken at more reasonable intervals than is often the case. It will, moreover, greatly conduce to the health of the child if it be well anointed over the whole body after each immersion, as explained in chapter 27 on Bathing.

The practicability of an infant's outfit consisting wholly of animal woollen materials meets with especial scepticism

in the matter of the woollen "diapers." It is assumed that these will chafe the child, that from constant wetting and washing they will become hard and stiff, that—in short, it is ridiculous and not to be thought of. As a matter of fact, woollen diapers are found in practice to answer exceedingly well, not only from a hygienical point of view, but because they keep cleaner and therefore involve much less trouble in washing. They cause no chafing, assuming that proper attention is paid to the child and that the parts are anointed, while the advantages in respect of comfort and absence of chilly feeling when first put on, and even when they become wet, as well as of comparative freedom from offensive odour, cannot be overrated. When the diapers are only wetted and not dirtied, they need merely be passed through clean water, and hung up to dry, when no trace of odour will be perceivable. These praises may also be freely accorded to the remainder of the Sanitary Woollen infantile outfit. The dresses are, of course, long-sleeved and high-necked, the prevalent absurd fashion of exposing children's necks, arms, and legs because "they look so pretty" being, it is perhaps unnecessary to say, an indefensible indulgence of parental vanity at the expense of the health of the children.

An argument which requires more serious consideration is the objection not unfrequently made that the Sanitary Woollen System is enervating and "coddling," especially for children. This is not only wholly unfounded, but is precisely the converse of the truth. The facilities and assistance afforded to the skin to perform its functions in a normal manner prevent the accumulation in the tissues of matters which should be excreted through the pores. The flesh is consequently firm and hard, and the surface blood vessels are in full activity, with the result that they

are able to effectively assist the body to repel attacks from chill or other influences likely to set up disease. Children and adults are thus "hardened" by the Sanitary Woollen System in the fullest sense of the word.

All the woollen materials employed should be wholly free from dye.

It remains to be added that the benefit accruing to infants from the Sanitary Woollen System may be diminished or enhanced by their surroundings. Pure, fresh air is a first necessity to children, and may be freely admitted if the clothing and bedding are of wool. It too often, however, happens that the clothing and bedding of the mother or nurse are of the old unsanitary order. This is nearly sure to be accompanied by more or less dread of chill from fresh air, and as a result, the child may be compelled to live, and especially to sleep, in an impure atmosphere filled with the emanations which proceed from clothing or bedding of vegetable fibre. It is thus of great importance that not only the children themselves, but that also those who have daily and nightly charge of them, should be Sanitary Wool-wearers, and should welcome and care for the perfect ventilation of living and sleeping rooms.

In conclusion, I will cite the following practical testimony which I have received to the advantages of my System for Infants :—

"The writer, feeling convinced of the value of the Sanitary Woollen System, procured in anticipation of the approaching birth of a child, an entire woollen outfit for the newly-born baby, which from its first existence has never worn a particle of linen. The appearance of the child, now six months old, is all that could be wished ; its limbs are agile and strong, the body is round, the flesh firm, and in short, the child is as healthy as it can possibly be.

“As to the practical worth of the Sanitary Woollen System, the writer has noted down the opinions of the monthly nurse, a woman of twenty years' experience, as of more value than a great deal of theorising one way or the other. At first the whole thing appeared to her ridiculous, and she used the various woollen articles with reluctance ; but after some time she expressed herself as follows :—

“‘Although I am poor, and have brought up six children in linen, I would not hesitate to clothe the next in wool, for it gives only half the trouble of linen. The colds which babies so frequently catch are completely prevented by the equable and sustained warmth of the woollen clothing, which is of the greatest importance, as so little heat is generated in the body itself. This particularly applies to the wet clothes which, when of linen, grow cold on the body, while the woollen ones remain warm. Another advantage is the time and labour saved in ironing. The washing of the clothes is simpler and quicker, and that of the frocks and shifts is not required so often, as I am surprised how long they keep clean and free from smell. I also notice that daily bathing and soaping do a child more harm than good. This child was best when simply washed, without soap, each day, and afterwards lightly rubbed with a woollen rag soaked in oil ; it was only bathed once a week. I intend to recommend the bringing up of children in wool wherever I can.’”

“To this may be added, that when the child was out of doors for some time, the clothes which it wetted frequently dried on the way, a proof of the rapid evaporation ; moreover, they *were free from odour.*

“In conclusion, the cost was about the same as of a linen outfit, having regard to the fact that only half the usual number of articles was necessary ”

XV.—SUMMER AND WINTER CLOTHING.

ACCORDING to my own experience, and to the communications received from others, I can answer that the Sanitary Woollen Clothing has acquitted itself splendidly in summer weather. Not but that we too have perspired, nor that we have perspired much less—assuredly not more—than others, but because the perspiring is effected much more easily and opportunely; that is to say, the perspiration is free, adequate and uniform, without creating any disturbance in the circulation of the blood, which in extreme cases causes apoplectic fits. Here I may mention that it is a mistake to suppose that it is part of the Sanitary Woollen System to keep on the coat uninterruptedly, even in the greatest heat. On the contrary, a follower of the System may do that which people who do not wear hygienic clothing hardly dare to venture.

After freely perspiring, the coat may be removed without fear of the consequences, and with considerable refreshment. This is a privilege which others cannot enjoy for fear of taking cold.

I advise wearers of the Sanitary Woollen Clothing not to seek relief in unbuttoning or opening their coats when the heat is intense. The relief is only felt at first, and soon changes into a feeling of an opposite character, for the partial cooling along the middle line of the chest, quickly interferes with the body's power of evaporation. The only correct plan is either to take the coat off, or to retain it closely buttoned up. In walking, when the heat is great, it is distinctly better to keep the coat closely buttoned up. At first the perspiration will pour out freely, although it will soon cease, unless, indeed, the

weather be excessively sultry. But when the destination is reached the coat may at once be removed, thus reversing the practice of wearers of "vegetable fibre" clothing, who may march in their shirt sleeves, but must put on their coats when they rest, if they would guard against catching cold.

I have considered the question of summer and winter clothing very carefully and have found that it requires something more than an off-hand answer. If we turn to the feathered and hairy animals, we shall find that by no means all of them alternate light summer with thick winter clothing.

Among hairy animals, otters, beavers, and others which are amphibious, make no such change, neither do the genuine inhabitants of the desert; for I never observed anything of the sort among the antelopes and wild asses at the Vienna Zoological Gardens. Lastly, no such change, as a rule, takes place with birds. Thus, among animals provided with a special vesture, those most liable to exposure and climatic influences do not vary their clothing with the seasons. The only hairy animals with whom the change is really marked are those which live in the woods and fields; and that is quite intelligible.

When the woods are thick with foliage, and the fields stand under growing crops, these animals find themselves no longer in the open air, but buried in the covert, and surrounded by a damp atmosphere, which greatly impedes the evaporation from their bodies. Nature has then placed these animals under a covering of leaf and grass, and the body naturally endeavours to lighten its clothing. When autumn scatters the leafy and grassy covering the case is reversed, for then heavier coats must counteract the exposure. With animals not liable to such alterations, and with the majority of birds, especially those always on the wing, this change does not take place.

In our climes, civilized man must be compared with the birds rather than with the animals of the fields and forest. For, like the birds, both in summer and winter he is in the open air, and even when indoors he is surrounded by dry walls, and not by plants constantly throwing off watery vapour. Therefore observation of the animal world does not teach us to change the nature of our clothing according to the season: at most, the alternation should be from heavier to lighter woollen material, and *vice versa*.

The answer will be to the same effect if we consult men leading a comparatively natural existence. The shepherd opines "that which is good for cold protects against heat," and puts on his cloak when the sun is too hot. In Hungarian pasture lands the shepherds wear the sheep-skin bunda both in summer and winter, with the difference that in summer they turn the woolly side outwards, and in winter inwards.

XVI.—THE SOLDIER'S UNIFORM.

WHEN persons suffering from disease or from tendency to disease adopt the Sanitary Woollen System they are usually delivered from such disease or tendency in a comparatively short interval, although sometimes a longer period may elapse, while the deliverance is especially rapid if abundant bodily exercise be taken in the open air. As the military training secures this active exercise, the improvement in the health of the men during their military service (which, independently of my System, I statistically established in my book, *Die Menschliche Arbeitskraft*) may be confidently expected under the Sanitary Woollen System to proceed more rapidly, safely, and thoroughly than heretofore. This would mean a reduction in the sick list, and in the losses

through death or unfitness of duty. If it be replied that the army is not an institution devoted to purposes of cure, and that only healthy men are permitted to enter it, I would observe that the *tendency* to disease may yet be present in men admitted to the army.

In addition to the removal of this tendency to disease in a proportion of the men, the treatment of the men must be directed to getting them into "condition." *i.e.*, to training and hardening them. The means by which this is accomplished in the army are the same as in the case of racehorses, *i.e.*, sweating induced by heating bodily exercise. Now, in training horses, experience has established beyond all dispute that the necessary degree of hardening is attained much more quickly and completely when the animal is covered with pure woollen clothing; and in England, where training is most practised, rowing, boxing, and other sporting men train not only by means of sweating exercise, but also with help of the Sanitary Woollen System, *i.e.*, by wrapping themselves in wool during the exercise.

Clearly what is good for athletes and racehorses is also good for soldiers. The correctness of combining exercise with wrapping in wool is strikingly proved by the experience of myself and other Wool-wearers, that the pure Woollen clothing alone, without any aid in the form of enhanced bodily exercise, is able to procure nearly as high a degree of hardening as bodily exercise not taken in conjunction with the Sanitary Woollen System. If considerable value attaches in time of peace to the quicker and more complete attainment by the soldier of a sufficiently trained condition, this is still more so during war, when it is of great importance that the new recruits, who enlist in a more or less enervated state, and require training, should be got into the necessary "condition" as quickly and with as little danger as possible.

The influence of the Sanitary Woollen System on the *effective capacity* in actual welfare is still more important. It renders the body *weather-proof* in a measure which is absolutely unattainable in other clothing. The wetting through of pure Woollen clothing is a matter of indifference to the body underneath it to an extent which astonishes everybody who observes it for the first time; and to this is associated the second pre-eminent advantage, that the clothing, after being wetted through on the body with rain or perspiration, dries with rapidity. That wool protects against cold need hardly be stated; but in face of the prevalent prejudice that wool is not suitable as clothing in hot weather, it is necessary to insist with the utmost energy that when the clothing is wholly of wool it is as great a protection against heat as against cold, and assertions to the contrary are wholly ungrounded*. If people would but *try*, instead of talking, they would find that the freedom afforded to the passage of the exhalation from the skin by clothing *made throughout* of porous wool, prevents the feeling of oppressive heat which arises when the exhalation is confined by impervious clothing. The *surplus* heat is thrown off as fast as it is generated, while the *necessary* heat is retained, preventing chill. So much for the heat generated by the body (of course clothing does not generate heat, but simply defends its possession). As regards protection against the heat of the sun, the non-conductive property of wool is the reason why ice when carried through the streets in summer is covered with woollen material. People should remember this fact when, in their ignorance of the true nature of the case, they say—"What! wear Woollen clothing in Summer, and sleep in Woollen Bedding! Why, I should melt!" No one will dispute that

* See Chapter 31, "Tropical Clothing."

the much greater independence of climatic changes which the Sanitary Woollen System thus procures, constitutes a very appreciable advantage for the soldier on a campaign.

People engaged in sporting pursuits had found, before I introduced my System, that clothing made entirely of wool is not only suited to training purposes, but that the *physical endurance* of the body is much greater than in other clothing. There are good reasons for this; Woollen clothing hinders the retrogression from the trained state which quickly sets in when the clothing is unsanitary, so soon as bodily exercise is suspended. The Wool-wearer keeps constantly in "condition." Wool-wearers can therefore, *ceteris paribus*, exercise, and execute marches and various physical performances of which other people are only capable after considerable practice and training. Wool-wearers also require much less time for recuperation of the energies than persons who are unsanitarily clothed, and who are at no time so fresh, buoyant and capable as Wool-wearers. If we apply these considerations to the military, there will be greater capacity for marching, greater endurance of hardships, and greater readiness for fighting on arrival at the battle-field, qualities which have long been considered by military men of the first importance.

There is a military proverb which enjoins "Cool blood and hot bullets." Presence of mind, or, in other words, stability of the emotions, is a military virtue which has not only been at all times highly valued, but which is especially necessary in the present mode of fighting. With the introduction of the repeating gun, the danger that troops, in their hurry and excitement, may aim badly and therefore without effect, or may fire away all their ammunition, and thus become practically disarmed, is greater than at any previous period, wherefore cool blood

plays an important part. Indeed, no officer will contradict me when I say that coolness is the foundation of all firing discipline, and not only regulates the activity of the soldiers, but is the indispensable proviso for the officer having his men in hand ; while the value of coolness in close conflict needs no argument. That in pure woollen, compared with unsanitary clothing, the emotions are distinctly more under control, has been widely attested, and can easily be established by comparisons instituted amongst military men.

Most shooting parties afford evidence that, with equal opportunities, the largest head of game is shot, not by the man who has the best gun, firing the longest range, but by the man with the steadiest hand. The same holds good in battle. I admit that when masses of troops are firing, the range and precision of the weapon outweigh the accuracy of aim of the individual. But in open file the steady hand is as superior to the better weapon as when shooting game. No one will deny that cool blood is necessary to ensure a steady hand. But apart from the consideration of the state of the emotions, experience has shown that the Sanitary Woollen System increases the steadiness of hand. Most of the communications which I have received on the point have been furnished by draughtsmen and other workers with the hand, but those which have reference to the special subject of shooting suffice to show that this advantage may be confidently expected to accrue from sanitary clothing.

No one will dispute that disease is a main enemy of campaigning armies. In this direction the influence of the Sanitary Woollen System is threefold. The greater power of resistance to weather influences affords increased security against chill-diseases and those of an inflammatory nature ; the enhanced capacity for enduring forced

narches, &c., lessens in an important degree the danger of the men becoming knocked up through over-exertion; and that the Wool-wearer's powers of resistance to infectious diseases are greater than those of people unsanitarily clothed has also now been sufficiently confirmed. This last advantage will of course be more apparent in the hospitals, but it will also tell indirectly before the enemy, for the removal of men to the hospital weakens the army as much as any other proportionate loss.

The advantage of entirely Woollen over unsanitary clothing in cases of wounds would require too much space to be thoroughly reasoned out here, but I may point out that wound-fever is sometimes a dangerous result of wounds. The fact that this does not accompany every wound shows that there must be a tendency to feverish sickening for wound-fever to develop. That this tendency is wholly removed or weakened in an important degree by the Sanitary Woollen System is among my commonest experiences; and when the tendency is present, a usual result of adopting the System is its early elimination, after which the Wool-wearer becomes "fever-proof." It follows that the tendency of the Wool-wearer to wound-fever is also less. I could adduce several other points, such as greater security against excessive loss of blood, diminution of the extent to which the entire body is affected by wounds, so that the Wool-wearer is not so easily placed *hors de combat* by light wounds, &c.; but enough has been said to direct attention to this side of the subject.

Having, I trust, made out a sufficient case to show that my reforms deserve the full consideration of the heads of the army, I proceed to discuss the ways and means of carrying these reforms into practice.

It may be answered that, *in time of peace*, the advantages which I have cited for the Sanitary Woollen System are,

from a purely military standpoint, inconsiderable, because the sick are sent into hospital or are discharged from the service, their places being filled by healthy recruits. *In time of war*, as in 1870, the soldiers can be supplied with Woollen shirts, which the great resources of the woollen industry can quickly place at their disposal, and then the army will enjoy the advantages of the Sanitary Woollen System.

As to the rapid delivery of an immense quantity of shirts of pure, porous, woollen material, I have my grave doubts, but, assuming such delivery, it is a great error to suppose that with these shirts the clothing of the army will be all at once reformed. This error rests on a widely-spread misapprehension of what I mean by my System, for which I claim the advantages cited above, on the following basis, established by experiments which can easily be repeated, and by thousandfold experience.

1. The virtue of Wool has long been recognised, but what has not been recognised is that Vegetable fibre, when employed as clothing material, is an element of positive injury to health, and is especially prejudicial to the "condition" of the body, because, owing to its retention of the body's exhalation, it becomes actively injurious itself. I will here just say that uncleanness in clothing has been at all times considered injurious to health, and the necessity for the constant cleansing of the clothing has been admitted. This is tantamount to an admission that the dirt in the clothes is something injurious, and erefore poisonous. Further, it is matter of general experience that clothing of Vegetable fibre, whether worn as Underclothing or as Outerclothing, much sooner needs cleansing than Woollen fibre, which again is tantamount to an admission that the unwholesome element which characterises unclean clothing is to a much greater

degree situated in the Vegetable than in the Woollen parts. The conclusion necessarily follows that the Vegetable parts of clothing, compared with the Woollen, constitute a danger to health, and that their removal is a hygienic advantage. To come at once to the military aspect of the matter: while it is conceivable that soldiers in barracks may have sufficient time and means for cleansing the Outer and Underclothing, this will not be so during a campaign, when frequently even the cleansing of the Underclothing is impracticable, to say nothing of the treatment necessary for the Outerclothing, referred to below. Therefore, at the most important period, the deleterious effect of the unclean Vegetable portions of the clothing on the soldiers' health and capacity is enhanced.

2. The principal danger from dirt in ordinary clothing of the present day consists not only in the employment of Vegetable fibre for Outerclothing, but also in *lining* the Woollen Outerclothing with materials of Vegetable fibre. The mistaken notion prevails, that because the Outerclothing does not come in contact with the skin it cannot, like the Underclothing, be fouled by the skin's secretions. Yet everyone knows that the perspiration does not stop in the Underclothing, but also penetrates into the Vegetable fibre with which the Outerclothing is lined. If such lining be examined, in a very short time the same dirty discoloration as in the Vegetable fibre shirt will be noticed to commence, even when there has been no abundant flow of perspiration. As regards the cleansing of the clothing, it may first be stated generally, that Woollen fibre is not easily penetrated by extraneous matters which are soluble in water; it can only be dirtied on the *outer surface* of the fibre. For this reason Woollen fibre can long be maintained sufficiently clean

by *dry treatment*, such as brushing, beating, and so on, although, of course, cleansing with water must ultimately be resorted to. Vegetable fibre, on the other hand, absorbs into its interior dirt and poisonous matters, which can then only be withdrawn by means of *wet treatment*, *i.e.*, by washing. Let us now consider the treatment of the Outerclothing. While the Woollen outer material can be maintained during many weeks sufficiently clean by dry treatment, the lining and other parts of Vegetable fibre should, from a hygienic point of view, be washed nearly as often as the linen shirt is changed. This would hardly be possible for soldiers in times of peace, and would be out of the question in a campaign, because there is not the necessary supply for frequent changing, and Outerclothing so lined takes long to dry; moreover, there would be the objection, even in times of peace, that with the method of washing necessary to cleanse the Vegetable fibre lining, the Woollen outer material would suffer to a disproportionate extent. For these reasons, so far as I am aware, the uniform is in times of peace only washed once a year, which is, of course, much too seldom when it is lined with Vegetable fibre. Most private persons, on the other hand, entirely neglect the regular washing of the Outerclothing; they are satisfied to keep up external appearances by brushing the outer woollen material, and continually carry about with them the dirt and evil odour which are located in the linings and padding, under the delusion that it does not injure them, while others cannot see it. That they are under a delusion can be shown by a simple experiment. Remove from an outer-garment of woollen material, which has been worn, and of which the lining is dirty, the lining of one sleeve, leaving the other sleeve untouched, and wear the coat so. Even the dullest person will be convinced

that the arm in the sleeve without lining is more easy and comfortable, is warmer in winter and cooler in summer, than the arm which is still subject to the deleterious influence of the Vegetable fibre lining. If this experiment does not suffice, it may be carried further, and the lining removed from one side of the body of the coat, the other side being left intact. Whoever after wearing this does not admit that the Vegetable fibre lining of the coat is loathsome and injurious to health, deserves to end his days in Vegetable fibre.

Thus everyone can easily ascertain for himself the positive harmfulness of Vegetable fibre lining in the Outer-clothing; indeed it is the most harmful element in our modern dress, and the above hypothesis—that it would suffice in case of war to provide the soldiers with woollen shirts—is a mistaken one, for the following reasons:—

1. There would remain the injurious influence of the Vegetable fibre, which is usually present in the military coat in the shape of especially heavy linings and even of padding.

2. This injurious influence would be enhanced, for the skin is maintained at a higher temperature by the woollen shirt, and is also stimulated by the wool, so that it acts more freely, throwing off a greater quantity of water and vapour, and increasing the proportion of noxious matter excreted (with corresponding diminution of the proportion excreted by the kidneys, intestines, and lungs).

3. When the coat-lining is unsanitary, the woollen shirt causes the air within the clothing to contain a greater proportion of moisture, especially, of course, in warm weather and when perspiration is induced by exercise; this moisture remains longer, because the Vegetable lining of the coat, when wet with perspiration, dries very slowly, and is impervious to vapour. The

consequence is that the outer skin becomes softened, enervated, and sensitive, and of course the sensitiveness is felt when the body is exposed ; if the blood be impure, this condition of the skin may reach a point at which troublesome eruptions ensue.

The assertion is frequently made that "wool is enervating," which is true, especially in respect of the skin, when wool is worn under a coat lined with impervious cotton, and of course in a yet greater degree when wool is worn, not only under the unsanitary coat, but also under a shirt of Vegetable fibre. *This, however, is precisely the mode of clothing the body against which I contend.*

I have established by experiments that if, in the first place the shirt, and in the second place the coat-lining, of Vegetable fibre, be discarded, leaving both under and outer-clothing *wholly* of wool, all these objections cease. The exhaled watery vapour passes freely into the air, without any diminution of the skin's activity ; the coat and shirt dry, when wetted by perspiration or rain, with the greatest rapidity, and the skin as rapidly attains the necessary dry state, thereby ceasing to be sensitive. In short, only clothing which is partly or wholly of Vegetable fibre enervates, whereas *entirely* woollen clothing, when not too thick and impervious, hardens the body almost as much as if clothing were dispensed with altogether.

4. Let experiments be made as to how the men themselves *feel*, first in a coat lined with Vegetable fibre, and cotton shirt underneath ; then in a coat similarly lined and woollen shirt underneath ; then in a coat without lining and with cotton shirt ; then in a coat without lining and with woollen shirt. Let the men march and exercise, and the question will very soon be settled in

favour of the last-named method as the only correct one. How is it that all who engage in athletic sports, and many who shoot, or make lengthy walking excursions, instinctively select pure woollen clothing, without lining? What is good for athletes and sportsmen must certainly be the best for soldiers.

On this matter there is no room for doubt, and simple experiments will serve to show that, from the hygienic and hardening point of view, the practice of lining, and still more of padding, the outer clothing with linen and cotton materials is to be condemned, whether the shirt underneath be of Vegetable fibre or of wool. It is equally easy to establish that if it be intended to procure for soldiers in a campaign the advantages which are now on all sides admitted to accrue from the woollen shirt, *the removal of the coat lining of Vegetable fibre is indispensably necessary*, especially in the warm season.

Another question is, whether the lining of the uniform coat is necessary from mechanical considerations. It is said that woollen material easily tears, and that the firm lining of Vegetable fibre supplies the requisite resistance. I may mention, in the first place, that the lining of uniforms is not deemed necessary in all armies, for instance, the Austrian soldier's uniform is not lined. Admitting, however, that a coat not lined has less resisting power than a coat which is lined, the following has also to be borne in mind: The wet sole of a boot wears and tears much more quickly than a dry sole, and the same is true in relative degree of woollen material; other things being equal, the coat which dries quickest will last longest, and that is the coat without lining.

If to the foregoing be added that the uniform-coat which is lined with Vegetable fibre must from time to time be washed, if it is not to lapse into an insufferably

disgusting state, while a similar garment without lining can be maintained clean for a much longer period by dry treatment; and if we consider that the wet treatment which the lining of Vegetable fibre necessitates injures the durability of the woollen outer-material—the assertion of the greater durability of the coat with Vegetable fibre lining falls, in my opinion, to the ground.

I shall be told that, especially in the cold season, the lining of the coat affords greater protection against cold. This my experience enables me to most distinctly deny. *Wool always feels warm, Vegetable fibre feels cold.* In clothing which combines wool with Vegetable fibre, the vegetable portions are not a factor for keeping the body warm, but for making it cold, diminishing the warming influence of the wool. Myself and the adherents of my System have found that a woollen coat without lining keeps the body as warm as a woollen coat and overcoat together when both the latter are lined with Vegetable fibre. What has just been stated about the chilling influence of Vegetable fibre in a dry state applies in a much greater degree still, so soon as it is wetted by rain or perspiration, when it becomes “icy” to the touch, whereas clothing wholly of wool never causes this feeling.

It will perhaps be contended that, while an unlined coat may do well enough when the air is calm, the wind penetrates much more sharply through it than when it is lined. This, of course, cannot be disputed, but the main point lies in the behaviour of the skin; we see that the skin of the face possesses in its power of enhancing its circulation of blood a means of defence against the influence of the wind. The skin under the clothing does the same, provided that it be not hindered by some other influence, such as that exercised by the unwholesome

lining of Vegetable fibre. If this be removed, the skin of the body will perform its function equally well as the skin of the face.

By this I do not mean to say that the necessity will never arise for more and thicker clothing, but this can be provided in another and a better than the ordinary way. If a thin woollen jacket, weighing no more than the coat lining, be worn between coat and shirt, it will maintain the temperature of the body far more effectually than a lining of Vegetable fibre, with the advantage that the jacket can be removed when not required. I do not even consider that soldiers require such jackets, for they have their overcoats or cloaks. If these be unlined, the cold must be very extreme for them to suffer inconvenience, and in a campaign like that of 1870, such jackets as I have described could, without great difficulty, be dispatched to the army.

It is sometimes said that no uniform-coat will fit neatly and closely to the figure unless it be lined. This I will not altogether deny: the Austrian soldier's uniform-coat without lining sits more loosely, more like a blouse, than the German uniform. Nevertheless, I submit the following considerations :—

1. The matter can only be regarded from this point of view in the case of soldiers on parade, not when they are on a campaign. The soldier fights with aid of the forces of his body, and even if a smart appearance is not without its effect on the enemy, this advantage must not be acquired at the cost of bodily disadvantages.

2. If elastic diagonally woven cloth, or the stockinet material used for riding-breeches, were used for uniforms, instead of the usual cloth of close web, the coat could be prevented from either looking like a blouse, or from easily bursting through fitting too tightly. Material suited to

closely fitting riding-breeches is also adapted to closely fitting uniforms, which are desirable for hygienic considerations as well as for their smarter appearance.

I now come to the question of pounds, shillings, and pence. It would certainly be the ideally best plan to thoroughly carry out in the army what I have called the Sanitary Woollen System—pure woollen outer and under-clothing, pure woollen bedding, and sleeping with open window—but this, of course, would involve a certain expense. My proposal, however, to remove the lining of Vegetable fibre from the outer-clothing—the coat, trousers, and cloak—involves a *saving*, a less expenditure, not a greater. The cost of manufacturing the uniforms will be less if the lining be left out, and the labour and expense which *should* be incurred for cleansing the lined clothing will not be required. The saving thus effected may be applied in procuring still stronger cloth than is at present used, if the durability without lining be questioned, a point already dealt with in this chapter.

As regards experiments which may be instituted in order to practically test the clothing reforms comprised in my Sanitary Woollen System, it is of the highest moment that they should be exactly and scientifically conducted. I have heard of experiments made by simply putting men into woollen shirts, without even giving any consideration to the enormous hygienic difference between a dyed flannel shirt and an undyed stockinet shirt. The first and most important step in such experiments should be the removal of all Vegetable fibre from the outer clothing, and when the advantages of this course have been established, the other reforms comprised in the Sanitary Woollen System may be undertaken. The question of the form which the clothing of the legs should take is fully discussed in the chapters on

"Trousers or Breeches," which I earnestly commend to the consideration of military authorities.

XVII.—SANITARY BEDDING AND BEDROOMS.

THE great hygienic value of this most important part of the Sanitary Woollen System cannot be exaggerated, and will be apparent to everyone who weighs the following considerations: In its day-clothing the body is more or less in an active condition, whereby the exhalation from the skin is enhanced, and the ventilation of the atmosphere in the clothes is facilitated. Of course, matters are produced which are due to this activity, and which must be removed; but the increased exhalation from the skin, and ventilation of the atmosphere in the clothes, sufficiently carry away the noxious portion of the exhalation.

On the other hand, the condition of absolute repose in bed is much less favourable to the removal of noxious exhalation. If a person be confined to his bed by disease, what does it avail him that his day-clothing is sanitarily correct? It is palpable that in cases of disease it is especially important to secure the healthiest conceivable conditions, and that the consequences of lying in a bed which from its nature tends to become a repository of evil odours, instead of letting them pass away and disappear in the air, must seriously retard, if they do not prevent, recovery. Further, the occupant of an unsanitary bed is much more reluctant to have the window open, to lie near it, and to let the fresh air exercise freely its purifying effect; because the gratification of the desire which the unsanitary bedding creates to throw off the coverings may set up a chill. Moreover, even if patients in un-

sanitary bedding could be thus brought nearer to the fresh air, the atmosphere surrounding them would still be vitiated by that reservoir of noxious odours, the unsanitary bed.

Before proceeding further to discuss the subject of bedding I will say a few words as to the night-clothing. This should of course be of undyed porous wool, and I recommend for men a costume in the nature of Pyjamas. Sleeping suits have been constructed of jacket and pants with or without feet, either knitted or of the stockinet material. These suits afford more protection to the body than the loose woollen night-dresses, especially on quitting the warm bed, when the heat of the body attracts a rush of cold air up so loosely-fitting a garment. Another alternative is to wear at night a change of day-shirt, drawers, and socks, and the comfort of this costume is only inferior to that of the sleeping suits.

The reasons for condemning from a hygienic standpoint the bedding hitherto in general use are—firstly, the employment of linen, cotton, and hemp materials for the sheets, mattress, coverings, stuffing, &c.; secondly, the use of dyed blankets, and blankets not wholly of wool; thirdly, the objectionable practice of not only dyeing the horsehair stuffing of mattresses and bolsters to make it nicely uniform, but even of adulterating it with Vegetable fibre. Further, the manufacture of wooden bedsteads with the inner, unseen parts left untouched with oil-paint, varnish, or some other material to effectually close the pores of the wood, so that these cannot absorb evil odours; the placing of the bed in an unventilated corner of the room, and anxiously keeping the windows closed; the practice in winter, if a sitting room adjoin a bedroom, of warming the latter by permitting the access of the vitiated air from the former; all these errors and bad

practices constitute the ordinary bed a breeding-place for maladies, haunted by all the diseases which have in course of time been gone through in it, and which treacherously lie in wait for the moment when, favoured by conditions of warmth and humidity, they may attack the unsuspecting sleeper.

In contrast to the unsanitary practices just denounced, I will make the following brief suggestions: the sleeping-room should be airy, sunny, and on no account in dangerous propinquity to a water-closet. It should not be papered, but the walls should be sized or, better still, distempered. The furniture should be wholly of sanitary construction (see Chaps. 28 & 29). This, of course, especially applies to the bedstead, as already explained, and here metal is to be preferred to wood, as well on economical as on sanitary grounds. The position of the bed is also very important. It should not be placed in a corner of the room; a better arrangement is the foot-end against the wall, so that the head lies in the more open portion of the room; but by far the best position for the bed is with the head near to the window, so that the respiratory organs, and indeed the entire body of the sleeper, benefit at first hand by the fresh air. It of course follows from this that the window must be left open at night; and to this end the best construction of window is that which pushes up or down (as in England), and not that which opens sideways (as is usual on the Continent). The curtains or blinds to all the windows should be of wool, and the wool should be undyed. It must be apparent to everyone who has attentively considered what I have already stated, that curtains or blinds of Vegetable fibre, especially those through which the fresh air must pass before it can be breathed, are hygienically inferior to animal wool.

As material for the bed furniture and bedding, none but substances of pure animal fibre should be employed, such as wool or hair. These materials of animal fibre, moreover, do not retain the mal-odorous exhalations from the skin, *i.e.*, they permit their free passage into the surrounding atmosphere, and consequently allow the function of cutaneous exhalation to proceed without impediment. In order to secure these highly important sanitary qualities, the material of the bedding should be practically undyed throughout. As hygienic considerations should be paramount when bedding is concerned, and ornament can be supplied by a coloured covering which may be removed at night, artificial dye should, in accordance with what is stated in Chapter 21 on that subject, be as much as possible avoided. At the same time, by the employment of black, brown, yellow, and white animal fibres, a variety of effect can be obtained without the use of artificial dyes.

Where the interior structure of the bed consists of a wooden frame and linen or hempen bands, the former should be treated with shellac, or the pores of the wood be otherwise entirely closed, and the latter should be impregnated with refined paraffin, as also the twine or other material used for connecting the bands with the frame. The impregnation must be done carefully, or the paraffin may soil the woollen material with which it comes in contact. Some very strong woollen material should be placed on the bottom of the bed to protect the mattress. The necessity for treatment with paraffin is, of course, avoided when the mattress rests on springs of wire netting, as in most modern iron bedsteads.

Respecting the MATTRESS there is little to be said, except that it must conform to the principles of pure wool throughout, and of freedom from dye, which

underlie the Sanitary Woollen System. The division of the mattress into three sections is not only to be recommended, but is really necessary, as unless the relative positions of the different sections are frequently changed, that portion which carries the main weight of the body must soon become hard by compression. When, notwithstanding the frequent changing of the sections, this hardness makes itself apparent in course of time, the mattress should be opened and the stuffing loosened.

The *PILLOW* is sanitarily the most important part of the bedding, and is even of more consequence than any portion of the day clothing ; for the odour with which it must become impregnated is continuously inhaled during the considerable number of hours that the bed is occupied. Hence, the pillow should conform with the greatest precision to the principles as to material and dye laid down in the Sanitary Woollen System ; the stuffing should be of pure undyed wool. Pillow cases and sheets can be made of light natural-coloured woollen material or of white cashmere.

With two or three of the natural coloured coverlets or blankets of camel hair or sheep's wool, and with woollen sheets, if desired, the bedding, at least for healthy, vigorous persons, is complete. Persons who from any cause have greater need of warmth should apply the additional Woollen coverings requisite to obtain a comfortable temperature. It is neither necessary nor useful to feel cold, for the idea that it is possible thereby to become hardened and accustomed to cold, is erroneous. To maintain the body warm, the covering need not be of equal density at all points ; it is much better to place two-fold, or even three-fold, covering over the feet and legs, up to the knee.

For military and naval men, and for travellers, the "sleeping-bag " is a very useful and complete substitute for Sanitary Woollen Bedding.

The use of materials of camel hair in bedding is not only technically quite practicable, but is hygienically strongly to be recommended. Wide experience has shown the camel hair bedding to have important advantages over that made of sheep's wool or other animal fibre.

1. Camel hair surpasses sheep's wool in indifference to the mal-odorous and soiling portions of the exhalation and secretions of the skin, *i.e.*, it allows them to escape still more thoroughly into the air and become innoxious. Camel hair bedding thus remains longer clean and free from all evil odour than sheep's wool, which is not only a hygienical, but also an economical, advantage.

2. The peculiar soft, delicate, specific nature of camel hair acts like an opiate, and induces, after the bedding has been some time in use, a more quiet and deep slumber than the sheep's wool bedding, whence it is especially to be recommended to persons who sleep uneasily or suffer from sleeplessness.

3. The camel hair bedding is even cooler in summer and warmer in winter than the sheep's wool bedding. Camel hair furnishes most excellent coverlets and "sleeping-bags."

The objection is not infrequently made, that those who adopt the Sanitary Woollen Bedding will be in a difficulty when sleeping away from home. This difficulty is much more apparent than real, and may be overcome by the use of the "sleeping-bag," or by the sleeper wrapping himself in one of the large-sized Sanitary Woollen coverlets or rugs. Thus enveloped, his body is preserved from all contact with the blankets of the bed on which he is lying. He will probably find two blankets above the sheets of the bed, and can insert himself between them, enveloped in his rug. Especially in strange beds is the Sanitary Woollen System of inestimable value, *as it effectually*

guards against risks from damp bedding. To this danger, which may, by oversight, arise even in the most careful household, travellers are especially exposed; and innumerable cases of rheumatic fever, &c., with their always disastrous, and frequently fatal, consequences, caused by sleeping between damp sheets, would have been avoided under the Sanitary Woollen System.

XVIII.—THE OPEN BEDROOM WINDOW.

A BOOK might easily be written on the immense advantages attending the practice of *always* sleeping with the bedroom window open, and on the great disadvantages which arise if this rule be neglected; also on the progress which has been made in the treatment of disease, since it has been recognised as a prime necessity of life and health that the atmosphere immediately surrounding the body should freely mingle with the open air.

It cannot be too often insisted upon that the body will not be hardened, or empowered to resist the attacks of disease, unless there be thorough ventilation of the bedroom. To ensure this, in mild and quiet weather, two windows should be open at top, when more than one person is sleeping in a room. But however cold or severe the weather, one window should always be open at the top, although the air can be prevented from blowing on the sleeper by the interposition of a blind or a curtain. To endeavour to ventilate a bedroom by an open window in an adjoining room is useless, as will quickly be recognised by the nose, which is the best test as to whether a room is properly ventilated.

If on returning to a bedroom in the morning from the fresh air it is found to be in the least stuffy, the ventilation

is insufficient. Nor is this stuffiness merely a sign that the air is impure; the odorous matters whose presence it indicates are the noxious matters of the body's exhalation, and have a distinctly deleterious effect when they are inhaled with the atmosphere which they pervade. Various unfounded objections have been raised, tending to establish the injurious qualities of the external atmosphere when breathed at night by sleepers. For instance, it is stated that the night air is laden with carbonic acid, which is dangerous to the breathing passages when inhaled. In making this assertion the fact is overlooked that the breathing passages invariably contain air charged with 4 per cent. of carbonic acid, while the proportion in the night air is at most 4 per *thousand*! I myself have made the experiment of charging the atmosphere with carbonic acid up to 1 per cent., without in the least affecting my breathing. On the other hand, if the water that streams down inside the window of a closed sleeping-room be collected, one drop of this liquid, impregnated as it is with the noxious exhalations given off by the sleepers, will suffice to poison a rabbit, as has been shown by actual experiment. Those who have adopted the Sanitary Woollen System do not perspire at night, and are not subject to the chills of which persons clad and sleeping in linen or cotton are so greatly in dread. The woollen clothing and bedding afford ample protection; and if the head, from baldness, or the thinness of the hair, be especially sensitive, some extra light woollen covering should be provided for it. The difference in the effect on the spirits, and in the refreshed, instead of jaded, feeling on rising from bed, when, by means of the Sanitary Woollen clothing and bedding, and the open window, the "noxious" exhalations of the body are allowed to pass freely away, instead of being inhaled over and over again,

can only be appreciated by those who have tried it. Children no longer toss about in their beds and throw off their clothes, leaving the lower limbs exposed, while the face and hair are clammy with perspiration. In the hottest nights they lie cool and comfortable, just as they went off to sleep.

XIX.—THE CLEANLINESS OF THE SANITARY WOOLLEN CLOTHING SYSTEM.

THE worst description of dirt is that which is offensive to the senses. Linen and cotton, whether worn as underclothing or used for coat linings, etc., acquire an unpleasant odour, as may easily be ascertained ; so that even persons who put on clean shirts every day must continue unclean in one respect, for the coat lining cannot be washed, and constantly gives off its offensive smell. The Sanitary Woollen clothing need inspire no fear on the score of cleanliness in this respect, as it is pervious to the skin's exhalation. When the clothing has been worn some time it may be laid in the sun, or shut up with camphor, when it will be found to have parted with any excess of emanations which it may have absorbed from the body through lengthy wear.

Then there is the dirt that takes the form of dust, which settles in woollen garments more readily than in others ; but this is compensated by the advantage that it can also be more easily removed. A linen dress covered with dust must go to the wash, whereas brushing and beating will take out all the dust in woollen clothing.

Dirt in the form of grease from the animal fat secreted by the skin only presents itself if the Sanitary Woollen shirt be worn for an unduly long period, because it does

not take up and fix cutaneous secretions with the same tenacity as linen or cotton shirts. This brings me to consider the dirt that accumulates on the skin. In this respect Woollen shirts are truly incomparable. Whereas shirts made of Vegetable fibre material retain all the dirt of the skin, converting it into a species of grease to be again deposited in a crust, the Sanitary Woollen shirts brush off the dirt in the form of dry dust so thoroughly that, in a fairly pure atmosphere, the body looks, and is, as clean as though fresh from the bath.

To sum up, everyone is unclean who neglects to wash when dirty, but everyone is clean who *avoids dirt*; and, as the body collects much less dirt in the Sanitary Woollen Clothing than in cotton or linen, the inference is clear that, other conditions being equal, wearers of the former are much cleaner than those who adhere to materials made from Vegetable fibre.

XX.—THE CLEANSING OF THE CLOTHING AND BEDDING.

THE endeavour has been made to found a charge of want of cleanliness against the Sanitary Woollen System, on my assertion that, when the clothing is of pure wool *throughout*, the Sanitary Woollen shirt does not need to be washed so soon as a linen or cotton shirt.

Whoever takes the trouble to understand my System will at once see that it is the exact converse of encouragement to uncleanliness, in that it directly combats the factor which is deposited as dirt in the clothing; for I require that Vegetable fibre, which catches and retains dirt, shall be replaced by porous material of animal wool, which will not retain the secretions from the pores

of the skin, but will allow them to freely exhale and pass away. The two-fold consequence is :—

1. Clothing constructed on these principles remains clean very much longer than unsanitary clothing, in proportion as the Sanitary Woollen System is strictly adhered to. Time and money are wasted, and the garment is subjected to unnecessary wear and tear, when it is sent to be washed before it is dirty ; for clothing is not only clean when it has been washed, but also when it has not been made dirty.

2. It follows from the foregoing that I urge immediate cleansing of the clothing when, notwithstanding its nature, it has become dirty ; thus I am as energetic an advocate of cleanliness as any other writer on hygiene.

It should, moreover, be borne in mind that linen and cotton dresses are called “washing dresses,” as distinguished from woollen, which may be termed “brushing dresses.” With the former, brushing is of no avail, and they must be continually washed ; while wool, in eight out of ten cases when Vegetable fibre would require washing, may be wholly freed from dirt by brushing or beating. To insist on washing a porous woollen shirt as often as one of linen or cotton would be just as absurd as to say that, because a cotton dress must be washed after wearing it for a week, a cloth or flannel dress must be washed as frequently.

The linen and cotton shirt becomes unwholesome in two or three days, or, after copious perspiration, in as many hours, and the feeling of discomfort and aversion which it sets up in the skin tells the wearer that the shirt must be washed. It must not be supposed, however, that, apart from other considerations, the Sanitary Woollen Shirt could be worn unwashed *ad infinitum* without a similar sense of discomfort setting in ; this must come at last,

although the period which would elapse before it would be felt is considerably longer than with a linen or cotton shirt.

As regards the outerclothing, whoever, like myself, has worn such of linen or cotton, knows that after a few days it requires washing. Ordinary woollen outerclothing is made externally of wool, and internally is lined with Vegetable fibre. The outer woollen surface is much less liable than Vegetable fibre to attract dirt; and as most people are chiefly concerned for their exterior, they seldom or never cause the outerclothing to be cleansed, not considering that a regular Augean stable of offensive odours collects in the linen and cotton linings, endangering the health.

This condition of things has been improved by the Sanitary Woollen System, which discards the offensive Vegetable fibre. But, even so, perfection has not been attained, and there comes a time when the Sanitary Woollen outerclothing should undergo a cleansing process. The only difference between outer and underclothing in this respect is that the latter requires cleansing sooner than the former.

The relation which the question bears to that of the effects of colours on health, which I discuss elsewhere, is simple. The colour of the outerclothing is not the sole, but an essential, factor as to how soon the necessity for the cleansing process will arrive; and my investigations tend to show that from a hygienic point of view, the necessity is greatest with black colour or dye, and least with wool which is completely free from dye. As "natural" wool is a blend of white and brown, and white wool *appears* sooner to require cleansing, the highest rank must be awarded to the "natural" wool.

The practical question for present consideration is, when and how should the outerclothing and bedding be cleansed?

As to when ; I answer, so soon as there is reason not to feel completely satisfied respecting the health and general condition, whether the complaint be termed headache, toothache, heartburn, rheumatism, catarrh, sleeplessness, disinclination to work, etc. As to how ; if the clothing or bedding be dirty, it should be washed. Deodorization can easily be effected by placing the bedding in a chest in which camphor or some equally good deodorizer has been deposited. Two hours before bedtime the bedding should be taken out, to allow the smell of the deodorizer to evaporate, and the process is finished. The clothing may be placed in a receptacle over night with camphor, and in the morning it will have been deodorized.

The outerclothing, even when wholly of woollen materials, should from time to time be washed. In America the washing of the men's clothing is very properly considered indispensable, and is undertaken at regular intervals by the housewife.

A particular form of brush has been devised for manipulating the Sanitary Woollen Outerclothing. It offers the great advantage that, by a special patented method of treatment, the bristles in the brush are rendered very soft, and that thus many more bristles can be inserted in the brush without making the latter hard. The effect produced by using such a brush is much greater than with one of the ordinary construction, and the separate bristles are better able, because suppler and finer, to penetrate the depths of the web and to cleanse it thoroughly.

XXI.—SANITARY COLOURS OR DYES.

TO properly understand this subject, it is necessary to bear in mind that each person has an individual constitution, and that consequently all people are not affected alike by one and the same substance or matter.

This may be illustrated by the well-known difference of taste which prevails respecting even those foods which would be expected to please and suit everybody, as, for instance, milk. Many thoroughly healthy people cannot endure milk; in nearly every large household will be found at least one person who not only dislikes milk, but whom it affects with stomach ache and diarrhœa. Others, again, who are fond of cows' milk have an insuperable aversion to the milk of goats or asses.

This like or dislike for certain foods is apt to take an extreme form, that is to say, one class of people will be exceedingly fond of them, while the other will be equally averse to them; I refer to mutton, onions, garlic, cheese, cray-fish, strawberries, etc. The two latter delicacies have the reputation of producing, in certain constitutions, eruptions of the skin, inflammation of the throat, and similar disorders. I myself suffer from inflammation of the throat if I eat strawberries; and this idiosyncrasy began with the setting in of puberty, and therefore with a so-called change in the constitution.

Returning to the question of colours, the diversity of taste in the choice of the colours of clothing is sufficient to show that not every colour affects all persons alike. Certainly, inasmuch as custom ignores in what instinct and feeling really consist, the eye alone is assumed to be responsible for the diversity of taste in the matter of

colours. This assumption, however, is shown to be incorrect by the actual discomfort, or, at least, diminution in comfort, which most people feel in black clothing; further may be cited the cases which arise from time to time, especially since the introduction of aniline dyes, of severe poisoning effects produced by the dyes of articles of clothing.

Natural colours are preferable to artificial. Whenever natural colouring matter is present in hair or wool it is not situated on the surface; either the inner pith of the hair contains colour, or, when the outer stratum of the hair which consists of numerous very minute spindle-shaped cells, is coloured, the colouring matter is found in the centre of each cell, while the rind of the cell is colourless. This may be verified by examining through the microscope black horsehair resolved by sulphuric acid into separate cells. With dyed hair the colouring matter is at best equally distributed in the hair, and will clearly evaporate more easily than natural colouring matter, as it lies partly on the surface, while the latter is completely enclosed.

Before I introduced my Sanitary Woollen System, the woollen shirts worn as underclothing were almost universally dyed. This I considered a most objectionable feature in woollen underclothing, and accordingly I made the entire absence of dye, *i.e.*, the employment of Natural coloured woollen material, a cardinal feature of my System. Moreover, the Sanitary Woollen System causes the skin to develop much greater activity, and thus to be consistently warmer than in the case of a wearer of linen; and it is the warmth of the skin which brings into action the dye of the woollen shirt.

The first insight into this subject which I obtained from personal observation was when I had occasion to wear

mourning. Under my black clothes I wore a cochineal-dyed shirt. About this time an Italian physician had remarked to me that the Savoyards wear almost exclusively wool (as, indeed, is the common practice throughout Italy), but that they suffer much from ischias (pain in the hips). Not long afterwards I felt occasional drawing and burning pains in the neighbourhood of the hips and loins, and I was reminded of the foregoing remark, which I admit caused me considerable alarm. I found, however, as I went on, that at night I was free from pain, which made itself most felt in a sitting posture, when the trousers were tighter, causing a sensation of numbness or loss of feeling over the entire region, and of uncomfortable heat. A rapid walk on a warm spring day solved the problem over which I had for some time puzzled in vain. The exercise induced perspiration, and this was followed by a sensation as though I had a mustard plaster applied to the region of the hips and loins. It then first occurred to me that the black trousers might be the cause of the annoyance, which, indeed, rapidly subsided on my changing the trousers for a brown pair.

In another instance, a friend reported to me that a numbness or loss of feeling in the skin of the chest had caused him serious alarm, until he found that feeling was restored on his ceasing to wear a grey-dyed woollen shirt.

A further consideration is, that the influence of dye in the clothes is largely dependent on the temperature and humidity of the atmosphere, it being less under conditions of cold and dryness, and greater under those of warmth and moisture. Thus the effect of a dyed garment in winter, or in dry weather, or when the body is in repose and the skin is cool, may be neutral, or even agreeable; while in summer, in hot rooms, or when the body is heated, deleterious effects (discomfort, languor, local

pains, etc.) may be felt, especially when to these conditions are added a damp atmosphere and perspiration.

The principles of my system of colouring matters are the necessary deductions from the foregoing consideration, and I will here shortly recapitulate them :—

1. For summer clothing, working and every-day costume, especially for any kind of athletic sport, as also in hot climates, the material should be entirely free from dye—*i.e.*, natural white or natural brown.

2. Dyed materials are least injurious in winter, in cold climates, when the body is in repose, and for Sunday, visiting, and holiday attire (but not for dancing exercise, which is a species of athletic sport).

3. "Fast"—*i.e.*, non-volatile dyes are admissible, but only when no residue or surplus of loose, unrinsed dye is left in the garment: this is easily tested, as in such case the colour comes off. As the process of rinsing can only be complete when the wool is dyed before being worked up, all fabrics which have been dyed in the piece, or printed with dyes, should be rejected.

4. The less colouring matter that a garment contains—*i.e.*, the lighter it is dyed—the smaller will be the danger arising from the colouring matter.

In carrying out a system of sanitarily coloured clothing, it would be impracticable to discard all artificial dyes, and I have therefore adopted certain dyes, especially indigo and cochineal.

I will here quote from a communication which was made to me by a correspondent :—

"I believe that you are yourself of opinion that the experience thus far attained is not conclusive. It is highly improbable that cochineal, indigo, and madder are the only sanitary dyes with which animal fibre can be treated; there must be others, as well as many which are capable of being transformed from their present harmful or indifferent nature to a wholesome quality, if made sufficiently well; for

instance, even the injurious nature of some aniline dyes may be much moderated. Permit me to express a doubt whether cochineal, madder, and indigo are alway used wholly pure; indigo cannot be used alone without some admixture of logwood, and the other sanitary dyes are often blended, in order to procure certain shades of colour. You are aware that imitations of indigo can be made which are so 'fast' that they withstand the test of sulphuric acid."

In reply, I pointed out to my correspondent that investigations as to the sanitary qualities of dyes can only be made by persons who are technically connected with dyes, and who must be practical, not theoretical, men. Such men will not institute researches which would cost much time and money unless induced or compelled thereto for business purposes; and this inducement or compulsion can only be created by a categorical demand for sanitary dyes from a sufficiently large number of consumers. The question of dye concerns only the Sanitary Woollen Outerclathing, the Sanitary Woollen Underclathing and Bedding being of natural colour; and the number of those who recognise the hygienic importance of sanitary dye is not yet large enough to affect the general tendency of manufacturers to use cheap, and often unsanitary, dyes. Moreover, the ladies have hitherto shown little interest in the question, and it is they who must give their support before a large range of sanitary dyes can be forthcoming. To show the importance of the subject to ladies who wear coloured stockings, I may refer to a paragraph which appeared in the papers, giving a detailed account (including the name) of a young lady who recently made her feet sore by dancing a whole evening, notwithstanding that her shoes gave her great pain. Within a few hours her blood was found to have been poisoned by the poisonous dye of her stockings having entered the wounds in her feet, and the account states that in order to save her life both feet had to be amputated.

In another case which was lately reported, a woman while knitting with green wool, noticed a small blister on the thumb of the left hand, which she pricked with a knitting needle, and pursued her work. Through the open blister the arsenic in the dye must have penetrated the hand and thence the arm, as very soon serious symptoms of blood-poisoning set in, and caused her death.

XXII.—TECHNICAL DIFFICULTIES.

WITH the continual development of the demand for Sanitary Woollen Clothing and Bedding the difficulties to be surmounted increased rather than diminished, especially as regards the Outerclathing.

Quite at the beginning, when I had only arrived at the conviction that the clothing material must be free from Vegetable fibre, it was a comparatively simple matter to examine microscopically a selection of patterns and to separate the pure ones from the adulterated, leaving a fairly large choice in point of thickness, web, dye, dressing, &c. Here already we met with a difficulty—the pure materials were always highest, and the adulterated lowest, in price. Then came the conviction that the thick felt cloths and stuffs ordinarily used for Outerclathing should be superseded by a more porous cloth. This again increased the price, as strong porous cloth is usually more expensive than cloth of closer web, for the following reasons:—

1. In pure wool, the difference between natural wool and shoddy is that the fibre of the first is long, of full vigour, and expensive, while that of the second is short, deadened, and therefore little durable, but it is low in

price. The mingling of the less costly but inferior shoddy with the natural wool is much more easy in the case of cloth with very close web than in weaving really good porous materials, when the woollen threads require to possess greater tenacity.

2. In weaving stockinet cloth, whole pieces are liable to be more or less spoiled by irregular working of the complicated machine, and losses thus incurred must of course be recouped by the manufacturer in the price of the unspoiled pieces. The greater costliness, again, diminishes the demand, and consequently there is less inducement to make stockinets.

A whole series of fresh obstacles arose when I discovered the hygienic importance of dyes. In the first place, shoddy, which of course is usually dyed, had to make way entirely for the more expensive natural wool. Secondly, as natural white wool can only be used to a limited extent for Outerclothing, recourse was necessitated to the wool of black sheep, and here came the following difficulties :—Sheep which yield black wool are few in number and widely scattered, so that the wool can only be procured in small parcels. Black wool drawn from different districts not only varies greatly in fineness, crispness, &c., but also in colour. To obtain anything like uniformity it was absolutely necessary to mix the wools together, and to add white wool. This gives rise to defects of colour (here and there too light or too dark threads) in the finished fabric, which diminish the value of the material, or even render it unsaleable.

When, therefore, I requested my authorised manufacturers to produce natural brown (*i.e.*, undyed) materials, I encountered the greatest opposition. The manufacturers of the shirts declared the idea an impossible one; and for a long time no one was inclined to risk

the manufacture of such materials for Outer-clothing. It was thus no small matter (in 1883) for my manufacturers to have accomplished, when they were in a position to supply—1. Natural colour underwear of the finest quality of wool; 2. All bedding materials in natural white and natural brown; 3. Knitted natural brown Outer-clothing for children and adults, and natural brown socks and stockings. The manufacture of natural brown stockinet material for outer-clothing presented the greatest difficulties of all, but even these were subsequently triumphantly overcome.

As explained in the first of the two chapters on "Trousers or Breeches," the practice of working in cheap shoddy led to the manufacture of the heavy cloths which I have termed "elephant hides," and which, owing to their thickness, and consequent imperviousness, are unsanitary. These heavy materials have the appearance and reputation of solidity, but are of course just the reverse, being trashy through and through. If comparatively light materials like stockinets were made with such rubbish, they would tear as readily as spiders' webs; but the tailors and the public are accustomed to this rotten "solidity," and when the first genuine, natural brown, light stockinet cloths were produced, and the prices quoted, everybody said "this will never sell."

The position is now somewhat changed, and people begin to understand that in this matter also I hit on the right direction. But from the earliest commencement to the day when the manufactured Sanitary Woollen Outer-clothing materials could be supplied in sufficient quantity, was a path strewn with thorns.

The question of price is of course continually raised, and I answer it thus:—In no province of industry has the principle of "cheap and nasty" been more unscrupulously

and unconscientiously applied than in that of the manufacture of Outer-clothing, not only by the employment of shoddy, but even by shamelessly weighting the woollen materials with mineral matter. I consider it one of my chief duties to my authorised manufacturers to assist them in establishing the converse principle, that the best, not the worst, is cheapest in the end. For even though good materials be expensive, the expense is abundantly recouped by greater durability, and above all because the "first wealth of health" is thereby promoted.

In the days when cloth was made of solid, pure wool, dyed only with indigo, the peasant farmer paid a good round sum for his coat, but he acquired a property which he could bequeath to his children. Contrast this with the dust which is every morning collected in the rooms in which the modern woollen materials of clothing, carpets, and furniture are used ! So large a proportion of this dust is shoddy that it is easy to calculate how soon the entire shoddy splendour will give out, and have to be thrown on the dust-heap. Whether the day will come when the authorities will proceed as energetically against adulteration of clothing as of food, is a matter which I commend to the public consideration. I consider it my duty to watch that my authorised manufacturers maintain the highest standard of quality, and I beg my adherents, in their own interest: 1. Not to be misled by apparent cheapness, but to satisfy themselves that the goods are unadulterated, and do not readily shrink. 2. If they desire my guarantee on these points, to insist before purchasing on seeing that the goods bear the genuine trade-mark. The success of my Sanitary Woollen System has led unscrupulous persons to endeavour to counterfeit some of the Sanitary Woollen articles, and the shops

swarm with imitation goods, some containing a considerable admixture of cotton, others containing shoddy, to say nothing of the treatment in respect of dye.

These counterfeits of the Sanitary Woollen Clothing, Rugs, &c., are sometimes palmed off upon the public by the following trick : the vendor procures a few specimens of the genuine goods, bearing the authorised trade-mark, and exposes them in his window, while inside the shop imitation goods are either sold as being genuine, or the purchaser is assured that the counterfeits are just as good or better.

It would be well if, in all such cases, the public would communicate the facts to the head depôt, when the articles required can be supplied, and such steps as are practicable can be taken to prevent a continuance of these deceptive and dishonest practices on the part of the retailer.

The sole guarantee of genuineness is the authorised trade mark,* with which the public may easily make itself acquainted through the descriptive catalogue issued of the Sanitary Woollen Clothing and Bedding ; and as it is one of the most pleasing features of my Reform that those who interest themselves in it and adopt it from conviction share my anxiety to see its general extension, and render me invaluable service by recommending it and explaining it to others, I feel confident that my appeal to them to assist me in protecting the public against the imposition of counterfeit clothing of dubious quality will not be disregarded.

* See opposite p. 188 of this book.

XXIII.—THE RANGE OF THE SANITARY WOOLLEN SYSTEM.

ALTHOUGH I neglect no opportunity to combat the notion that the Sanitary Woollen System must afford to all who adopt it entire immunity from disturbances to health, I will here briefly consider what the experience so far (December, 1885) gathered has shown that the System cannot perform. But, first, I must make a few prefatory remarks.

Everyone is born with a nature wholly peculiar to himself, which finds expression, not only in all that he does or omits to do, in his outward appearance, features, handwriting, gait, voice, etc., etc., but also in the conditions which relate to his health. These conditions are (a) *quantitative*, *i.e.*, they refer to the general strength of constitution; there are strong and delicate natures in every possible degree. (b) *qualitative*: the fact that the human body is composed of a considerable number of various organs, tissues, and systems gives rise to great diversity among different people. The rarest case is when the constitution of all the organs, tissues, and systems of a body is equally good or bad; on the one hand there is usually a so-called "weak side," a "sore point," a point of least resistance, on which it is rightly said that every disturbance to the health, either exclusively or in the main, fastens; on the other hand, most people have a "strong point." For instance, one person's sore point will be his stomach, another's the lungs, a third's the mucus membrane of the nose, a fourth's the nervous system, a fifth's the intestines, and so on, *ad infinitum*. Hardly any one but will have some "sore point" in his

organization, and of course the converse holds good, *i.e.*, nearly every one has an organ or system of which he has never to complain, and with which nothing is ever wrong.

Now, when a person adopts the Sanitary Woollen System, there may be considerable change in his state of health, but his *inborn original nature* undergoes no radical change. A nature originally delicate will be more healthy than before, its powers of endurance will be greater, many troubles will altogether disappear, but it will always remain delicate; *i.e.*, if two persons, one born delicate and the other strong, adopt the Sanitary Woollen System at the same time, both will be better and healthier for it, but the gulf between them continues as a rule to be as wide as ever. The difference can only be overcome when the previous disparity was not *innate*, but was due to the very enervated condition of the one, while the other was already tolerably hardened. The *innate* difference is never overcome, and, for instance, the nature of women will always remain more delicate than that of men. Here I may point out that, naturally enough, many of those who adopt the Sanitary Woollen System are delicate, and are either actually ill, or with strong tendency to illness; while people endowed with hardy, tough constitutions are less drawn to it, unmindful that "prevention is better than cure," and sceptical as to the greater vigour and comfort which it would procure for them. Consequently the System is often enough subjected to unfair criticism; and because it cannot perform the impossible, is visited with the blame which is due to the delicacy of the inborn constitution.

What was previously a "sore point" remains so nearly always, even after the adoption of the Sanitary Woollen System. For instance, a disordered stomach can be cured by the System, but the stomach will usually remain a

"sore point," *i.e.*, every disease-cause which can still take effect will tend to make itself felt in the first place in the stomach.

So much as regards general *tendency*, and we will now consider the diseases to which Wool-wearers are subject, and whence they arise.

Neglect of some of the principles (woollen clothing, woollen bed, sleeping with window open, *i.e.*, pure air) of the Sanitary Woollen System, may induce symptoms of the nature of an illness, but of mild character. I have observed such incidents with my own children who still attend school, and who have occasionally suffered from what is called school-feverishness, lasting half a day or a day, due to the offensive school-room atmosphere.

Excessive mental emotion or excitement is a not infrequent cause of illness in Wool-wearers. That mental agitation can of itself make people ill, and destroy the power of resistance to disease-causes, may be read in most medical works. Anger, fear, grief, care, home-sickness, thwarted love, are popularly known as disturbances to health. But, it will be said, the Sanitary Woollen System is supposed to protect against such evil effects: to which I answer, that this protection is no more to be conceived as absolute than is the idea of bodily strength. The strongest athlete can be overpowered by an ox or a lion, and similarly the greatest strength of mind may be subjected to an influence with which it is unable to cope. Wool-wearers experience an enhanced capacity of resistance to the effects of the emotions, but a sudden great misfortune, or reverse following on reverse, may be too much even for them, especially if they be originally of a delicate constitution. It is the same with work. The Wool-wearer can perform a greater amount of physical or of mental labour than was possible before he adopted the

System, but it does not follow that he has become a *perpetuum mobile*. If he labour too long or too intensely he will suffer like anybody else from the effects of over-exertion. Even then he has the advantage over an unsanitarily clothed person that, in consequence of the active condition of his skin, he sooner rids himself of the evil effects; *i.e.*, other things being equal, his vexation or wrath evaporates sooner, his excessive fatigue disappears more quickly; but, until the emotion or fatigue has passed away, his power of resistance to disease-causes will be affected.

Wool-wearers are, of course, liable to be affected by all poisons. No human being is proof against poison. Whoever inhabits a room where the wall paper contains arsenic; or whose occupation exposes him to the action of phosphoric or metallic poisoning, or to continual stench of decaying or putrefying matter, is liable to suffer in his health, even though he be clothed in wool. It remains his duty to take every possible precaution against influences which are obviously injurious, when he cannot altogether avoid them. And lastly in cities, especially where the drainage, etc., is defective, Wool-wearers will never be so healthy as when they can breathe the air of the mountain or the forest. But be the conditions what they may, the Wool-wearer will never suffer as badly as people who are unsanitarily clothed; and his finer sense of smell will always enable him, if he has taken to heart the teaching of my Sanitary Woollen System, to make the best of an unfavourable situation.

XXIV.—EFFECTS OF EXCESS OF FAT AND
WATER IN THE TISSUES.

(1879.)

THE English word "condition" is the only adequate term wherewith to express that state of mind and body in which the health and working power leave nothing to be desired. Let us first see what constitutes "condition." Briefly stated, it depends upon the correct proportion of the most important bodily constituents, and upon certain physical properties of the living tissues.

As regards a correct proportion of the bodily constituents, we may limit our enquiry to an examination as to three of these—albumen, fat, and water. The first is the foundation of muscle, nerve, blood, etc., and, in fact, sustains the existence of the body. Relatively to this substance, water and fat may be viewed simply as auxiliaries, although indispensable in themselves. A proper condition of the body requires that these three constituents shall be present in certain proportions, while the richer the body is in albumen the sounder it will be and the fitter for work; on the other hand, any excess of water or of fat will lessen its energies and its power of repelling the action of influences likely to promote disease.

Touching the physical properties, we have first to consider the degree of excitability of the life conductors of the body, chief among which are the nerves and the muscles; for upon this quality depend energy, speed, and power of excitability in bodily and mental work, as well as in those processes of adjustment which sustain the body against external disturbing influences. The second

point relates to the condition of elasticity in the sinews, ligaments, vessels, lung tissues, etc. Any diminution in their flexibility and firmness lessens the energy and the power of resistance of the body.

Imperfect action of the skin will induce, with varying rapidity, certain changes in the proportions of the constituents and in the physical properties of the substance of the body.

These changes must be considered separately.

Foremost I place the increase of the store of fat, which almost invariably supervenes in cases of sedentary habits of life, when there is no want of food. The injurious effects of an accumulation of fat are as follows:—

Careful experiments have established that fat people possess considerably less blood than the lean, and it is consequently a mistake to suppose that obese people are necessarily full-blooded. On the contrary, they are poor-blooded, which in itself is a malady made manifest by a never-ending series of minor disorders of the general economy; and there are a variety of diseases to which fat people fall a prey and succumb much sooner than the lean, notably all those which are determined by the quantity of blood in the system. With reference to vital energy, it is notorious that persons suffering from poorness of blood are incapable of doing the same amount of work as those who possess a full measure of blood, because the working power of an organ depends upon the store of blood in it. Another drawback of obesity is that the fat diminishes the necessary space for the circulation of the blood and the play of the respiratory organs. The first of these evils brings about an abnormal distribution of the blood in the system, which is less apparent if the body be resting, but shows itself as soon as the circulation quickens, when the rapid flushing of the face indicates

an excessive rush of blood to the head, which may produce dizziness or apoplexy. Another irregularity in the distribution of the blood is, that its return from the lower parts of the body towards the heart is hindered by the reduction of the space in the abdominal cavity. This causes heaviness and lassitude in the legs, and a tendency to the formation of varicose veins ; while, if the circulation of blood in the system be impeded, there will ensue dropsical swelling of the legs. The obstruction to the return of the blood from the abdominal organs causes the extremely troublesome, and in their later stages of development even dangerous, hemorrhoidal complaints which almost invariably affect the obese. A hampered circulation is also one of the reasons why fat people are less capable of work than the lean. If an organ be required to do work, it needs 80 per cent. more blood than when at rest. Every labour therefore necessitates an alteration in the distribution of the blood, to which fat operates as a hindrance, blocking the ways so that the blood cannot flow in sufficient quantity to the part that requires it.

The limitation of space due to fat is also mischievous, from its interference with the free play of the lungs. On this point I myself took measurements, which went to show that, among men of forty years of age, the obese could only empty a breathing measure to the extent of 18 cubic centimetres of air to every kilogramme of weight of body, after taking in the longest possible breath, while the lean would inhale 40 to 50 cubic centimetres, or about three times as much. It follows that the obese are disabled from exceptional exertion necessitating fuller breathing than usual and a more copious flow of blood through the lungs, which latter have not sufficient space either for the air or the blood.

The obstruction caused by fat is shown in the rapidity with which an obese person becomes heated by exertion; but even in repose this interference with the free play of the respiratory apparatus is injurious, and renders the body sluggish, because it checks the excretion and combustion of the substances (carbonic acid, water, and lactic acid) which hinder the proper functional processes of the body.

With regard to the greater liability in cases of obesity to attacks of disease, I may particularly refer to the danger of pulmonary affections. If any such malady render one portion of the lungs unserviceable, life will be further shortened by the reduced working capacity of the remnant which may be still available for use. Fat people are also far more susceptible to such maladies as gout, dropsy, emphysematous lesions, etc.

The effect of fatty deposits upon the physical properties of the living tissues, and especially upon the measure of their activity, may be easily verified by experiments. If a nerve be severed in a living animal so that the brain can no longer transmit its action and is thus reduced to a condition of rest, globules of fatty matter will be gradually deposited, and in proportion as this proceeds the active faculty of the brain will decrease. A similar change affects the muscles when their nerves have been cut. Their power of contraction and the energy of the contractions diminish in the same ratio as the granules of fat increase in number and size. Since, therefore, the measure of excitability in nerve and muscle governs the power and energy, not only of bodily, but also of mental work, it will be easily understood why corpulent persons become inert and limp both in body and mind. As regards the mind, I may add that fatty degeneration of the brain is one of the most frequent causes of imbecility and mental aberration.

From the foregoing it will be seen that anyone wishing to preserve health and working capacity should keep strict watch whether any deposit of fat is going on in the body. Such symptoms must be taken as a *memento mori*, evidencing a wrong system of living; and in order to stay the further accumulation of fat, and to get rid of what is superfluous, recourse must be had to increased action of the skin. There is no better remedy. Against the well-known BANTING cure, consisting in abstinence as much as possible from fatty or farinaceous food, I would caution all persons with whom the deposit of fat has attained any considerable proportions, because under such circumstances it may become dangerous; and even though it bring no peril with it in particular cases, the efficacy of the BANTING cure is infinitely inferior to the agency of an active skin in the restoration of a healthy condition to mind and body.

An inordinate increase of the percentage of water is not so apparent as the deposit of fatty matter—if the two morbid conditions do not manifest themselves concurrently, which is mostly the case—but it makes itself distinctly felt; the flesh is flabby and doughy, whereas under normal conditions it should be perfectly elastic and firm. Accumulation of water in the system directly tends to increase the percentage of water in the blood, which means poorness of blood, and a consequent lowering of the powers in all parts of the body; for their nutrition is lessened, and the water in them increases, crippling the vital forces, or, in other words, diminishing the normal activity of nerve and muscle, and eventually suspending it altogether.

The experiments of Professor NÆGELI have established that germs of fermentation and putrescence require a certain proportion of water in the solution or tissues in

which they settle, in order to flourish and multiply. For instance, fermentation may be stopped by thickening the liquor, and meat may be preserved by desiccation.

My Sanitary Woollen System maintains and assists the activity of the skin, under a covering of porous woollen clothing *throughout*, draining the water from the body, and reducing or thickening the mass of the bodily juices. In times of epidemics, the firmer the tissues thus become, the greater will be the energy of the vital forces to withstand the attacks of disease-germs, which are weakened in proportion as the degree of concentration of the bodily juices is raised. Hence, a comparatively small difference in the percentage of water in the tissues may decide the struggle of the latter against the germs of infection.

XXV.—THE CAUSES OF DISEASE, AND DISEASE GERMS.

(1879.)

I HAVE for some time studied the question indicated in the heading of the present paper, particularly with a view to ascertain the cause of the liability of the human body to disease, and the means by which it may be steeled to effectually withstand external unhealthy influences. In professional parlance this power of resistance goes by the name of "immunity," and in the following remarks I shall make occasional use of this word in the above sense.

My inducement to revert to these studies is a remarkable coincidence between the latest outcome of my researches and the investigations prosecuted by Professor NÆGELI, the Munich botanist, on the subject of the most important

group of the external causes of disease—namely, the poisons of infection—on which he has published a book entitled, *Die niederen Pilze in ihrer Beziehung zu den Infektions-krankheiten*.*

I will begin with an account of my own discoveries, to be followed by an exposition of those of Professor NAEGELI. My attention has for years been especially directed to that particular change in the condition of the body which is popularly called training, or hardening. The problems for solution were as follows :—Wherein does this change consist, what are its causes, and what its uses? Professional works supply but scanty information on these points.

The first result of my studies was, that in the process of hardening the body I recognised such a change in the relative proportions of the three most important constituent parts of the tissues—albumen, fat, and water—as clearly pointed to the conclusion that the hardening is mainly brought about by the elimination of fat and water. I also contrived to obtain, by taking the specific weight of the body, numerical values expressing in figures the hitherto undefined notion embodied in the term “hardened,” or “in good condition.” As water and fat are lighter substances than albumen, it follows that a man in good training must be specifically heavier than one in a weaker condition, and this has been determined beyond doubt by measurement and weight.†

Another outcome of my studies was a clearer perception of the circumstances favouring the process of hardening the body. The misconception that this consists in simply inuring the body to cold has wrought much

* The Subordinate Fungi or Germs in their relation to Infectious Diseases.

† See “The Specific Gravity of the Body,” page 119.

evil among the general public. I have succeeded in determining that my System of clothing, which admits of the free escape of the watery vapour given off by the skin, tends to harden the body, while clothing likely to check the elimination of water from the tissues is enervating.

The process of hardening the body consists in the gain of firmer and more compact flesh, richer in albumen, and with less fat and water. I believe it to admit of no further doubt that this is synonymous with an increase of the power of the body to withstand the action of morbid influences, and that, consequently, the current conception of florid exuberant health is altogether erroneous. The healthiest people are endowed with tough, wiry, firm-fleshed and well-knit frames, and such subjects withstand much better not only climatic changes, but also those inflammatory affections which are engendered by the intrusion of living disease germs into the human body.

Shortly before I had thoroughly possessed myself of these facts, there appeared the above-named work by Professor NÆGELI, containing disclosures so noteworthy on the subject of the so-called infectious diseases, that I at once formed the design of communicating some of its leading features to my readers, without, however, then suspecting into what intimate connection NÆGELI's researches might come with my own.

To Professor PETTENKOFER, of Munich, pertains the merit of the discovery that the germs of infection in cholera and typhus (nervous fever) find a dwelling-place in the underground-water passages into which wells are sunk; that in such localities they will not only exist, but multiply; and that from this base of operations they carry out the work of infection by finding ways to reach the human body. He was the first to promulgate the

fact, since extensively confirmed by others, that the risk of infection increases when the level of underground water is lowered, and, conversely, that the danger diminishes as the water rises. This harmonizes with the fact that intermittent fever, which is generated in marshy surfaces, makes its appearance with augmented frequency when the sinking of the water-level lays bare more extended tracts of marshy surface, thus allowing the unquestionably animate germs to rise in the air.

On this so-called underground-water theory of PETTENKOFER, NAEGELI grafts his observations. From a series of experiments carried on for a period of nine years with the subordinate fungi or germs, he is led not only to adopt, but to endorse with fresh and convincing arguments, the opinion long ago expressed by other observers, that the germs of infection in the above-named maladies belong to the same group of living organisms as the familiar ferment of putrescence—that is, to the group of bacteria which are so exceedingly minute that, according to NAEGELI, 30,000 milliards of them make up the weight of one gramme.

That certain soils, such as that of Munich, are especially productive of typhus, is explained by NAEGELI, taking PETTENKOFER's views into account, in this wise:—

“The first condition of a malarious soil, breeding endemic and epidemic maladies, is underground water, lying not too far from the surface, with alternate rise and subsidence of level, resulting in alternations of wet and dry strata. When these strata become dry, the germs cling to the earth, and where the soil is light and the air follows the subsiding level of underground water, the germs pervade this underground atmosphere, and if there be an issue towards the surface they will rise through it into the open air.”

He shows very clearly that this underground air is attracted into houses by the suction of the fires in the kitchen and other rooms ; and he adds that the best warmed rooms are the most dangerous. Professor NAEGELI therefore sets his face against heated bedrooms at night, and even suggests that by heating some other unoccupied room at night the course of the germs may be diverted from the sleeping rooms.

But it appears that the germs cannot rise with the underground air whenever the stratum of earth containing them has again become wet, either by a fall of rain from above or by the elevation of the underground water-level. The germs will then cling to the ground so firmly that not even a powerful current of air avails to detach them.

Two remedies are suggested for this chief cause of an epidemic soil : the complete removal of the underground water, or at any rate its relegation into lower depths ; or, if this be impracticable, the maintenance of a constantly uniform surface level of the underground water.

To guard against the penetration of air ascending from epidemic soil, Professor NAEGELI recommends cementing the cellar floors and walls, and the ground floor ; and as the underground air not only rises into the interior of houses, but makes its way through the walls as well, he further suggests an air-tight outer casing for the foundation walls. Finally, with regard to the constitution of the soil, the danger will increase with the degree of its porosity or capacity for holding underground air, and of its readiness to dry. Hence, firm clay soils are exempt from infection, while the most unhealthy soils are those consisting of gravel and coarse sand intermingled, like the Munich soil.

Professor NAEGELI's experiments, which extended over a period of years, on the conditions of the generation

and growth of the subordinate fungi or germs, have led him to the conclusion that these fungi require as nutrient elements of existence certain substances which are soluble in water. But they can live only on condition that the pabulum so formed shall consist of certain proportions of water and food materials—in other words, provided that the solution has the required degree of concentration. Here we need only consider the effect of an augmentation of this degree, and I shall adduce a few familiar examples by way of illustration.

The fermentation of wine-must, fruit-juices, brewers' mash, etc., is effected by means of the fungus familiarly known as "barm," or yeast. This process of fermentation may be checked by simply withdrawing some of the water from these juices, that is, by thickening the liquor, when fermentation will cease, because the germs cannot subsist in this excessive proportion of the nutrient material—*i.e.*, in this case, of the sugar. A similar effect is produced if, instead of drawing off water, the quantity of sugar be increased.

The same applies to the germs of putrescence. To prevent the tainting or putrefaction of meat, some of the water is withdrawn from the juices, which are thereby thickened. The degree of concentration under which the germs lose their potentiality for decomposition and dissemination is not equally high with all the species. Professor NAEGELI divides them into three classes in this respect: the bacteria, to which belong the ferment of putrescence and the germs of disease; the yeast fungi, the most familiar among which are the brewers' yeast and the vinous ferment; and the fungi which produce what is called mildew.

As regards these three classes it should be noticed that, while the yeast fungi need and bear a higher degree

of concentration than the bacteria, they are in this particular far surpassed by the mildew fungi. For instance, a moderate drying will stay putrefaction of meat, but to prevent mildew a much higher degree of desiccation is necessary. A comparison between the germs which cause mildew and fermentation may be instituted by reference to fruit-juices and preserved fruits. Moderate thickening will suffice to check fermentation, but to guard absolutely against mildew the thickening process must be carried much further.

Any substance which germs are unable to use as aliment becomes injurious to their existence when it has attained a certain degree of concentration. This point is of great importance in its application to what is called disinfection, and NÆGELI points out that insufficient disinfection, as of cesspools, for instance, involves much more risk than the total neglect of it.

He says :—"If germs derived from cholera, dysentery, and typhus cases find their way into cesspools they will only retain their specific nature for a short time; thereafter they either die or lose their infectious properties. On the other hand, the consequence of insufficient disinfection—*i.e.*, of disinfection short of the degree of concentration that kills—is that morbidic fungi will continue to germinate and ferment, while at the same time, and for that very reason, they will preserve their specific nature of infection. Such inadequate disinfection, therefore, is tantamount to preserving the germs, whose infectious quality is revived when they, through insufficient disinfection, emerge into the upper air, and make their way into the human body."

The most interesting of Professor NÆGELI'S observations is that there occurs a *struggle for existence* between the different species of the germs when they come into

contact in a nutrient solution. Not only does this explain the connection between the process of bodily hardening and the power of resisting epidemic attacks, but also many phenomena attending the fermentation of liquors; and on that account I am induced to dwell at somewhat greater length upon the subject, quoting NAEGELI'S own words:—

“It was formerly assumed that any plant will be found wherever climate and soil favour growth, provided that seed had previously reached such spots. Now, however, we know that this depends quite as much upon its surrounding fellow plants, and that in particular the most closely allied species will exert a decisive influence. Many species can grow in certain localities only if others ranking in the same genus be wanting. For instance, the rusty-looking Alpenrose thrives well in calcareous soil, but only when the hairy Alpenrose is absent. If the latter be present, it will utterly extirpate the former. The like holds good of the two primrose species found upon more or less damp grounds.”

(I may add that the most familiar amongst these plant struggles are those occurring between useful growths and weeds.)

“The same law governs the lower fungi. One genus, which under given circumstances will thrive well, is exterminated by another genus which here appears the more favoured plant; whereas the former, under different conditions, is strong enough to expel the latter. Inattention to this fact has given rise to many erroneous assertions respecting antiseptics.”

To render these phenomena more intelligible, I will adduce an example. If germs of putrefaction or fermentation, and of mildew be placed in certain saccharine solutions having a neutral reaction (that is, neither acid

nor alkaline), only the first-named will multiply, setting up lactous fermentation. But if to the same solution be added a half per cent. of acetic acid, the germs of fermentation alone will multiply, and cause vinous fermentation, whence it comes that must, containing too little acid, will turn sour; and if, finally, 4 or 5 per cent. of tartaric acid be put into the same solution, only mildew fungi will be produced.

It would be wrong to conclude from these facts, which infallibly recur on every occasion, that a half per cent. of acid prevents putrefaction, and 4 to 5 per cent. prevents fermentation; for the germs of putrefaction will actively multiply in the same nutrient solution with an additional $1\frac{1}{2}$ per cent. of tartaric acid, *provided they be not exterminated by the germs of fermentation.*

I may explain that must, or unfermented new wine, without acid would unquestionably turn sour, and a rather large proportion of acid would be needed to prevent the souring of the wine; but if, on the other hand, vinous ferment be added, the latter will gain the advantage, even with a low percentage of acid.

Professor NAEGELI then goes on to show that the strength of individual numbers also exercises a decisive influence in the struggle. It would appear that when one kind of germ takes possession of a solution in great numerical strength, it will vanquish its adversary, if the latter be in a minority, under conditions that would ensure its own defeat were it deficient in numbers itself. This we see in unfermented wine and brewers' mash; to prevent them from souring, yeast is needed in such quantity that it may retain the mastery over the ever intruding germs of the acetous ferment. With a knowledge of these facts we can explain the relation of the body to the germs of disease.

The following is the fourth instructive discovery of Professor NAEGELI respecting the subordinate fermenting fungi. Each species excretes certain elements, which as a rule are entirely characteristic of itself. Thus vinous ferment and brewers' yeast throw off, as a special excretion, tartaric acid; the "mother of vinegar," vinegar; the rennet or lactous ferments, lactic acid; other ferments butyric acid, and the ferment of putrescence the well-known offensive effluvia.

It may be observed of these excretions, that they imperil the existence of the germs themselves whenever they accumulate beyond a certain percentage in the solution which the latter inhabit.

Thus, for instance, fermentation will cease in must-liquor very highly charged with sugar, when the percentage of alcohol has attained certain given limits, even though there should still be a sufficiency of fermenting material—that is to say of sugar—unless by exposing the solution to the air the notoriously volatile tartaric acid is allowed to escape.

The same applies to decomposition. In open cesspools putrefaction proceeds until all the material matter is resolved, because the offensive excretions of the fungi escape; but when a cesspool, fosse, or ditch is kept closely shut down—of this I myself have had manifold experience with putrescent sea-water and decaying carcases—the process of decomposition is completely arrested, as fermentation would be in a well-corked bottle.

NAEGELI especially addresses himself in his book to the task of determining from his experiments what preventive measures should be adopted with reference to the morbid germs existing elsewhere than in the body; but of this question I shall not speak now. He only explains part of the phenomena of the relations of these germs to the

living body, although he might certainly have elucidated the whole problem from his experience of them in inert solutions.

What NÆGELI correctly apprehended is shown when he gives, as an illustration of the relation of these germs to the living body, the case where, in his experiments, two different kinds of germs came into conflict in one nutrient solution.

This bears directly upon the contest between the germs and the living tissues of the human body, which begins in a nutrient solution suited to both the combatants alike; and very important is NÆGELI'S assertion that the contest turns upon numbers. Therefore, since the number of the bodily tissues concerned is a fixed quantity, it will depend upon the *numerical strength* of the germs whether they will set up disease.

The assault may be so overwhelming that the body will infallibly succumb; but even the most dangerous germs of infection are powerless for evil if the attack be commenced by an insufficient number. NÆGELI rightly says that until he made this discovery he had altogether doubted that the infecting matter could consist of live organisms, for he reasoned as follows:—

“One such germ in a sufficiently nutrient solution, which the human body usually affords, can propagate 100,000 individuals within seven or eight hours, and would thus infallibly induce disease. Yet this cannot be the case, or we should be driven to the impossible conclusion that during an epidemic of cholera or typhus fever those that sickened had alone inhaled or swallowed these tiny microscopic germs, while all other members of the community had not.”

The fact that during the prevalence of an epidemic one section of the inhabitants enjoys good health, another

feels but slightly affected, a third sickens more seriously, while a fourth section dies, some speedily, others after protracted illness, is ascribed by Professor NAEGELI to the varying strength of the infection; but he does not take into account that it must also depend upon the condition of the body and its juices as to which of the two combatants in the struggle shall gain the victory. In this direction he touches upon the familiar experience that a person once attacked by small-pox, scarlet fever, typhus, etc., will for a greater or less subsequent interval of time enjoy immunity from those disorders. In this, as we shall see, he is correct, without, however, hitting the mark as accurately as he might have done from the knowledge gained in his experiments with germs elsewhere than in the body.

Researches prosecuted for many years having long ago convinced me that an inordinate percentage of water in the body will intensify liability to sickness, I at once recognised in NAEGELI'S discoveries the true explanation of the fact ascertained by me, that seasoned soldiers enjoy greater immunity from infection than men less far advanced in the term of army service. Strong and sustained bodily exercise stimulates the activity of the skin, draining the water out of the body—that is, it reduces or thickens the mass of the bodily juices.

In times of infection this of itself is an advantage for the living tissues of the body, because the firmer these are set, the greater will be the energy of the vital forces for the struggle with the germs of infection, which are weakened in proportion as the degree of concentration of the bodily juices is raised. Hence a comparatively small difference in the percentage of water in the body may decide the issue in the struggle of the latter against the germs of infection.

What may therefore be learned from these discoveries, as applicable to infectious diseases?

That the latter are fostered by an effete bodily condition, which is largely caused by an irrational method of clothing. I have examined from this point of view whatever is known respecting all kinds of epidemics, and everything confirms this. Were it customary to clothe ourselves according to the dictates of reason, to drain and harden the tissues, we might be as exempt from epidemic disease as are the horse or the dog (see Chapter xxviii.)

Destructive infantile disorders, like scarlatina, measles, and quinsy, are emphatically maladies of enervation and enfeeblement. The prevalent irrational clothing of children, not only in their infancy, but also during the school years, is responsible for much of these disorders.

XXVI.—THE SPECIFIC GRAVITY OF THE BODY. (1879.)

THE discovery that a superfluity of tissue water in the body materially increases its liability to sicken from infectious disease became a keystone for my studies on "Strength of Constitution," a term which includes the question of greater or less liability to sickness, as well as that of the working capacity. Not only did it now clearly appear upon what strength of constitution is based, and by what means it may be enhanced, but also that it can with a large degree of certainty be estimated by measurement.

In compiling a tabulated statement of measurement of soldiers, for the purpose of calculating the averages of health for each of the three years of army service, I had

at first no suspicion of the astounding result obtained by the computation of the weight per litre (quart) volume of the individual soldier ; indeed I feel satisfied that no professional man would have expected to find so great a variation.

The smallest litre-weight among the sixty-five men measured amounted to 764, the highest to 1,060 grammes,* a difference of almost 40 per cent. If in these two extreme cases the men were equally tall and stout—that is, of quite the same bulk, say 70 litres—the light man would weigh 118 lbs., the heavy man, 159½ lbs., so that the latter would be heavier by 41½ lbs. The difference is the more surprising if we take into account that these two men were almost of the same age, varying only by one year ; that the light man was by no means a sickly, feeble subject, but apparently so healthy and strong that no objection had been raised to his admission into the army. Still greater differences would be found if the specific gravity of people of the lowest degree of constitutional vigour could be measured.

If the differences in weight of the litre volume of the strong and the weak amounted merely to a fractional percentage, they might be regarded as a curious scientific discovery of no practical importance. But the case stands otherwise.

An instrument is required which will determine, even with approximate accuracy, the bodily bulk. A method of testing the bodily condition would then be supplied, which in point of accuracy and diversity of application, would far surpass any that has hitherto been devised. Now such an instrument can certainly be constructed, not by a scientific man without the necessary means, but at the public cost. The simplest way of ascertaining the

* 1,000 grammes = 1 kilo = about 2½ lbs.

bulk of the body is by its immersion in water, but this plan is cumbersome and inconvenient, and is impracticable with invalids, females, etc. As against the above method, the following apparatus is worthy of consideration. It consists of an enclosed air-tight chamber, connected on the one hand with an air-gauge, and on the other with a second chamber, the air in which can be forced into the first-named chamber. If the first chamber contain nothing but air, the air forced into it from the second chamber will raise the column of mercury in the gauge up to a certain point. By introducing a compact body into the first chamber, and thus displacing the air, the column of mercury will be made to rise above the level previously attained, in proportion to the greater bulk of the body intruded. Consequently the bulk can be correctly estimated from the height of the column of mercury. And if the body be subsequently weighed, the division of the weight by the number of volumes (litres) will give the weight of each litre.

Small instruments of this kind already exist, but the problem is to build an apparatus large enough in dimensions to admit an adult. The cost would not be great, and the money would be well expended, as I shall show.

The question now arises, respecting which properties of the body will the determination of its weight per unit of capacity (litre) afford information? The answer must be sought in a consideration of the parts which the various bodily constituents that are weighed play in the production of vital phenomena.

The lightest bodily substance, if we put aside air, is the fat, with a litre-weight of 937 grammes. Important as an element of nutrition, it becomes injurious when present in excess, causing a diminution in the quantity

of blood, and impeding the circulation, while its decomposition evolves an abnormal amount of heat. Corpulent people are incapacitated for strenuous work, because they so rapidly become heated ; and if overtaken with illness they readily develop strong feverish symptoms.

Next to fat, water presents the lowest litre-weight, namely, 1,000 grammes. Some of the injurious effects of an excess of water in the body have already been explained, but I will recapitulate the most important points :

1. Superfluous water renders all the tissues flabby, and diminishes their power of resisting mechanical strain. They become more brittle, as regards the bones, are more easily lacerated and distended, and the natural coalition of the organs suffers. Thus bone fractures, dislocations, bruises, lacerations, twisting of the intestines, etc., and the intrusion into the system of alien matters, including the germs of infection, will more readily take place. These diminish the capacity for strenuous labour, and constitute so many extra risks of sickness.

2. Excess of water in the muscles has a disabling effect, imparting a feeling of lassitude ; a watery muscle is weak, and tires quickly.

3. Excess of water in the tissues is particularly injurious in its action upon the nervous system. It heightens the sensibility of the nerves, so that trifling influences produce painful and morbid excitement. Persons thus affected easily catch cold, suffer from nervous irritability, and in short are exposed to all disturbances of the nervous system. Moreover, excess of water in the nerves becomes a hindrance to the transmission of their excitation, which is bad in every way ; for it increases the liability to sickness, while lessening the capacity for work, particularly mental work. The flow of thought in the brain is

obstructed, reflection becomes difficult, sluggish, less comprehensive, and the memory fails. There is a form of idiotcy, in which the brain cavities hold abnormal quantities of free water ; but an excess of water permeating the brain substance will of itself induce dulness.

4. The injurious effect of an excess of water in the blood and other bodily juices can be inferred from what has been stated in a preceding essay on the subject of liability to infection from disease germs. A watery condition of the stomach and bowels favours the propagation of the seeds of infection in the *primæ viæ*, or alimentary canal, so that the germs of cholera, or dysentery, or probably of mucous fever, are enabled to make a general attack against the body, and will more readily ferment if the bodily juices be watery.

While certain quantities of water and fat are necessary to the existence of the human body, any excess beyond the indispensable proportion is detrimental. But since every other constituent of the human body is specifically heavier than the water and the fat, a body which possesses these in an excessive quantity must be specifically lighter than one normally constituted ; so that a man of inferior specific gravity will be less fit for work, both physical and mental, and less capable of withstanding morbid influences of every kind.

The conclusion, based upon the nature and influence of the lighter bodily constituents (water and fat), that the low litre-volume of the living body is an unfavourable sign of its condition, is confirmed when the heavier elements are considered.

I have ascertained by experiments that thoroughly dried muscular flesh has a litre-volume of 1,357 grammes, while water has 1,000, and fat 937. Now we know, beyond a doubt, that the actual working substances in

every living tissue are those which remain after drying—*i.e.*, the so-called albuminous substances, and the salts always found in combination therewith. The more plentiful the supply of such substances in the living tissue, the more energetic are its vital manifestations. A muscle, for instance, will be firmer and more powerful in proportion to its solid constituent parts, and the same applies to the energy and rapidity of its contractions. The larger the amount of solid constituents in the brain and general nervous system, the more energetic will be their manifestations. The same may be said of the intestines, etc. Chemical experiments show that the mass of solid residue in the tissues may present very considerable divergence (as much as 32 per cent.), and thus it is quite intelligible that a strong person, thoroughly fit for work, should exhibit a much higher specific gravity than a weak, sickly person.

Lastly, a cardinal point is the quantity of bone-earth or phosphate of lime. Of all the elements largely entering into the constitution of the body, this is the heaviest, namely 3,180 grammes per litre volume. It is well known that the robust possess strong, compact bones, while the weak have delicate and light ones. The more energetically a man works, the more powerful become his bones—that is, firstly, they increase in length and thickness; secondly, the protuberances to which the muscles grow become enlarged; lastly, not only does the bone substance accumulate material, but it hardens, and acquires a higher specific gravity. We see this in animals; the bones of the domesticated hog or cow, which takes little exercise, are spongy and brittle, while the bones of the same animals in a wild state are extraordinarily hard, compact, and heavy. The following illustration will make this easier to be understood. If coal or wood be

consumed in a stove, the products of the fuel will be of two kinds—the *gases* that escape through the chimney, and the *ashes* which drop into the ashbox. The quantity of ashes collected will show what amount of work the stove has done. The process in the body is analogous; the more the body works, the more nourishment will it use up, giving rise to substances (such as carbonic acid, water, and urea) that quit the body, and yielding ashes which the body retains in the form of bone-earth. The bones collect the ashes, and the larger their store the greater has been the amount of work performed by the body. Hence old people have a larger store of bone-earth than young persons; but if of two individuals of equal age one possess more bone-earth than the other, it will be an unmistakable sign that the former has done more work than the latter, either from superior diligence or the force of circumstances. Thus the specific gravity of a man shows whether or not he is active and accustomed to labour.

These considerations are of importance in their application, both to the practice of medicine and to health-culture. On the latter point they lend additional weight to the arguments with which I have repeatedly sought to enforce my sense of the value of hardening the body by the promotion of the activity of the skin, the thorough ventilation of rooms, etc.; because it is now obvious that these measures not merely afford protection against colds and chest complaints, but also operate as preventives against epidemic contagion.

In this discovery, there is much that is reassuring; for having regard to the enormous difficulty of warding off the attacks of these invisible germs of infection, and of evicting them when in possession; considering, moreover, that the range of infectious diseases continually

widens with the extension of facilities of communication, an anxious temperament might give way to despondency. My researches remove the main ground for discouragement. If the body be adequately hardened, infection need be no more apprehended than colds and chest complaints, and the method which I have explained of ascertaining, by determining the specific gravity, whether the requisite degree of hardening has been attained should give additional force to this sense of security.

Lastly, the whole rule of health may be summed up in the simple maxim : Procure, and maintain, the highest possible specific gravity—that is, firstly, prevent the deposit of fat ; and, secondly, promote the elimination of water from the tissues, avoiding anything calculated to check it.

The body has the peculiarity of defending its property of fat and tissue-water, which it is reluctant to throw off. It takes advantage of every careless movement, every opportunity, however apparently insignificant, to repossess itself of that which has been wrested from it. This is a familiar experience as regards fat. Corpulent persons who proceed to Carlsbad, or resort to some other kind of anti-fat regimen, no doubt lose a few pounds on every occasion, but as soon as the special treatment is over the fat will reappear. I experienced this in my own person when I began my researches on the subject of health-culture. Every forcible remedy adopted produced a slight diminution in the measurement round the body, but as soon as I ceased the special cure I returned to my former size. At present (1879), however, I am really master of the situation. In a few months my measurement round the body permanently receded to the extent of about $5\frac{1}{4}$ inches, while the weight per litre-volume of body bulk rose by 15 grammes (or $1\frac{1}{2}$ per cent.), and my

flesh, in point of firmness and hardness, resembles that of the most seasoned soldier. Nor did this entail any particular trouble in the accomplishment, for the entire change, including the elimination of superfluous water and of accumulation of fat from the tissues, has been brought about by the adoption of a *suitable change in the system of clothing*, combined with thorough ventilation of the living and sleeping rooms, and with—in my own special case, where the elimination of fat presented the chief difficulty—four pedestrian tours, each lasting over some days.

As regards the clothing, several points need consideration. First comes the material of which it is made. I have already shown that animal wool meets the requirements of health-culture to a much larger extent than materials made of Vegetable fibre, such as linen, hemp, and cotton, in consequence of the greater impermeability of the latter to watery vapour. The German proverb, describing a healthy, comfortable man as one "sitting in the wool," goes to show that popular usage is in this particular in advance of science; and it is indeed hard to understand how linen and cotton should have so long and so extensively held their ground as clothing materials.

The rate at which this question has been maturing within the last decade is instructive, and important to the right apprehension of the practical deduction and suggestions which I have to make.

My own earliest practical application of wool was to advise persons subject to colds to wear a strip of flannel next to the skin, from the chest down to the stomach, and some benefit was certainly derived therefrom. Next followed the use of undervests, and finally of woollen shirts, worn under white shirts. This was an error. The body was indeed protected, but at the same time

enervated, and the woollen shirt, placed between the outer white shirt and the body, soon became moist with perspiration and disagreeable. For this reason many doctors pronounced against the use of woollen shirts, but this was again an error. Not the woollen shirt, but the overlying white shirt produced the evil, and should have been discarded. I recognised this in the year 1868, and at once made my opinion known. Then came the Franco-German War, 1870-71, and the experience gained in it opened up a wide career for the woollen shirt, although the mistake was still made of wearing a white shirt over it. I now (1879) find, however, that it does not depend upon the shirt alone—that is to say, it is not sufficient to wear a woollen shirt without a white one over it—but that *all* linen and cotton material in the clothing, not excepting that used for lining and stiffening coats, etc., and for pockets of coats and trousers, is pernicious to health. The clothing should be made throughout of pure animal wool. How astonishingly sensitive the body is to the benefits of this I have had many opportunities of observing in my own circle.

XXVII.—BATHING AND TREATMENT OF THE SKIN.

BEFORE I advocated the Sanitary Woollen System I had spoken against the too frequent use of the stimulant of cold baths, and this especially applies when Sanitary Woollen Clothing is worn. The latter attracts the blood to the skin, which is good, and cold baths do the same thing for a short time ; but the combined effect is bad, just as two good meals, taken together, would be unwholesome. For wearers of ordinary clothing cold

baths are beneficial, when not used in excess and too regularly, because the linen or cotton shirt has the bad effect of driving the blood away from the skin. To such persons the cold bath affords an increased circulation of the blood at the surface, at least for a time. But *dry* woollen clothing, after a cold bath, causes such a flow of blood to the surface as may impoverish the supply to the brain and the intestines. We here again see that nature's laws must be respected. The Wearer of Sanitary Woollen Clothing must take a hint from the woollen-coated animal, which does not throw off its clothing, go into cold water, dry itself, and then resume its dry clothing, but goes, coat and all, into the water. The cooling effect of the evaporation set up through the drying of the wet coat on the body counteracts the excessive tendency to expansion of the surface blood-vessels ; and it is precisely to this evaporation that is due the lasting refreshing effect of the bath. Let the wearer of Sanitary Woollen Clothing follow this example, and, if he wants to be refreshed, wet his fleece. The body should either be anointed with an unguent (for which a "Skin-Salve" is prepared), or it should not be dried ; and in warm dry weather the shirt may be moistened, and then the dry outerclothing put on. The effect is most pleasant, affording an enjoyment from which the wearer of linen or cotton is debarred, and preventing the languid feeling often experienced after bathing. But here again moderation is a golden rule ; as already explained, Wool-wearers do not require the cold bath for its stimulating effect ; while, as the secretions pass freely away in vapour, instead of being turned to water on the skin, the latter remains longer clean and wholesome. Wool-wearers should therefore study their feelings in the matter, and be guided by them. Summer bathing in the open should

be on the same plan. The shirt may be kept on and afterwards wrung out, or it may be damped before it is resumed; the best bathing costume is a combination garment, with short sleeves and legs, and affords valuable protection against the sudden shock on entering cold water. The bather simply keeps this on, after wringing out the surplus water, and draws on his Outer-clothing.

This wetting of the Under-clothing will be found a capital substitute for the refreshment of a bath when such cannot be had.

To allay uneasiness, I may remark that experience has long shown that pure woollen clothing, when wet, may, without any injury to the body, be allowed to dry on it. A constant proof of this is afforded by the woollen-clothed fisher population on the shores of the Baltic, who are noted for their splendid health.

In PIERER'S *ENCYCLOPÆDIA*, of 1835, the article on "Baths" concludes with the words, "the use of public Baths declined and gradually ceased as the linen shirt came to be more generally adopted in place of the woollen garment previously worn, and in respect of bodily cleanliness stress was laid on washing the shirt and not the body itself."

I consider this observation a very just one. The more I investigate and reflect on the question of bathing and washing, the clearer I see that the Wool-wearer feels, precisely in the same way as the Wool-wearing animal, the desire from time to time, especially in the warm season, to bathe, *i.e.*, to wash the whole body, which, when it is clothed in wool, is very sensitive of dirt. On the other hand, the skin of the Linen-wearer becomes insensible to dirt, and thus he loses in great measure the desire for bathing. For it is a fact that the mass of the people bathe far less at the present day than in earlier

times, when every village had its baths. Bathing is now, except perhaps in the case of dwellers by the sea, a luxury indulged in only by the better-off classes. Thus the assertion that people clothed in Wool are shy of using water is directly opposed to historical truth. With the old Wool-wearing nations—Greeks, Romans, Jews—the system of bathing was far more developed, and far more common, than it is at the present day under the reign of linen and cotton.

XXVIII.—THE AIR IN ROOMS.

THE injurious effect of the air confined in rooms is one of the oldest and best known themes of sanitary science. Writers on health abound with advice as to ventilation, the keeping as much as possible in the fresh air, and so on, and my readers know the importance of sleeping at night with the window open. Therefore, in making the following suggestions with reference to the air in rooms, I am only pursuing and extending the ancient track. I have now (autumn 1881) had three years' experience of the Sanitary Woollen System, and I can safely say that it has answered the expectations formed of it. It is a powerful remedy, and when the body is hardened, maintains those who adopt it in as sound health as, for instance, the horse, or the house-dog. More than this cannot be demanded of any system by those who dwell under artificial conditions, within four walls. But the improvement implied by the above comparison will be patent to every one who knows how much less often the dog is ill than its owner.

To laymen at the beginning, the Sanitary Woollen System may have seemed as if it would accomplish even more than this, but medical men know that all systems

of cure and rules of health, such as the use of special baths, change of air, change of diet, etc., work much more energetically at the commencement than when the body becomes accustomed to the altered conditions. The reason is that the bodily machine at once seeks to restore the equilibrium thus disturbed, and to this end works more rapidly, causing freer and more complete exhalation of matters noxious to the health. The consequent improvement at the commencement should not be allowed to mislead, as the value of a rule of health can be first estimated when the body is accustomed to it.

This stage in the Sanitary Woollen system has now been reached by many, and the conclusion arrived at is, that the System procures the addition of health for which man has hitherto had every reason to envy the domestic animals; but the Wool-wearer shares with the domestic animals those diseases which are the *raison d'être* of veterinary surgeons. The question now to be asked is, Cannot matters be carried any further? Again the animals supply the answer, and most plainly.

I describe the Wool-wearer as being as healthy as a horse or a dog, or more precisely, as housed cattle; a higher degree of health is attained by grazing cattle—for example, by sheep. These are much less subject to diseases due to noxious exhalations—for instance, Wool-wearers do occasionally catch cold in the same way and for the same reason as housed cattle, while grazing cattle are absolutely weather-proof; but the latter are not proof against infectious diseases, although the fact that sheep are more so than oxen was impressed upon the soldiers in the Franco-German war, who had for that reason to subsist on mutton. That sheep are sometimes infected with parasites does not affect the argument, for many wild animals have parasites,

To what is the higher degree of health of grazing cattle due? Simply to the cause that makes our soldiers healthier during the month of the manœuvres than when they are penned in barracks. Grazing cattle constantly bivouac, at least in summer, and are not poisoned by the air of their stable. Yet a degree higher in health than grazing cattle are ground game (hares, foxes, deer, partridges, pheasants, etc.), which also bivouac in the winter. These animals are not only weather-proof, but epidemics are much rarer with them than with grazing cattle; still, however, such diseases do occur, and it is very interesting to inquire the reasons, which are explained by the following two facts:—

1. Animals which live *on* the ground are more proof against epidemics than animals which live *under* the ground; for instance, field mice are subject to violent epidemics, which will destroy nearly the whole of them in a district; and this occurs when the mice are so numerous that the whole ground smells of their excrement, and is therefore saturated with deleterious matter produced by themselves.

2. The birds in the air are absolutely infection-proof. I have never heard of nor seen an epidemic among crows, jackdaws, sparrows, starlings, swallows. The only diseases to which they are subject are from lice and worms; and they sometimes suffer from predatory animals, frost, hail, etc. They hardly ever come in contact with their excrement, and are removed from every kind of miasma of the ground. On the other hand, many attempts at poultry-farming fail, because if more than a certain number of birds are kept on a given piece of land, chicken cholera is developed, and nearly all the birds die. Young pheasants cannot be reared on the same land for more than two consecutive years, or they die in very large numbers.

Now comes the question to what degree of health Man may hope to attain, having regard to existing circumstances and customs, and without heavy expenditure ; in other words, without building castles in the air, or seeking to inhabit balloons, as he would require to do to become as healthy as the birds. This condition is therefore unattainable ; and here, as everywhere, to demand perfection generally leads to realizing little or nothing. Those who have followed my suggestions as to Sanitary Woollen Clothing and Bedding, and sleeping with open window, have reached a degree of health equal to that of the horse ; the next degree, and the only one practicable for discussion, would be health equal to that of sheep.

The experiences of this winter (1881-2) give me the firm assurance that this is tolerably easy to attain, for it is merely a question of the atmosphere in living and working rooms, respecting which I am in a position to say something more radically hopeful than my predecessors on the subject of ventilation.

Before coming to the practical side of the question, I must again institute a comparison with the domestic animals. If they be classified according to the facility with which they contract disease, the lowest place must be assigned to stalled cattle, the horse and the ox, who live in the same space in which they deposit their excrement. Why does the dog possess more power of resistance to disease ? Because the dog is cleanly indoors, and does not, like stalled cattle, subject itself to the injurious influence of the odour of its excrement ; while chained dogs who cannot get away for the purpose, are not confined in close rooms. The greatest strength of resistance, and the toughest nature of all, has the cat, which carefully buries its excrement, and is not confined to the atmosphere of rooms, or chained to miasmatic

ground, as dogs frequently are, but seeks the airy and lofty parts of dwellings. These considerations show that the worst enemy to the health of every being is found in the mal-odorous portion of its own exhalations. This is most readily apparent with respect to sewage, and the attention of sanitary authorities has been rightly devoted, in the first place, to the removal of this source of disease. I may, however, point out that the plan of the cat, which buries its excrement *immediately*, is better than that of allowing it to ferment and distil, so as to give out a maximum of odour.

That the atmosphere in rooms which are inhabited—even when no air from drains, etc., forces its way in—soon becomes loaded with noxious matter, has, of course, long been recognised ; but much too little attention has been paid to the fact that these exhalations are not only dispersed in the surrounding air, but are also caught up and retained by the objects in a room, to be again given out. So long as a dwelling-room is abundantly ventilated, there is no danger, and followers of the Sanitary Woollen System are in this respect much better off than those who are mis-clothed ; for they can not only sleep with open window, but also, as they are not afraid of draught, and have less need of external warmth, can work with open windows and doors.

The difficulty begins when the cold necessitates warming the rooms ; proper ventilation then becomes expensive, for the warmth escapes simultaneously with the vitiated air, so that many people resign themselves to the inevitable, keep their windows shut, and live in a stuffy atmosphere.

I believe that the danger thus incurred would be greatly lessened if all those objects were removed from the room which absorb the noxious odours. If they would retain them, their presence would be a benefit, but

they give them out again, and they are and remain mal-odorous. After a close examination of the subject I am in a position to denounce the unwholesomeness of the dust in rooms. It is only necessary to inhale the odour under a piece of furniture, whence the dust is not regularly removed, to be convinced of this; or to compare the very different smell of the atmosphere of a room before and after the latter has been thoroughly cleaned and dusted out. Further consideration of what constitutes the dust in rooms shows that this offensive smell is less that of the dust particles *per se*, and has in a much greater degree been taken up by them.

The following are mainly the constituents of the dust in the rooms:—(a) Earth dust: We know that the earth readily absorbs odours, and gives them forth again under the influences of warmth and damp, hence the dangerous ground miasmas. (b) Coal dust: Coal has such strong absorbing power that it has long been used for deodorization; it seems to retain odours more firmly than earth dust, but still coal dust cannot be considered harmless. (c) Vegetable fibre dust: This proceeds from the linen and cotton materials of clothes, etc., and from the droppings of horses, etc., in the streets, also from the wear and tear of floors and wooden objects. The shoddy dust referred to on page 96 must be added to the list.

Dust thus constituted cannot but be most dangerous company in a room, if allowed to remain; and, when it is disturbed and enters the lungs, is not only irritating to the mucous membrane, but, on becoming moist, may be injurious in the body. The disagreeable odour when a dusty floor is wetted is well known, and a damp atmosphere suffices to let loose the smell. Hence follows the recommendation not only to remove the dust of rooms as often and as thoroughly as possible, but also

to adopt certain methods of doing it. In dealing with the dust in rooms most ladies and their servants make three mistakes.

The first is that the dust is more driven about the room than actually removed. If a room of which the windows are closed is swept out, and the furniture wiped down, it looks comparatively clean, but is nothing of the sort, because a large portion of the dust has deposited itself on the walls, and on projections, such as picture-frames, mirrors, etc., between the books on the shelves, and behind the heavier furniture standing against the walls. Nor are things much improved by the opening of one or more windows on the same side of the room. What is wanted is a thorough draught of wind ; and if a room has only windows on one side, a window in the passage or elsewhere should be opened to cause such a draught as will really carry the dust out of the room. Windy weather is of course best for this purpose, to which I attach so much importance, that I would recommend the sweeping out of rooms to be deferred when, in the absence of wind, it is impracticable to create a good draught.

An important help in getting rid of the dust by means of the wind is to attach a large piece of paste-board to a wooden handle, and, after the room has been swept, to stir the air, driving the minute dust out of the corners and angles, away from the walls, preventing it from settling anywhere, until the room *smells* free from dust. No sense can be so relied on for accuracy in this respect as that of smell : long after no more dust can be seen the nose will detect it.

A second mistake is the belief that through moisture (tea-leaves on carpets, or a damp cloth on wooden floors) the dust is prevented from rising, and is removed. Some, of course, is removed, but only such as is on the floor,

and that not entirely. The fine dust, clinging to the walls and ceiling, can only be dealt with by stirring the air, as just described. And it is this fine dust which is most dangerous, for it consists of the light, possibly organic, matters, while the heavier mineral dust sinks to the floor. The third mistake is the habit of overlooking the dust which is more difficult to get at, behind furniture, pictures, mirrors, and so on. It is only necessary to smell at these places to be convinced that they must assist to vitiate the atmosphere. The removal of such dust would be easier if all furniture stood on castors; but if furniture be not placed quite close against the wall, a stick may be introduced to loosen the dust, etc., so that it may be driven out when the air is stirred.

Another point with reference to the atmosphere in rooms is connected with the flooring and the furniture. Proofs of how eagerly and freely offensive odours are absorbed by wood, which gives them out again whenever wetted, are open to anyone who likes to try the simplest experiments. I am inclined to believe that wood of which the surface is not painted or polished takes up the exhalations of the body in a similar manner as do textures of Vegetable fibre when used as clothing.

Everyone is acquainted with the disagreeable smell of a room in which is rough woodwork, such as register-boxes, deed-chests, book-stands and the like, in (German) government offices. The general ill-health among those who work in these offices, which is ascribed to the sedentary nature of their labour, is certainly not attributable to that alone, but also to the exceptionally bad atmosphere, mainly caused by the very old wooden lumber, charged with evil odours.

All woodwork in rooms, including furniture and flooring (the former not only externally and in front,

but also internally and at the back) should therefore be treated with varnish, oil paint, linseed oil, or some similar preparation, which will have the effect of closing the pores of the wood. One of the most important sources of lurking evil odours will thus be removed. Flooring may be first treated with a caustic solution of manganese of potash, and then oiled.

Not a few people object to sitting on upholstered furniture; some find it too warm, others have no further reason to give than "the unpleasant feeling." May not such "feelings" proceed from odorous matters? as the materials of vegetable fibre in the stuffing of a well-used piece of upholstery will generally be found on examination to emit a repulsive smell. Here, therefore, is another source of vitiated atmosphere in living-rooms, which makes itself felt directly the windows are closed.

My sister, who is resident in New York, has told me that one of the best known German physicians in that city remarked to her that no house ought to be inhabited for more than sixty years, but should then be pulled down, as it is infested with all the diseases of those who have ever dwelt there. He was right; probably every reader at some time or other, on entering an old house full of woodwork, has been struck by the unwholesome smell. What is then to be done? My readers will scarcely reconcile themselves to the radical remedy suggested by the American physician, nor do I consider it necessary. If all plain wood were to be thoroughly oiled or varnished, I believe that old houses would no longer be haunted by such evil spirits. As regards ordinary upholstered furniture, it would be a great step in advance to discontinue its employment in the rooms usually inhabited, and if new upholstery be procured it should be of Sanitary materials. I have had the furniture

for my daughter, on her marriage, made in this manner by a firm of upholsterers here, and find that it is easy to effect, without adding to its cost or detracting from its appearance. Ordinary upholstery can be altered so as to be Sanitary, and where material of vegetable fibre cannot be dispensed with, it may be impregnated with suitable oily matter ; for instance, with paraffin. Carpets should be used as little as possible, and should be of pure woollen material. I particularly caution against old upholstered heirlooms, to which the remarks of the American physician respecting houses, quoted above, are entirely applicable.

The walls of rooms, staircases, etc., should not be papered, as wall-papers retain bad odours. Moreover, any defective place in the paper forms a haunt for vermin and a trap for dust, and damp walls are a breeding place for mould. Instead of being papered, walls should be sized, or, which is still more wholesome, although technically it presents more difficulties, whitewashed. Of course, oil paint is in itself the best covering for walls, as it would completely prevent their retaining bad odours.

In conclusion, I must inflict a deep wound on the house-wifely heart. If the nose be applied to white window curtains, even after they have been up a very short time, they will be found to smell like "dirty wash," and are therefore just as prejudicial to the atmosphere in the room. Whoever can afford it should have woollen curtains, and whoever can not has the economical alternative of dispensing with curtains altogether. I have never permitted their presence in my study, and therefore know from experience that they are not necessary.

I may point out that woollen curtains are free from the danger of catching fire, as they will not flare up like

curtains of Vegetable fibre, if a flame comes in contact with them.

XXIX.—HOSPITAL CLOTHING AND BEDDING.

I HAVE been asked in the following communication from a correspondent to deal specially with the question of what clothing materials should be worn when nursing cases of infectious diseases:—"I lately heard that a lecturer on sick-nursing warned nurses not to wear woollen dresses, which easily convey infection. Washing dresses were recommended, and it would seem that frequent washing must be a great preventive. This, however, is impracticable with woollen dresses, and the same is true of woollen bedding, while linen sheets can be continually changed and cleansed."

In face of the fact that the germs of infection can be conveyed in so many different ways, including that of the air, I would submit that the advice to wear cotton dresses on this account is as logical as if it were sought to exclude the sparrows from a garden by shutting the gate. But, further, I would point out that such advice can only have been given by a person who is unaware that two things are necessary to induce infection: (1) the *germ*; (2) the *tendency to be infected*.

The relations of the two classes (animal and plant-fibre,) of textile materials to these joint conditions of infection are shown in the case of cholera. So long as the specific cholera-germ is absent, no one sickens with cholera, although there are plenty of people with a tendency to be infected. If, however, the germ be imported, it is well-known that, even in the worse epidemics, not everyone who is exposed to the germs will sicken—in fact, only a minority are attacked. Thus, if

the cholera-germ be absent, sins against hygiene, whether in the form of unhealthy clothing, bad food and drink, bad air, etc., generate all kinds of sickness, but not cholera ; if, however, cholera is "in the air," this specific disease ensues. But whoever complies with hygienic rules, and keeps free from terror, may defy infection.

If each person into whose organism a disease-germ enters were attacked with the disease, the extraordinary facility with which these minutest of creatures are conveyed would involve the sickening of everyone in the locality where an epidemic breaks out. As, however, only a moderate percentage sicken, the *tendency* is proved to be the determining influence. This tendency, as I have previously explained, consists in such a condition of the body as is suited to nourish the germ, and this condition only exists when the body is enervated or weakened ; for the germs of disease and decay only settle and multiply where a certain disposition to disease is already present.

The question is whether clothing wholly of animal wool or of plant-fibre is better. The wearer of the former, who has adopted the Sanitary Woollen System for some time—and has thus not only avoided any accession of matter which could tend to disease, but has also freed his body from the residue of such matter—has *no tendency to disease* ; and to him it is therefore a matter of indifference if the germs of infection settle in the air or water or in his clothing. The advantage that the germs less easily adhere to clothing made wholly of plant-fibre is considerable, having regard to the ubiquity of the germs in the hospital atmosphere, and this advantage is purchased at the expense of a *tendency to infection* which is, at all events, much greater than that of the wearer of all-wool clothing.

The doubt may be expressed whether clothing exercises so great an influence as I describe on the body. This brings me to a subject which I have never yet discussed with the precision and plainness which its importance deserves. I will illustrate it by referring to the nature of wood.

New furniture of fresh, plain (not polished nor painted) wood—pine, for instance—gives out quite a different odour to that which characterises it when it has been used a few months; at first there is the fresh, turpentine-like, resinous smell, which subsequently changes to a musty, repulsive odour, similar to that of dust and of old books and papers.*

This smell is not only that of woodwork itself, but also of the atmosphere which surrounds it, and several such pieces of furniture, together with a flooring of plain wood, will communicate to a whole room a constant musty, unpleasant odour. If, however, all the plain wood (which usually comprises the back and unseen parts of most furniture as well as the flooring) in a room be treated with oil paint, polish, varnish, or lacquer, a *double change* will be effected: not only will the close, unpleasant smell of the plain wood itself have vanished, but the atmosphere in the room will have undergone a remarkable change, for from this, too, the odour will have disappeared.

First let us consider the origin of the close smell which furniture of plain wood acquires. Is it developed from the interior of the wood, or does it force its way into the

* Anyone who cannot detect this by the sense of smell need only ask a carpenter or cabinet maker, who will tell him that it is a pleasure to work up fresh wood, on account of the fresh resinous odour; whereas old woodwork which has already done service in rooms, stables, furniture, buildings, &c., smells so offensively that even to the bluntest sense the work is objectionable.

wood? This question is easily solved: if a piece of plain wood is allowed to lie for some time in a stable it will indubitably smell of stable manure; if it be in a cowshed, it will smell of cow manure; and if it be in a room inhabited by human beings it will take up the odours given out by them. The source of these odours is therefore the exhalations or excretions from the living beings which are in the same stable or room in which the plain wood is deposited.

Our second inquiry must be: If wood attracts the mal-odorous exhalations of living beings, why does it not so absorb those odours as to purify the air?

There are substances which really act as purifiers of the air, because they either, like living plants, consume odorous matters, or, like coal, so completely absorb them that they cannot be any more detected. But plain wood neither acts like the living plant nor like coal; and hence is nothing more nor less than a reservoir of evil odours. We find in one object two opposed characteristics, viz., odorous matters whose scent gradually diminishes until it becomes scarcely perceptible, and, conversely, odorous matters which form a centre of attraction for all other such matters in their neighbourhood to accumulate more and more in and around the wood. It suffices, however, to overlay the surface of the wood with another substance possessing no attraction for evil odours, to break the connections between the odour in the wood and that in the surrounding atmosphere, by destroying the absorbing power of the surface of the wood.

We may now return to the clothing question; fabrics of plant-fibre absorb, in the same manner as plain wood, the odours which emanate from human beings, and it is therefore clear that a person who has plant-fibre materials in his clothing or bedding suffers both in the action of

his skin's exhalation, and in the deterioration of the air which he breathes. The retention by plant-fibre fabrics of mal-odorous matters prevents these from escaping; not only is the atmosphere of the clothing and bedding bad, but the whole air of the room is affected, and this becomes more and more the case in proportion as the quantity of materials of plant-fibre and plain wood in the room is increased. The result for those who wear plant-fibre and breathe a vitiated atmosphere, is that they acquire the *tendency to disease*, for their bodies become impregnated with these odours, and form a suitable soil for disease-germs. It is thus most important that there should be no half-measures. Everything which, as described above, may be a continuous and increasing source of vitiation of the atmosphere should be removed or rendered innocuous.

Referring to the special subject of this chapter, Hospital Clothing, I would first remark that the point of most consequence is not the clothing of the Nurses, but the clothing and bedding of the patients, and the nature of the furniture and walls of the room. If the former be all of pure wool,* and the furniture be either of iron, or so painted or varnished as to be wholesome; further, if the walls are treated in the manner which I will subsequently explain, two eminent advantages will be achieved:—

1. Patients will sooner be cured of their disease; for the power of retaining evil odours which plain wood and plant-fibre possess defeats in great part, if not altogether, endeavours to ventilate.

2. These measures minimise the chief of the two conditions necessary to infection, namely, the *tendency to*

* Some special precaution should be taken in such cases as that of "peeling" after scarlet fever. Old clothing may be worn, which can be afterwards destroyed; and the blankets, &c., should be disinfected at frequent intervals.

disease, a consideration which is especially important, because the great facility with which disease-germs are conveyed renders the most careful rules insufficient to prevent their transport.

As regards the clothing of Nurses, in order that it may not absorb the evil odours in sick rooms, and that the Nurses themselves may be proof against epidemics, they should be clothed in wool *throughout*. This clothing should be protected (*but only when they are actually nursing*, and the clothing is liable to be soiled by the excretions of the patients) by a cotton or linen cover, which should be washed daily.

Lastly as to the walls of rooms. Many authorities on hygiene attach much value to the so-called porous ventilation, *i.e.*, to the fact that ordinary walls are pervious to the air, and thus ensure a certain amount of ventilation. Covering the walls of a room with oil-paint is therefore condemned as shutting off this means of ventilation. I formerly held the same view, and caused my walls to be distempered; but since I have tried the other plan, I have altered my opinion. I first caused my staircase, in which there was always a smell from the water-closet, to be treated with oil-paint, with the result of greatly improving the freshness of the air, and I have subsequently painted other portions of the interior of my house with a similar satisfactory effect. When the walls are unpainted, and especially when they are papered, the air cannot be pure, and the ventilation which takes place through the by no means fragrant materials of the walls is nothing to be grateful for.

Let the experiment be tried, in some one room in a hospital, of coating walls, flooring, and all woodwork and wooden furniture thoroughly with oil-paint, not merely the parts which are seen, but inside, outside, and all

round; let the bedding and clothing of the patients be wholly of pure wool, and then estimate the result by the evidence of the nose! In such a hospital-ward the atmosphere will, I believe, under equal conditions of ventilation and cleanliness, be found to be better than that in ordinary wards.

XXX.—THE PLATINUM DEODORIZER, OR
“ODORICIDE.”

I HAVE long felt that the difficulty of properly ventilating living rooms in winter constitutes an important obstacle to the practical carrying out of my System, which, in addition to its title of “Sanitary Woollen,” may be termed a “Pure Air” or “Anti-offensive-odours System.” The recommendations made in the foregoing chapters may be relied on to effect a very considerable improvement; but even assuming that they are all carefully adopted, the maintenance of a thoroughly pure atmosphere in rooms will still present difficulties, especially in the cold season, when rooms are necessarily kept more closely sealed against the open air. For instance, my own study is crowded with a mass of papers and books, and Vegetable fibre in this form is as prone to harbour evil odours as when it is in the form of rough wood, or of linen. To counteract this and other inevitable causes of the vitiation of the air in rooms, recourse should be had to the extraordinarily effective apparatus for which the name “Odoricide” (Odour-killer) has been registered, and which is the most powerful agent ever produced for *destroying* evil odours, and combating the continual vitiation of the air in rooms by the breathing and exhalation of their occupants. Its deodor-

izing influence is especially valuable in sick rooms, or where smoking, or eating and drinking, have filled the air with odorous matter.

The "Odoricide" somewhat resembles a bulbous hyacinth-glass, with narrowed neck, fitted with a glass extinguisher. The glass is filled with *pure* spirits of wine, in which a wick rests. The wick passes up through the neck, and a little glass tube is inserted into the top of the wick, supporting a spiral of platinum wire. To set the apparatus working, the wick is lighted, and burns with a flame until (in about a minute) the platinum wire gets red hot, when the *flame* is extinguished by popping the extinguisher quickly on and off again. The platinum wire then continues to glow at a temperature of about two thousand (2,000) degrees Fahrenheit.

The practical effect of this is, that as the air immediately surrounding the spiral becomes heated it rises, and is replaced by air drawn in from all sides, and compelled to pass through the glowing spiral, causing the combustible matter contained in the air to be consumed. If half-a-dozen smokers were to endeavour to fill with tobacco smoke an ordinary-sized room in which an "Odoricide" is burning, they would not succeed. The fumes would be constantly drawn through the spiral and consumed. The same thing happens to all odorous matters in the atmosphere of the room. If the "Odoricide" be lighted in a room after dinner, however strongly the atmosphere may have been charged with odours, it will promptly destroy them.

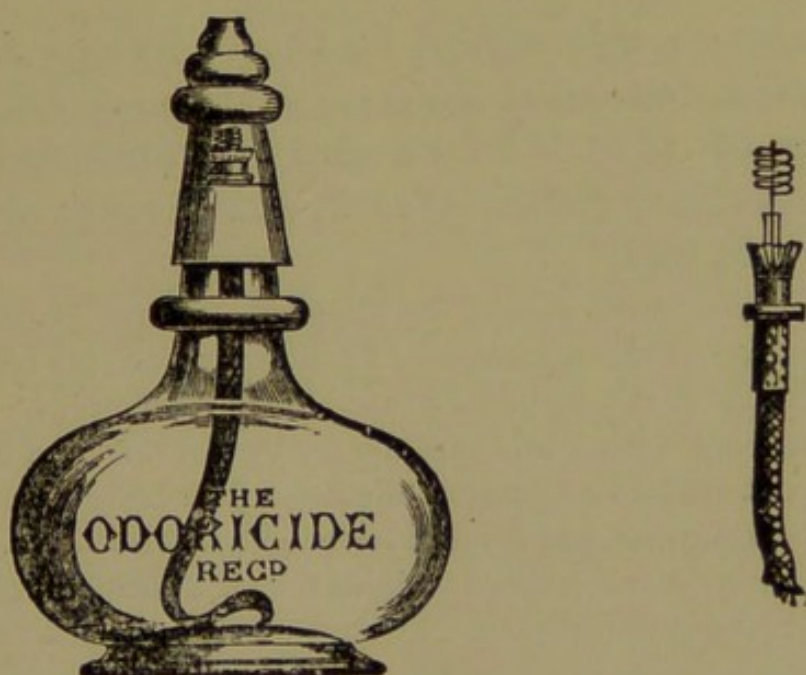
Usually, a few minutes suffice to effect this, but in very large rooms two or more "Odoricides" may be required.

To extinguish the glow, the glass cover should be replaced, and should be left until the "Odoricide" is again required, as otherwise the spirit will evaporate.

A few drops of Eau de Cologne or other good perfume added to the spirit will be continuously imparted to the atmosphere.

It is of great importance that the spirits of wine should be free from fusel, and of proper strength.

The "Odoricide" should be protected from draught.



The spiral should not be allowed to continue to glow until all the spirit is consumed, or the wick will char ; if this happens, the charred portion must be removed.

I recommend the use of the lamp in rooms which are badly ventilated, or which are filled with odours, such as dining-rooms, sickrooms, etc , also in workrooms, offices, schoolrooms, and in cases where, out of consideration for others, the ventilation is insufficient. Persons who believe that they cannot sleep with the window open, whether on account of cold, or of chronic illness, or because of the vicinity of some evil-smelling locality,

should deodorize the atmosphere of their rooms with this lamp, bearing in mind that when it is allowed to burn too long in a room of moderate dimensions it may induce headache.

XXXI.—TROPICAL CLOTHING.

AN article on this subject by the celebrated African traveller, GERHARD ROHLFS, went the round of the newspapers in 1885. I here give a summary of the principal assertions contained in it, and subjoin my own observations in reply.

"Sheep lose their wool in very hot climates, and hair grows in its place. Lions and other animals, who in colder regions are furnished by nature with thick fur, have only thin hair in the tropics.

"Men should learn from this that too heavy clothing, and woollen clothing, are not suited to a tropical climate. The body is weakened by constant perspiration, and the skin becomes more sensitive. This is the main reason why Northern peoples find it so difficult to acclimatise themselves in the tropics. The argument of defence against changes of temperature is untenable when the thermometer rarely sinks at night below 77° Fahr. If the early morning dews are feared, india-rubber overcoats or coverlets are sufficient protection, without having recourse to flannel suits. Flannel is worn in cold regions in winter for warmth, and it is illogical to wear such clothing in the hot zone. Why are the British, who are the chief advocates of flannel, so unable to bear a hot climate? Partly because they indulge to excess in brandy, instead of wine and beer (!), but still more, because they over-stimulate their skin by day and night, and thereby enervate it, so that it becomes incapable of the necessary reaction.

"It is not true that the Arabs clothe themselves in wool. A sheik will put on his whole wardrobe of burnouses, cloths, and turbans when he has occasion to enter a town, but when at home he simply wears shirting.

"We should learn from the natives, who merely clothe themselves with strings of pearls, with large leaves, with tanned or untanned skins, &c., &c. Only when they come in contact with civilization do

the negroes clothe themselves, and then they used cotton prints, and feel more comfortable than the whites who wear flannel. The value of cotton materials imported to South Africa for the blacks is immense, while flannel and woollen materials find no market, and are not used by the natives. At the large courts in Inner Africa the chief persons wear a quantity of cotton clothing, but the apparel is so constructed as to freely admit the air to the body.

"If, therefore, the climatic conditions and the example of the natives are to be observed, wool should be rejected by man as nature rejects it for the animals; and its place should be taken by the indigenous cotton, which has the advantage over linen, that it does not retain the wet so long, and therefore is not so chilling in its effect.

"Under all circumstances the pores of the skin must be kept open, and the greatest cleanliness must be observed, for the skin is in the tropics the safety valve of health to a much greater extent than in more moderate climates. Much of the functions of the kidneys is performed by the pores, and it is all the more important not to weaken the latter by excessive perspiration. Especially in damp heat—on the coast or in the marshy districts—would wool be unhealthy, creating a condition similar to a Turkish bath. People enhance the difficulty of living in the tropics by wearing too heavy clothing, and however useful woollen clothing may be in cold countries, in the tropics it is wholly injurious. Let us copy the natives, who content themselves with the least possible clothing, and let us not weaken our skins by wearing wool, like the English, who can consequently only endure a tropical climate for a short time, and are compelled to send their children born there to Europe. It is illogical in hot countries to wear clothing which makes one still hotter. Where cotton is indigenous, let the clothing be of cotton, and where wool grows let it be of wool!"

GERHARD ROHLFS has clearly not thought it worth while to read the writings of the man who has instituted the most exact and detailed researches on the scientific questions which have to be considered in respect of clothing, and who has accumulated more practical experience regarding the hygienic effect of the various methods of clothing than anybody else before him; otherwise it is impossible that ROHLFS would have published the above unqualified statements. Those who are acquainted with my writings will sufficiently

recognise the weakness of ROHLFS' arguments, but the publicity given to them makes it necessary that I should at least refute his most glaring errors.

The arguments in favour of cotton, which ROHLFS draws from the animal kingdom, would be sensible and intelligible, if when sheep are transposed to the tropics cotton or grass were to grow on their bodies instead of wool; for the hair which the animals produce in the tropics does not differ in its *material nature* from wool; it consists of horny matter, and its relations to gases, fluids, temperature, electricity, etc., are precisely those of wool. The tropical animals simply teach us to clothe ourselves more lightly, but not to select another material, such as vegetable fibre.

In treating wool and flannel as synonymous terms, Herr ROHLFS most unmistakably shows how superficial is his knowledge on this subject. The difference between flannel and the Sanitary Woollen Clothing which I have devised for a warm climate is precisely that between the coat of an animal in a cold climate and in a warm one, for this reason: wool, like the animal's coat, consists of two elements, viz., long and short fibres. For flannel both kinds of fibre may be used, but in the Sanitary Woollen materials of long-staple wool the short fibres, which constitute the element of density, are eliminated by combing, which is a reason why clothing of long-staple wool is suited to a warm climate. Further, the rectangular web of flannel necessitates a firm and close conjunction of the threads; and this kind of web offers less resistance to the tendency of the wool to shrink and felt, so that, after once or twice washing, flannel becomes a species of felt. In this respect the stockinet web of long-staple wool acts quite differently, because the nature of the web is five times as porous as that of flannel, and

the elasticity of the serpentized threads affords a security for the maintenance of this porosity, which the straight threads of the flannel cannot give; further, because, owing to the nature of the web and to the absence of underwool, the shrinking and felting in washing are reduced to a minimum.

The rectangular web of flannel deprives it of all elasticity, and it must therefore be worn looser than the stockinet garment; consequently the former is more apt to work into folds under the outer-clothing, covering the skin in parts with a three-fold layer of flannel, which is greatly too much.

Lastly, all the flannel shirts for daily use which I had ever seen or worn, prior to the production of the clothing which I devised, were dyed or chemically bleached. The contrast between the natural-coloured stockinet shirt of long-staple wool and such a dyed flannel shirt may be compared to that between day and night. If ROHLFS draws conclusions as to my Sanitary Woollen System from experiences made with such flannel shirts, he displays an ignorance of the subject which would perhaps have been excusable five years previously, but which now that the System has been introduced to all parts of the world, is scarcely ingenuous, especially as his article on this subject was originally written for a leading German newspaper. What we learn from the animals is simply that lighter clothing is required for the tropics than for colder regions, but both kinds of clothing must be of the *same material*. This is precisely what I have embodied in my System, in that I have caused the thicker shirt, mainly woven of short-staple, to be constructed for the winter and for a cold climate, and the much more thin and porous shirt of long-staple for the summer and for hot countries. Thus my System is

entirely in harmony with the animals' teaching; and when ROHLFS says it is illogical to wear the same clothing in the hot zone as in cold and moderate climates, I ask in reply whether it is illogical to select as clothing in the hot zone the same material, animal fibre, as in the cold and moderate climates—the fabric for the hot zone, of course, to be lighter, thinner, and more porous than for the latter; this and nothing else is what we are taught by observation of the coats of tropical animals.

Coming now to the arguments which ROHLFS derives from the practice of the natives, I have to say that the example which he quotes of the Arab Sheik is anything but convincing. Nobody doubts that there are occasions when the Bedouin feels too warm in his thick close burnouse, but the question whether the Bedouin would not be better off if he were clothed in a stockinet shirt of long-staple, instead of in cotton shirting, does not appear to have received the consideration of Herr ROHLFS.

While I am on this subject I will insert an extract from an article in No. 52 of *Ueber Land and Meer*, 1885, on the Caroline Archipelago, by a German resident in the tropics:—

“Wherever in these parts the mischievous European influence has not made itself felt, the clothing is limited to a piece of matting attached to a belt, the length of the matting being greater for females. The Ponape women are contented with a showy colored cloth twisted picturesquely around the loins. At the Mission Stations they have been compelled to adopt semi-European clothing, which everywhere in the South Sea has proved exceedingly pernicious to the health of the natives.”

To this I would add that experience has been the same wherever savages accustomed to go naked have been induced to adopt European clothing, and I ask, in what

does the destructive influence of the latter consist? I do not dispute that the negro feels more at ease in the calico rag which barely covers his nakedness, than the white man, who is wholly enveloped in flannel, for the former is nearly naked, and that is, as I stated long ago, the proper sanitary costume in the hot parts of Africa. I will here give a further report, from the *Schwäbischen Mercur*, of 9th September, 1885:—

"On the Cameroon river men and women are clothed alike, simply with a cloth thrown round the loins. Occasionally, in addition to the waistcloth, a vest, or shirt, or kind of petticoat is worn. Much rarer still are trousers. ZÖLLER does not conceal his sympathy for this primitive clothing; he laments that the national costume is destined to be superseded by European clothing. A well grown negro in the costume which King Bell and Managa Bell wear to the present day presents an imposing appearance, which would lose exceedingly in European clothing.* The waistcloths are much better suited than European trousers to the negro, because they look better, and are also more cleanly. To me it is incomprehensible that the English Mission could introduce shirts and trousers for their scholars. In my short journeys into the interior I had a good opportunity of comparing and weighing the advantage of both costumes. Those of my black companions who had adopted the fashion inculcated by the Missionaries diffused an odour which was anything but agreeable, whereas the negroes who simply wore the customary native waistcloth sprang into the water at every opportunity, and kept their skins much cleaner."

So long as Europeans persist in the error of walking under a tropical sun in as complete an outfit as is worn in Berlin *Unter den Linden*, the tropics will continue to be a cemetery for them; while the native populations will be doomed by the curse of imported calico stuffs and ardent spirits to destruction, like the North American Indians. But will Herr ROHLFS maintain that because a big business is done with Africa in calico stuffs, this is

* A striking but well-grounded admission of the æsthetical poverty of our tasteless European clothing! G. JAEGER.

any proof of their conduciveness to health? In that case he must also credit ardent spirits with being a blessing for these regions, for in them also a big business is done. The rule for the tropics should be as little clothing as possible, but such clothing as is worn must, even more in the tropics than anywhere else, be of undyed wool. I shall continue to hold this view until Herr ROHLFS can prove to me that the skins of human beings in the tropics secrete no noxious matter, or that cotton abrogates in the tropics its property of eagerly absorbing water and evil odours.

I am curious to know how ROHLFS can reconcile his requirement that "the skin must always be kept open" with his recommendation of india-rubber coats and coverlets.

I would further point out to Herr ROHLFS that my assertions respecting the healthiness of the Sanitary Woollen System in the tropics are not merely based on my scientific studies and my experience in European climates, but also on numerous reports from persons who have practically tried the System in the tropics.*

It only remains to reply to ROHLFS' allegation as to the enervating effect of wool. My readers will however, sustain me in declining to refute for the hundredth time an accusation which is continually renewed, and which rests upon absolute ignorance of what I have so often pointed out as to the hardening effect upon the tissues of clothing made *throughout* of porous wool, in draining

* Dr. HUGO TOEPPER writes in "A Hundred Days in Paraguay," Hamburg, L. Friedrichsen & Co., page 152—"On the occasion of a storm my people were freezing in their thin cotton things, and tried in vain to keep warm by drinking spirits. I emptied the water out of my boots, and felt as well as ever—thanks to Professor JAEGER, in Stuttgart, and his Sanitary Woollen System."

from them their surplus water and fat. I will only ask, is the training by means of woollen coverings to which men and horses are subjected for sporting purposes, an enervating process, or is it not rather the exact opposite?*

Could the publication of Herr ROHLFS' article be due to a desire to justify the fact that recently a body of our healthy German marines had been despatched to Cameroon in cheap Vegetable fibre clothing? Here I am reminded of an incident which occurred at the time that I was a student at Tübingen.

The late well-known physicist NÖRREMBERG, an obstinate, eccentric man, fell seriously ill, and refused to consult a doctor. His friends begged a leading physician of those days, Dr. RAPP, to see NÖRREMBERG. When RAPP arrived he was received by NÖRREMBERG with the most disrespectful remarks as to the ability of the profession. Without saying a word RAPP felt his pulse, inspected his tongue, wrote a prescription, and gave it to the patient with the brief injunction, "two spoonfuls to

* The following is extracted from a letter written by a traveller in the tropics:—"Personally, I am very decidedly for wool. I have wandered for six months through the hottest regions of South Brazil, in woollen shirt, trousers, boots, a woollen shawl, and a felt hat. I rode daily nearly six hours, through river and swamp, slept in the open air, under rain, and was for months in the worst fever nests, like Pernambuco (where an epidemic was raging), Lococo, and Senegal, in Africa, without having to complain of illness for so much as a minute. I slept with most comfort in a hammock, rolled in my camel hair rug. Now, as I am by no means a Hercules, there must be some reason for all this. I feel very grateful to the wool, especially for the cure of a pulmonary attack. Of course my strict temperance was a great help. . . . It was delightful to see the natives accustomed to the heat, sweating, groaning, and idly lolling, while I, who am only a poor Northerner, accustomed to a cold climate, ran about, loaded and saddled donkeys, made purchases, carried burdens, and in short worked unceasingly, and yet felt no inconvenience."

be taken every hour—Good day, NÖRREMBERG ;” he then took his hat and turned to go. NÖRREMBERG threw the prescription on the ground, and exclaimed : “ You quacks understand nothing at all about it ! ” RAPP turned at the door and said shortly, “ The *post-mortem* will show, Good day ! ” This remark tamed NÖRREMBERG ; and I recollected it when I read of the equipment of our marine soldiers. “ The *post-mortem* will show ! ”

THE JAEGER SYSTEM IN AFRICA.

MR. H. M. STANLEY'S OPINION.

To the arguments and the experience set forth in the foregoing chapter may now be added the testimony of the greatest of modern African travellers, who has favoured the London representatives of my Sanitary Woollen System with the following letter :—

“ CAIRO, 1st February, 1890.

“ GENTLEMEN,

“ I am in receipt of your book on ‘ Health Culture ’ and have read with interest that portion of it referring to Tropical Clothing.

“ I have pleasure in testifying to the excellence of the Jaeger Clothing which, during my late journey, I found very good.

“ Yours faithfully,

“ HENRY M. STANLEY.

“ To Dr. Jaeger's Sanitary Woollen System Co., Ltd.”

THE JAEGER SYSTEM IN SIBERIA.

The subjoined letter is from heroic Miss KATE MARSDEN, who, by special authority of the EMPRESS OF RUSSIA, investigated the condition of the lepers in Siberia :—

“ MOSCOW, RUSSIA, *April 27th* 1892.

“ DEAR SIR,

“ Before returning to England, I wish to thank you for having persuaded me to wear Jaeger Clothing. Humanly speaking I owe my life to that and not taking stimulants ; and I really believe that no woman could have gone through all my dangers, privations, and difficulties without both of these aids to health. Having travelled over 21,000 versts, through the bitterest Siberian cold and the tropical heat of Alexandria, and never once having taken cold, I feel bound to let you and everyone know to what I attribute this fact.

“ Yours faithfully,

“ KATE MARSDEN.”

“ The Managing Director,

“ Dr. Jaeger's Sanitary Woollen System, Co., Ltd.”

XXXII.—CAMEL HAIR.

WHEN I came to recognise the important influence of the colour or dye of Woollen Clothing on the health and working powers, I subjected all woollen textile stuffs to a prolonged investigation. My researches soon elicited communications from practical quarters, pointing to a physiological superiority of camel hair to sheep's wool, and I determined on making an experiment with clothing and bedding of camel hair. The result decided me to give the highest place in my Sanitary Woollen System to camel hair, and this decision has met with a success which I could not have anticipated.

Camel hair exercises a more hardening influence on the body than sheep's wool, and disperses adipose tissue more readily. If we consider these various effects, we find that they undoubtedly represent the characteristics of the camel, which is much more moderate in its requirements than the somewhat greedy and almost incessantly feeding sheep. Further, the temperament of the camel is peculiarly placid, and its nature is hardier than that of most animals.

The odour of the camel, as may be readily ascertained by a visit to a zoological garden, is milder, softer, more free from any irritating quality than that of sheep. The musk-like scent of the camel is retained in its hair, and its remarkably soothing, pain-assuaging effect is well known in the East. I have made practical application of this attribute, by causing wadding of camel hair to be constructed for healing purposes, and it has done excellent service in cases of rheumatic and nervous complaints, neuralgia, toothache, headache, earache, etc.

Unfortunately, camel hair has not yet been successfully employed as material for underwear, as it cannot be woven of sufficient durability to withstand the severe friction to which it is thus subjected. In the East it is manufactured into thick mantle stuffs, coarse and fine hairs being worked up together. For the purpose of making a finer web, particularly stockinet web, the coarser hair requires to be removed by combing, and it is this coarser hair which constitutes the main element of durability.

This difficulty does not, of course, apply to the manufacture of camel hair bedding and of the camel hair coverlets and rugs, which I can most strongly recommend, on grounds of hygiene, comfort, and practical use and convenience. (See "Bedding," Chapter 17). While on

the subject of camel hair, I may quote here a communication which I received from a Moscow correspondent in 1883: He says, "In my former travels I found that the Bedouins and Arabs looked down with contempt on our flannel clothing; they frequently jeered us about our unpractical costume, and showed us their's of camel hair, maintaining it to be the best protection for the body; they displayed their sinews and muscles and mocked at ours. I must admit that when endurance, rather than momentary exertion of strength, is in question, the Bedouins are as immeasurably superior to us as is the camel to our European domesticated animals."

XXXIII.—GIRDED LOINS.

A CORRESPONDENT who has adopted the Sanitary Woollen System writes: "I cannot become reconciled to wearing a belt, notwithstanding that this was generally practised in the Middle Ages, and is still customary with the military, and among the inhabitants of southern countries (although nothing similar obtains among any of the four-footed creation). To wear a belt seems contrary to nature, as it checks the processes of breathing and digesting, especially of the former in the case of the male sex, whose respiration brings the abdominal region more into play, while the female sex breathe chiefly in the region of the chest. A man's breathing-muscles are attached to the cervical vertebra, the collar-bone and shoulders, and the ribs, which latter they extend and widen. So that, if a belt be worn, only the upper part of the chest is capable of the proper undulatory motion incidental to respiration."

In reply to this I have to say that my experience of wearing a belt has been acquired at different periods of my life. As seminarist and student—a period during which my health was good—I regularly wore an ordinary gymnastic belt, and found that it suited me very well, with the exception that if I took off the belt when I was perspiring, I easily caught cold in the part which the belt had covered. This induced pains in the direction of the navel, such as are caused by cramp or colic, without, however, affecting the bowels, and could be very troublesome for two or three days. I consider this to have been an affection of the peritoneum, caused by enervation of the skin of the abdomen, for, of course, at that time I was not clothed in wool.

In the second period of my life—from 27 to 46 years—during which I suffered with my digestion and in my general health, I wore no belt, and could not bear to have anything tight round the loins, because the circumference of the abdomen continually varied; and, after meals, when my dyspeptic troubles commenced, I was obliged to loosen the trousers, although these were made to fit very easily. The pain in the direction of the navel, described above, frequently made itself felt, especially in summer.

About the time that I inaugurated the Sanitary Woollen System I was reading the well-known *gourmand* BRILLAT-SAVARIN, who writes amusingly and even instructively, but whose book has as little claim to the title of *The Physiology of the Sense of Taste* as a cook would have to that of “physiologist.” I was much struck, however, by the remark, that in cases of tendency to corpulence the wearing of a belt was much to be recommended, not only in the daytime but also at night. I was aware that corpulence is injurious, and that the

body, when constrained, possesses great capacity of self-help. Simultaneously, therefore, with adopting the Sanitary Woollen System, I began to wear an ordinary leather belt about two inches wide, but only during the day. I found that I bore it very well, and as the Sanitary Woollen System caused my dyspepsia, and the puffed-out condition incidental thereto after meals, to disappear, I could maintain the belt equally tight throughout the day without inconvenience. Certain other evils, however, made themselves noticed.

I *felt* that a LEATHER belt was wrong, especially when I perspired, and there gradually arose a disagreeable sensation in the skin whenever pressed by the belt. I consequently tried a woollen belt of similar width, but it afforded too little resistance, and was soon useless, rolling up and cutting like a rope. My hope that the body would accommodate itself to the pressure of the belt was not fulfilled as I desired; the circumference under the belt continually lessened, so that I had to keep tightening the strain to prevent the trousers from slipping; but above the belt, and to some extent below it, the protuberance was proportionately increased. It was thus clear that this form of woollen belt did little or nothing to hinder corpulence. In spite, however, of the inconvenience described, I considered that the belt had distinct advantages, as somehow I felt comfortable with it, and during this period, which lasted till within a year of the time of writing (1882), I was free from the pain over the navel, previously referred to.

My experiments entered on a new phase during an excessively hot summer. I must premise that I formerly suffered considerably from difficulty of breathing, and from great corpulence ($42\frac{1}{2}$ inches round the body). The relief afforded by the Sanitary Woollen System has

exceeded all my hopes and expectations, but still I am not completely satisfied. The normal measurement round the body should be 75 per cent. of that round the chest. The latter is in my case $39\frac{3}{8}$ inches, and the measurement round the body should therefore be $29\frac{1}{2}$ inches, whereas it fluctuates between $31\frac{1}{2}$ and 34 inches, according to my condition and the season of the year. It is thus still about 4 inches too large, and I know that in proportion as it is smaller or larger, I am more or less well.

The difficulty in breathing had also greatly improved, but I was unable to account for the circumstance that when I walked somewhat quickly up hill, I felt—especially in hot weather—a pain at the lower end of the breast-bone, shooting right and left. I had often puzzled over the origin of this pain, and had long accepted a mistaken theory that it arose from some old-standing distortion of lungs and chest, which would accompany me through life, when light was at last thrown upon it in the following manner:—

I was panting up the southern slope of a valley at the hottest period (between 4 and 5 p.m.) of one of the hottest days in the summer, the path being entirely without shade, and the sun burning pitilessly down upon me, when I suddenly perceived that the pain rose exactly at the junction of the diaphragm with the anterior verge of the chest, and was the natural consequence of the vehement action of the diaphragm. On further observations of my movements in breathing, I remarked that I breathed exclusively in the region of the diaphragm and lower ribs, and that the upper ribs remained almost completely inactive. I now remembered the well-known fact that difficulty in breathing (asthma—in horses, broken-windedness) is caused by a wasting of the lungs,

which always commences in the tissues of the upper portions; and I had long thought that this affection was due to insufficient use of the lungs. When I further considered that men are much more subject than women to asthma, I had a clear perception of the whole case, as follows:—

Two conditions of breathing must be distinguished: (1) Quiet breathing, when lying down, sitting, or walking slowly, is differently performed by men and by women; at least, this is the case in our state of civilization, although I doubt whether it is so everywhere. Men breathe only in the region of the diaphragm, whereby merely the lower portions of the lungs alternately fill and empty, while the upper portions are inactive. Women, on the other hand—chiefly because the diaphragm is hampered by the corset or by the clothing being tied round the hips—breathe in the direction of the upper ribs, and therefore with the tips of the lungs: this is the cause that women are, relatively, attacked less frequently than men by asthma. (2) When the breathing is accelerated by strenuous motion of the body, the difference in this respect between ordinary men and women disappears, and the whole of the lungs is called into play.

It is thus clear that, when a man leads a sedentary life and is seldom or never compelled by strenuous bodily movement to breath with force, two things will happen. The inactive tips of the lungs will waste away, entailing subsequent difficulty of breathing, and he will become so accustomed to breathing solely in the region of the diaphragm, as to lose all facility of breathing in the region of the upper ribs. If an occasion then arise for more abundant respiration, the body will fall from habit into the error of endeavouring to supply this by increased activity of the diaphragm, instead of obtaining assistance

from the direction of the upper ribs. The two-fold consequences are: (1) The result is inefficient, because only the lower lobes, instead of the entire lungs, are worked: (2) The vehement movement of the diaphragm produces the pain which I have described.

In considering how this might be remedied, the circumstance that the climbing of ascents induces enhanced activity of breathing led me to think of people who inhabit mountainous districts, and before my mind's eye stood the German Tyrolese (whom I have long respected for their simple and healthy manner of living), with their belt of nearly two hands' width in front. I reasoned that the wearing of so broad a belt limits the possibility of breathing in the region of the diaphragm, and this, whenever the need for breath increases, compels recourse to the region of the upper ribs, thus preventing (1) the wasting away of the tips of the lungs through disuse; (2) the habituation of the body to dispense with breathing in the region of the upper ribs; (3) excessive and painful breathing in the region of the diaphragm.

I at once caused a belt, exactly as broad as that of the Tyrolese, to be made of strong woollen material; and the result surpassed my expectations. The effort of breathing when climbing ascents was greatly lightened, and I was at once entirely freed from the pain in the diaphragm.

What, of course, could not at once be remedied was the wasting away which had, undoubtedly, affected the tips of my lungs. How far this, in the case of a man in his fifty-first year, can be overcome I am unable to judge; and I do not suppose that, especially with my sedentary mode of life, I shall ever become an active mountaineer. But the fact remains that I have occasion weekly to ascend a hill $1\frac{1}{4}$ miles long, and 705 feet high. I do this without effort in twenty-five minutes, and, if I exert myself,

in twenty minutes. When I also consider that I can trot $1\frac{1}{2}$ miles on a slight descent, I feel that, as an asthmatic subject of many years' standing, I have reason to be satisfied; and I ascribe these results, in the first order to the Sanitary Woollen System, and in the second to the Tyrolese belt.

The belt must be six inches broad in front, narrowing on either side towards the hips. The chief difficulty of constructing such a belt of woollen material was the tendency of the broad band to fold together, and thus to lose its efficiency. This has been overcome by inserting pieces of whalebone or steel, and I can now strongly recommend this "Tyrolese" belt to be worn, especially by those who suffer from corpulence and difficulty of breathing.

ABDOMINAL BELTS.—In many abdominal complaints, and during and after pregnancy, as also in cases of very corpulent persons, it is serviceable to wear a belt. A good belt should sit well, and give the required support, without pressure, and should keep in its place. Obviously, a badly constructed belt which is liable to shift, is troublesome and fails of its purpose; while if it presses on the abdomen it may do more harm than good. As the same form of belt is not adapted to every case, there should be a variety of forms. The importance of hygienic material in the manufacture of such belts is obvious and they are now made (see particulars of "DOMEN" Belts, at end of this book) of the pure woollen material, so that persons who have adopted the Sanitary Woollen System, and who require an abdominal belt, may procure one which is sanitarily irreproachable; and such belts will be found much more healthy and comfortable, even by persons who have not yet adopted the System. In addition to these belts, other remedial appliances are manufactured in accordance with my System.

XXXIV.—WOOLLEN CLOTHING FIREPROOF.

EVERY winter brings its sad record of that most terrible form of death, burning alive. So surely as the season arrives when candles are lighted and fires in open grates are kindled, the newspapers present one horror after another. Young children, blooming girls, mothers of families, and the old, all are among the victims of "Death by burning."

In a recent instance, one of two sisters, who were dressing for a ball, caught fire at the lighted candle on the toilet table; the other tried to extinguish the flames, and both were burned to death. In another case, a lady who was walking in the grounds of the London Exhibition passed over a flaming match, thrown carelessly down by a smoker, and was also burned to death. It would be easy to fill this book with similar authentic horrors, but it will be more to the purpose to point out that all the agonised deaths and saddened memories which have been due to the clothing and bedding of the victims accidentally catching fire, would have been avoided if the material of the clothing or bedding had been of animal wool, instead of vegetable fibre, as between these two classes of materials there is a very great difference in respect of inflammability.

Cases often occur in which the hair catches fire, but it never burns down to the skin, as would certainly happen with vegetable fibre. If a piece of linen or cotton be held over a lighted candle, as soon as it ignites it burns away with a clear flame until nothing remains but the ash. If a similar experiment be made with woollen material, a considerable time will be required before it will ignite at all, and then the flame is extinguished so soon as the

material is removed from the lighted candle. Thus people are fire-proof in wool—*i.e.*, their clothing or bedding will not suddenly catch fire ; while, when clothed in woven material of vegetable fibre, they are practically torches ready for the lighting.

By covering the body, therefore, wholly with material of animal wool, we have it in our power to protect ourselves and those who are dear to us against a calamity which, as is shown by the case above quoted, of the lady who was burned to death by passing over a blazing match thrown on the ground, no amount of foresight can ward off with certainty, when the clothing is of an inflammable nature.

XXXV.—THE ADULTERATION OF WOOL WITH COTTON.

THE surest mode of detection is by microscopical examination. With a thirty-fold magnifier an admixture of cotton can easily be recognised. The woollen thread appears as a cylindrical body of almost circular shape, with wavy outline ; the cotton thread appears flat and ribbon-like, with angular folds, as if crumpled.

A second test, which anyone can apply, is by holding the separated warp and woof to a flame. Pure woollen thread fuses to a shapeless mass before it is consumed, leaving a shapeless ash, and extinguishes directly it is removed from the flame ; cotton or linen thread burns steadily on after removal from the flame, and the form of the thread is distinctly preserved in the ash. If a thread be an admixture of wool and cotton, it will burn irregularly.

XXXVI.—EATING AND DRINKING.

IS it not surprising that, whereas every wild animal, without any instruction or previous knowledge, at all times discovers what food is suited to it, there should be in the so-called era of exact research, such confusion of opinions as to what Man may eat and drink? a confusion which becomes greater in proportion as chemists heap analysis upon analysis, and physiologists institute experiment upon experiments.

This anomaly sufficiently indicates whither we must turn for enlightenment on the subject; we must endeavour to learn from the animals which live wholly free from artificial influences, and which are guided solely by their instinct, how and by what means they discover with comparative certainty the food that is suitable to them. The answer is simple; the animal seeks its food with its nose. By help of its sense of smell it discovers its food, even when the latter was previously quite unknown to it, and by the same sense it usually recognises the converse of food—namely, whatever is injurious to it. The question whether Man can make the same use of his sense of smell is one that may be solved without any course of learned study; a few experiments, which each reader can at once institute, will suffice.

1. Everyone knows that certain foods agree with him, and everyone is acquainted with certain venomous plants, or other poisons. If such objects be tested with the sense of smell, the odours of the wholesome foods (with the reservation mentioned in the next paragraph) will be found to be for the most part agreeable; while the poisons and unwholesome foods are usually mal-odorous. For instance, all eatable fruit, such as pears, apples, straw-

berries, raspberries, oranges, &c., is distinctly fragrant; while poisonous berries, however inviting their appearance, such as deadly night-shade, the herb paris, &c., generally smell offensively.

2. To a hungry man the smell of suitable food is attractive and agreeable. On the other hand, the same food will smell disagreeably to the same person when once he has assuaged his appetite with it (the windows are thrown open after a meal to get rid of the disagreeable "smell of dinner"); and in a condition of satiety it would be injurious to continue taking the food.

3. A sick person may be injured by taking food which agreed with him perfectly when he was healthy, and of which the smell is now, in his sick condition, repellent to him. To this may be added that, while offensive odour usually indicates that the object is unfit to be enjoyed, or is generally prejudicial to health, fragrance, on the other hand, does not of itself prove an object to be eatable; for instance, most flowers are fragrant, but we do not think of eating them. If a thing may be eaten, it must, in addition to its fragrance, awaken a feeling of appetite or desire to eat it; this familiar sensation is accompanied by increased flow of saliva ("the mouth waters"), and by involuntary movements of the organs of the mouth, especially of the tongue.

We see from these facts that Man, in his sense of smell, has, however circumstanced, a means of recognising whether a food will agree with him, and this not only qualitatively but also quantitatively; the sense of smell suffices of itself to indicate to him when he should cease to eat, namely, so soon as the odour of the food ceases to be agreeable to him.

The sense of taste performs the same service, and, especially in respect of ceasing to eat, is much plainer in

its admonitions than the sense of smell; for immediately enough has been taken, the agreeable taste of the food is converted into a feeling of disgust: and everyone knows, or can readily ascertain by experiment, that if this feeling be disregarded and the same food continue to be eaten, either the stomach will be upset by over-eating, or at all events there will be inconvenience during digestion.

From the foregoing may be laid down some general rules, which apply as well to drinking as to eating.

1. If before eating and drinking, the odour of the food or drink be inhaled, and the odour be agreeable, creating a feeling of appetite, the food may be taken, while it should be rejected if the odour repel.

2. Eating and drinking should cease when the taste is at its best. The proverbial injunction to "leave off while you are hungry" is practically correct, for if eating be continued until the feeling of disgust makes itself plainly felt, this feeling is a symptom of excess. 3. As there is no food which equally agrees with everybody, and as even within the limits of a single family the most various tastes are represented, according to age, sex, and idiosyncrasy, human beings cannot be uniformly fed like cattle; allowance must be made for this difference of tastes, and it should be a rule that *no one be forced to eat*. If ten people sit at table, the fact that a dish is agreeable to nine of them is no proof that it must suit the tenth, who may be either sated, or ill, or may possess an idiosyncratic aversion to the food; and in all three cases the tenth person would be injured by partaking of the food. The practice of forcing food on guests and on children is a mischievous one, especially in the case of the latter, whose health is too often sacrificed to the senseless pre-conception of parents, that children must eat what is put before them; and the deleterious consequences would be

much more common if they were not frequently allayed by the child's stomach revolting against this violation of nature's law, and throwing up the unsuitable food. The proper course to pursue with children is never to force them to fill the stomach, or to appease their hunger, with food to which they are averse, but the endeavour should be made on every occasion to accustom the child to the food. This does not necessitate eating considerable quantities of it—tasting is quite sufficient. The maxim that children must eat what is put before them should be changed to *children should taste everything which is put before them, but should only appease their hunger with food which they relish.*

It will be objected that it is impracticable, especially in large families, to study the individual taste of every member; special dishes cannot be cooked for each one. It involves very little extra trouble to serve, in addition to the cooked dishes, bread, butter, fruit, eggs, and milk, or at least to have them in readiness. Not only are bread and fruit alone an excellent diet (with the reservation mentioned below), but most children eat them willingly, and if a child is averse to the dish offered to it, the substitution of, say, some milk and bread, is not a very serious matter.

Moreover, the regular supplementing of the fare with food which does not require preparation directly conduces to the health of the mistress of the house, especially when she herself prepares the meals. Every observant housewife knows that the continued inhalation of the smell of the cooking destroys her appetite for the food which she has dressed. This is also the case when she does not herself cook, but superintends the cooking; and she eats with much more appetite when in a hotel, or when dining out as a guest. Every experienced family doctor knows

how frequently the house-wife in the middle classes suffers from complaints which are in many cases due to nothing else but loss of appetite, caused by the smell of cooking, the sufferer not having sufficient insight to seek a remedy in food with the preparation of which she has not been concerned; such food may be purchased ready cooked, or may be taken in the form of fruit, or of eggs, which do not develop any powerful odour in cooking. Most women concerned with cooking instinctively prefer some alternative to the food served for dinner, and eat more at odd times than at the regular meals.

It results from the foregoing that in the interest of the mother as well as of the children, less importance should be attached to the preparation of dishes for the chief meals, and more to foods which require little or no preparation, and may be eaten at other times, such as at luncheon, or early supper. I lay especial stress on fruit, which children should eat daily, if possible fresh, or at least preserved.

A further important precept in respect of eating and drinking has reference to the necessary variety.

I. VARIATION OF QUANTITY.

I here touch on a subject which has ceased to be understood among those to whom the term "educated" is usually applied. I say ceased to be understood, because formerly, prior to our culture becoming overgrown with that learning which takes too little account of nature's laws, the importance of FASTING was more clearly comprehended.

This was at a time when the priesthood everywhere formed and superintended the manners and customs of the people, establishing these customs under the ægis of

the highest—divine—authority ; and although I firmly hold to the protestant religion of my forefathers, I do not hesitate to declare it a misfortune that Protestantism has relinquished all care for the bodily welfare of its adherents. Anyone possessed of the self-control necessary to make a trial of fasting will at once be convinced of the extraordinarily beneficial influence which is thereby exercised on the health and working powers, not only with such persons as banquet luxuriously, but with all classes, down to the peasant and artisan. Where fasting was, and is, prescribed by religion, it takes the form 1, of a weekly fast day ; 2, of a yearly fasting period ; and both forms are, from a hygienical point of view, absolutely correct. During the fast, opportunity is afforded to the body to purge itself of the gross and subtile residue of its everyday nutriment. That is in itself a species of recuperation, and the other recuperative element consists in the abrogation of a state of equipoise always allied with a depression of the vital energy, which recovers so soon as the state of equipoise is disturbed.

Not only can fasting restore the lowered vital energy, but it is in fact a remedial treatment directly indicated by Nature ; for in many illnesses the customary food smells disagreeably and excites disgust. One of the chief symptoms of illness in an animal consists in abstinence from food, and every conscientious and intelligent physician prescribes in most cases fasting or meagre diet. What has been lost sight of is, that this rule is not simply a cure, but is periodically necessary to counteract the accumulation of that which is termed tendency to disease. In short, I advise everyone to fast at regular intervals, if only by omitting on one day in the week the midday meal ; or at least to observe a day of fasting when he notices a diminution of vital or working vigour.

Especially is fasting to be recommended as a preparation for strenuous mental exertion. I say this from my own abundant experience. For years I have made a rule of observing a fast day prior to starting on a lecturing tour, and on the day of the lecture to take nothing after breakfast until the lecture is over, at most drinking a little; indeed every such tour is practically for me a time of fasting, and to this I mainly ascribe my retention of bodily and mental vigour under very severe exertion. It would be well if the observance of a weekly fast-day could again by custom become an ordinance, and where the practice still holds good, every effort should be made to maintain it. *I consider the Fast-day as hygienically imperative as the Sunday rest.*

2. VARIATION OF QUALITY.

It has been established by observations of animals, by experience in prisons, and by innumerable facts occurring in daily life, that all uniformity in eating and drinking acts prejudicially on the health, and that every variation in this respect is gladly welcomed by the entire organism. Hence the Latin maxim, *Variatio delectat*, "Variety is pleasing;" and I would emphasize this by saying, *Variatio delectat et roborat*, "Variety is pleasing and invigorating."

The question of variation of quality is not one of luxury and epicurism; on the contrary, the simpler the meals the greater the possibility of varying them. Whoever eats, say, 1st day, bacon and peas; 2nd day, roast meat and potatoes; 3rd day, curds and bread; 4th day, fish and potatoes; 5th day, cold meat and bread and butter; 6th day, soup, boiled beef, and vegetables; 7th day, farinaceous food and fruit, can procure a much greater

variation of quality than by partaking of five or even ten different dishes together. In judicious family circles importance is attached to varying the meals, but the ordinary bill of fare of eating houses, etc., is arranged with sadly little intelligence in this respect.

The above applies not to eating alone, but also to drinking. At the present time a great deal is being written and spoken against the increase of alcoholism. It is generally overlooked that the *sameness* of the drink constitutes, equally with excess in the quantity, a deleterious element in drinking. Not only those who indulge too freely in alcohol become victims to its destruction of body and mind, but also they who are addicted to one exclusive form of alcohol; and the ruinous effect is developed more quickly, and in a greater degree, in proportion to the uniformity of the drink. This especially applies to spirits and beer. The habitual beer drinker, as well as the dram drinker, falls into a condition of chronic disease. The danger to wine drinkers is not so great, for even when a man drinks year after year the produce of his own vineyard, the monotony is much less than in the case of dram and beer drinkers, not merely because the vintage varies from year to year, but even any one vintage continually alters in its development from the condition of must to that of maturity. Whoever values his health should practise a sensible variation in his drink; he should alternate not only the kinds of alcohol, of wine, beer, or must, but he should include water among his lists of varieties, in analogy with the Fast-day. While on this subject I will also refer to the rule that the daily drink should consist of light beverages; strong drink is just as injurious as excess, which, however, need not altogether prohibit the occasional moderate use of strong drink, if only for the change thus introduced.

In conclusion, I would remind my readers that there is no rule without its exception. I have here adduced general principles which I believe to be interesting and important. But I must not be misunderstood as giving my sanction, for instance, to eating any berry that may be found in a wood, and which may not appear to the finder to smell offensively. That is expecting too much guidance from a sense which civilisation and an artificial mode of life tend inevitably to blunt. Great caution is necessary in eating fungi, berries, or anything of which the nature is not precisely known. Much more reliance may be placed on the warning given by a repellent odour, even when the food is familiar. In such cases the food is almost certain to disagree.

XXXVII.—HEALTH RECUPERATION.

IN closest connection with what has been said respecting variation in eating and drinking must now be entered a plea for the necessity of variation in two other directions, in the interest of health and the maintenance of the working powers.

I. CHANGE OF AIR.

Air is a yet more indispensable vital element than eating and drinking, for if we are deprived of it, if only for a short time, we are lost. We have, moreover, in the course of this work, become sufficiently acquainted with the fact that good and pure air is one of the prime conditions of remaining healthy, and that close, impure, mal-odorous air is one of the most treacherous causes of disease. I say "treacherous," because, although people

may accustom themselves to it, they can only do so at the expense of successive sacrifices of their health and working power, with the certain prospect that some day the accumulated effects in the body will, as it were, overflow, when disease will lay the victim on a sick bed, or consign him to the grave. These considerations, however, do not exhaust the importance of the subject of air, as will be seen by what follows :—

We saw above that even the most suitable food will not sustain a man's health and working power, if he exclusively nourishes himself with it for a lengthy period ; experiments with animals teach that in extreme cases they will, when thus fed, die of hunger. A similar, if less extreme, result follows if a person remains continuously in one and the same air. The only reason why the consequences are not so severe as in the case of food, is that the changes in the weather never permit of an absolutely lasting uniformity in the quality of the air. But it is precisely from the variations in the weather that the important influence which change of air exercises can easily be observed. Everyone who takes a little notice of his own condition is aware that even the apparently finest weather, if it remain quite the same for a lengthy period, induces depression of vital energy, a state of weariness, a feeling of disgust ; and that a change of weather constitutes an actual deliverance.

Equally well known is the exhilarating feeling, after remaining for some time in a closed room, of going out into the open air. That this is not merely due to the fact that the air in the room is bad, and the outer air good, is shown by the converse case ; if a person has spent the whole day in the open air, and especially when, in a campaign, several days together are thus spent, he welcomes with delight even the most mal-odorous quarters,

because they afford a change which disturbs his state of equipoise. On a walking excursion it will be found that, after a long interval of open fields, the air in the woods is greeted with joy; but if hours have been passed in the close air of the woods, it is refreshing to once more traverse the open fields.

These simple observations should direct our attention to change of air as a recuperative element; and for persons whose occupations keep them indoors the necessity of a daily "constitutional" in the fresh air is recognised. It must not, however, be supposed that this will suffice to maintain the working capacity at its highest point. The body has an astonishing faculty of accustoming itself even to a change, when that change preserves a certain uniformity; and this is equivalent to a diminution of the vital energy. People who are the slaves of a certain routine are not usually considered to possess a high degree of working capacity and of health, but rather to suffer from depression of vital energy. This implies that the regular daily "constitutional" is not enough; the daily change of air must be supplemented by a weekly change differing from that of every day; and to this again should be added a half-yearly, or at least yearly, more complete change of air, such as is procured by holiday tours, etc. The more thorough the change, the more fresh are mind and body maintained. That the German Emperor, William I., retained his mental and bodily faculties so unimpaired at his great age was not a little due to his alternating the air of Berlin with that of Wiesbaden, Baden-Baden, Ems, Gastein, and Babelsberg. This brings me to speak again of the hygienical ordinances of religion. The Catholic Church, in prescribing pilgrimages, did not lose sight of this element of change of air, and provided for it in a manner

which rendered it obligatory on all classes and ages. Our worldly institutions supply something similar, in the shape of the army manœuvres, but unfortunately these affect only a very limited portion of the population. The scholastic and legal vacations tend in the same direction, and afford the opportunity to many people of change of air, but not to the extent to which this could and should be the case. An improvement in this respect has been effected by arrangements to facilitate access by the poorer classes to the advantages of change of air, but it is only a drop in the ocean of sluggishness and want of understanding of these matters. There should be an organization for extending the practice of change of air, similar to that which was formerly provided by pilgrimages.

2. CHANGE OF OCCUPATION.

The fact that Nature imposes fatigue as an interruption to every kind of activity, and alternates the daily work with the nightly sleep, is of itself an indication that Man is not a machine capable of sustaining a continual uniform progression ; and anyone who makes observations and institutes experiments on this head may easily convince himself that the question is not merely one of action and repose, but also of variation of action, both as regards quantity and quality. Hard work must not only be varied with rest, but also with lighter work, and the effect is most recuperative when the variation is, further, qualitative ; for instance, when head work is exchanged for hand labour ; hand labour for foot exercise ; the ordinary occupation or profession for what is termed "working for one's own pleasure" ; mental or physical labour for pleasure or social enjoyment. The man whose

occupation is a monotonous round of working, eating, and resting soon falls into the morbid condition of a "slave to routine," and this is why institutions are common in all civilised societies, which render practicable this alternation of employment, with its recuperative influence. It is one of the mistakes incidental to the secularising of these institutions, that, owing to want of intelligence and to avarice, their utility is questioned. Sunday is an institution of leading importance in providing for change of occupation. Where the Sunday rest is not observed, apart from the moral consequences, the working powers and health of the community are so reduced that the advantage of the Sunday labour is more than lost through the general diminution in working capacity; and wherever the institution of the Sunday rest has been permitted to lapse, energetic efforts should be made to restore it, on hygienical and national economic grounds. I go further, and plead on the same grounds for re-establishing the irregular holidays, simply because the regular Sunday rest is not sufficient. As stated above, the body has the faculty of accustoming itself to every regular recurrence, and regular Sunday rest cannot alone prevent men from sinking into slaves to routine; irregular intermissions of labour are required, and these the irregular holidays provide. If men were machines, the sum of whose performance depended on the number of hours they worked, the contention would be just that the observance of 18 secular holidays in the year would be equivalent to a diminution of 6 per cent. in the annual production; but the condition of the health and the working power is a leading factor in the production by human labour. Take the first named factor—health. The average number of sick days per head among soldiers, who are in the most vigorous period of life, and

whose occupation is of the healthiest nature, is 14, and I believe I do not err in estimating double this average number of sick days for the working classes, which gives a loss of about 8 per cent. of the time which might be devoted to labour. I am persuaded that no inconsiderable proportion of this loss of labour might be saved, if the people could again have the hygienical institutions which have been lost to them in these uncomprehending, doctrinary modern days. We see in our own children the animating effect of an irregular holiday which is really used for the purpose of recuperation ; and what is good for the child in this respect is equally good for the adult, who indeed requires such opportunity for recuperation more than does the child, as soon as he is past his prime. It is therefore time that an energetic "Thus far and no further !" should be opposed to the senseless indifference to the health and working power of the people displayed by insatiable seekers after gain. So long as this is not undertaken by the authorities, let no one, either for himself or for those around him, allow work to make him unmindful of the necessity of opportunity for recuperation of the vital forces ; otherwise he will be living on his working capital.

XXXVIII.—HYDROPHOBIA, AND THE SWEATING TREATMENT.

SWEATING has always been considered a healing process, while suppression of the secretion of sweat has been regarded as injurious. To a great extent the proper understanding of the importance which thus attaches to the function of sweating has been lost sight of ; and I therefore recommend to my readers' attention

the following extract from No. 8 of the *Fundgrube (Mine of Wealth)*, 1886 :—

“The English lady physician, Miss KINGSFORD, has addressed a letter to the *Pall Mall Gazette*, in which she restores to light a dissertation on Hydrophobia, by a French physician BUISSON, in the year 1855. BUISSON had noticed that this form of madness is peculiar to the dog and cat races, and that these animals never sweat. He further knew that the poison of snakes, spiders, and scorpions may be rendered harmless by a treatment frequently successfully adopted where the poisonous creatures named are indigenous. Lastly, he was aware that the ordinary poison of smallpox does not act when the person inoculated is at once placed in a sweating bath, and that malarial fever and similar diseases are often cured by the treatment in question. He soon had occasion to make the experiment on himself. Some foam of a sufferer from Hydrophobia, to whom he had been called, fell on a spot where his skin was scratched; before long he felt frightful pains, and all the symptoms of Hydrophobia were presented. After the approved remedies had been found useless, he went into a Russian sweating bath at 124° Fahr., and soon fell into a perspiration, when the symptoms moderated, and finally ceased altogether. He could again drink, was able to sleep soundly, and the next day was quite well. From that time he cured Hydrophobia by the sweating treatment, and in a short period treated 80 cases with complete success. In his dissertation on the subject he states that the experience of a lengthy practice had taught him that the disease generally lasts three days after it breaks out. On the first day cure by means of ample perspiration is certain, on the second day uncertain, and on the third day nearly hopeless. But who that is acquainted with a certain cure would wait for the third day?”

To this important communication I add an extract from a recent publication by Graf von der RECKE-BOLMERSTEIN, in Silesia, who confirms BUISSON's assertion that the most ready and certain remedy for a bite from a mad dog is a sweating bath :

“The sweating bath is equally applicable to snake bites, as I have myself experienced. In proof that there are poisonous snakes here, I may state that a woman was bitten by an adder in the calf of the leg, and in spite of medicinal treatment died after five months.

The thigh on the side which was bitten was swollen and blackened up to the abdomen. Four years later a girl was also bitten by an adder. I heard of it on the following morning, and found her much swollen on the side affected, and in a state of giddiness. I at once ordered a sweating bath, and found her quite lively the next day, without any swelling, and she has remained healthy until now, 12 years after. Six years ago a woman was badly bitten by a dog, which was undoubtedly mad, on the upper part of the bare arm; as soon as I heard of it I ordered a sweating bath, and she became and has remained perfectly well. I am of opinion that the sweating bath is a certain cure for all blood poisoning however caused."

I subjoin another newspaper extract from the *Casseler Allgemeinen Zeitung*, of 27th June, 1886 :—

"A man in New York who was bitten by a mad dog, and who did not believe in hydrophobia, has related his experience, authenticated by a well-known physician, to a representative of the *New York Times*. The dog which bit him was pronounced by medical evidence to be unquestionably mad, but the man was convinced that people in similar cases die of fear, and he determined to combat this fear with all the strength of mind he could command. He took cooling drinks, and would not allow himself to get excited. After eight days his doctor was dismayed by a change in the patient's expression. The patient himself felt violent pains in the eyes, the pupils of which became so dilated, and his sight so keen, that he could read the smallest print without glasses, for the first time for twelve years. After the eighth day, great restlessness and feverish excitement were noticeable; he felt as if he must bite or attack some one, and he carefully kept out of the way of everybody. Some nights after, when sweating violently between blankets, he experienced pains throughout the whole body, and a feeling came over him as if he must fly out of bed, or throw himself into the water. During this crisis he held himself down for four hours, with both hands fastened to the sides of the bed, exerting all his physical strength. At last the pains left him, the fever-heat vanished, and he felt himself wonderfully relieved; the blankets in which he had been wrapped were saturated with perspiration. When the doctor came again he was dumb with astonishment to see his patient doing so well. The patient is convinced that an excited imagination and a want of strength of mind are much more conducive than the bite of a raging dog to an outbreak of

hydrophobia in the person bitten. The doctor who watched the case admits that he is astounded at the recovery, and believes that even if the patient is not absolutely restored to health, he is at all events out of danger. The hygienic success of the cure is ascribed by the doctor, next to the astonishing behaviour of the patient, to the intense natural sweating bath during the crisis of the disease."

Among the journals which reproduced Miss KINGSFORD'S letter to the *Pall Mall Gazette* was the *Dresdner Nachrichten*, in whose subsequent issue of the 28th November, 1886, appeared the following letter from a Dresden physician, conveying a striking corroboration of my theory as to the importance of the sweating function.

"I am able from my own experience to furnish a parallel case to the cure of Dr. BUISSON. Some twenty years ago I had occasion to dissect the corpse of a person who had died of dropsy. I was greatly pressed for time, and slightly injured the skin of my left hand. I felt a weak, biting pain in the small wound, but forgot the matter in my hurry. A few day later I was attacked in the morning by a severe shivering chill, which returned in the evening. This was the symptom of the resultant blood-poisoning! In the following night there broke out, quite of its own accord, a tremendous outburst of perspiration, and at the same time I felt the glands in the left armpit to be swollen and painful. The sweating was accompanied by unquenchable thirst, and craving for cold water. The next morning I called Dr. PÖBING to my aid, and we agreed that I should continue the abundant drinking of water. The sweating and the drinking of enormous quantities of water (without taking any nourishment) lasted three whole days. On the fourth day the thirst, the sweating, and the pain in the armpit ceased. I was saved!"

In disease due to ferments, the question of *tendency* is the first to be considered; this is formed by the presence in the body of matters which can easily be removed from it by use of the sweating bath, and thus the ferment is deprived of its nutriment.

I therefore recommend prompt recourse to this simple and tried remedy in cases of bites from animals which may be rabid or venomous.

XXXIX.—NORMAL DURATION OF
HUMAN LIFE.

A FRENCH naturalist first pointed out that domesticated animals live five to six times as long as they require to grow to full size. A horse, for example, is fully grown in four years, and remains fit for work up to the twentieth year, as a rule ; dogs of the larger breeds grow for one-and-a-half to two years, and live to the tenth year ; and the same law obtains among other hairy animals with whom we can estimate the limit of age.

That the rule also holds good in reference to Man may be learned from tribes living in a wild state. The native Australians, for instance, perhaps the most perfect specimens of men in a natural condition still extant, reach their full stature between the tenth and twelfth years, becoming old at from fifty to sixty. Properly speaking, they never ail, and in particular are free from epidemic disease, their life being such as to have an especially hardening effect on the body, as they go quite naked, and build themselves no habitations.

Considering, therefore, that in our climes full growth is attained on an average about the eighteenth or twentieth year, the normal termination of life should take place at the ninetieth or hundredth year. That potentially we are endowed with such longevity, is shown by the isolated examples of centenarians of both sexes met with in every calling and every country. Consequently, putting accidents on one side, we must conclude that deaths, when occurring at a less advanced age, are the direct result of the unnatural mode of life adopted by civilized man, partly, indeed, on compulsion and without any fault of his, but to a great extent from ignorance or

carelessness. In some cases the foundations of disease are laid in childhood by improper methods of rearing, while in others a debilitated constitution is hereditary.

It is therefore evident that much remains to be done in the interest of a national system of health-culture, both publicly and individually; and it is certainly a cheering sign of the times that, within the last decades of the present century, this important task has been taken up in the most various quarters in a manner heretofore unknown.

Many will be alarmed at the idea that all, or even a large percentage of mankind should live to so great an age; for, as it is, the progressive increase of population in Germany is proportionately greater than that of the supply of food.

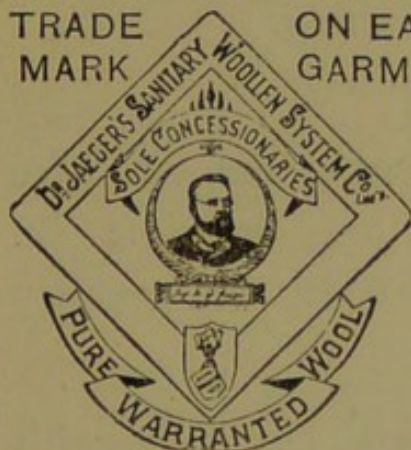
This is, so far, correct, and the extraordinary prolongation of life of all weakly persons might be unfair on the bread-winners, who must support them. But if health-culture be devoted to raising the standard of working capacity, such fears will speedily vanish. To the man who is capable of work and whose body is hardened, the whole world lies open nowadays, and there is room for the further dissemination of the human race for centuries yet to come.



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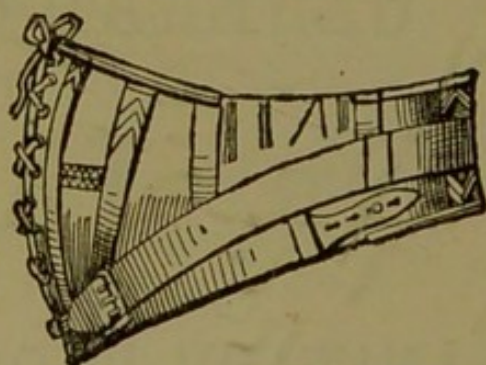
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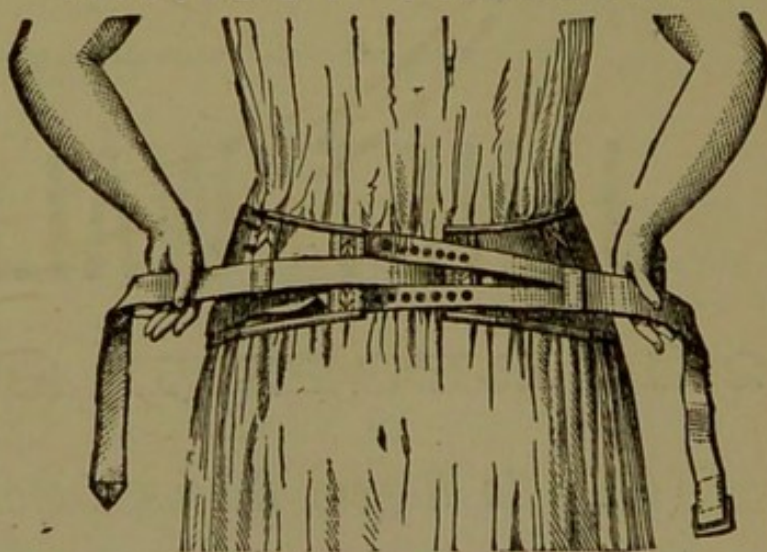
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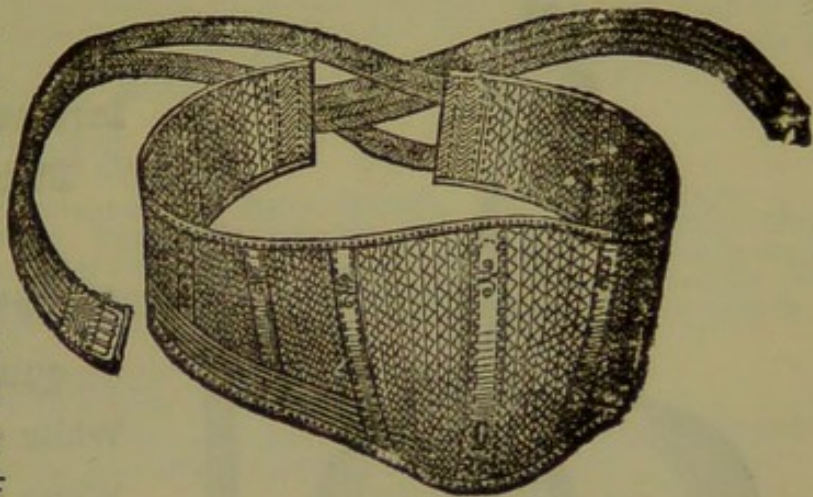
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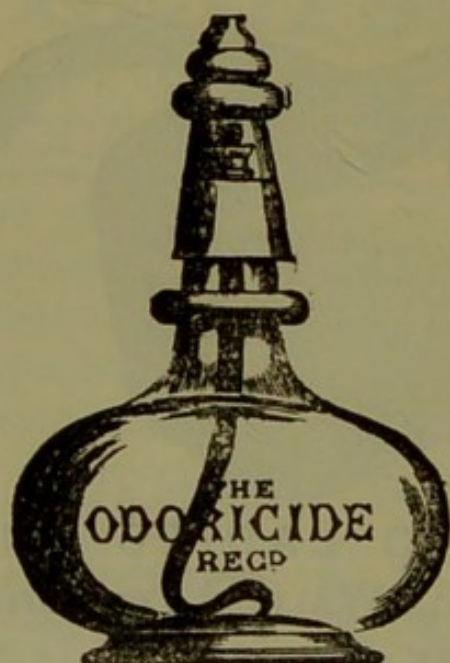


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The platinum wire then continues to glow at a temperature of about two thousand (2,000) degrees Fahrenheit! This intense heat draws through the glowing wire the atmosphere of the room, purifying it from mal-odorous matters.

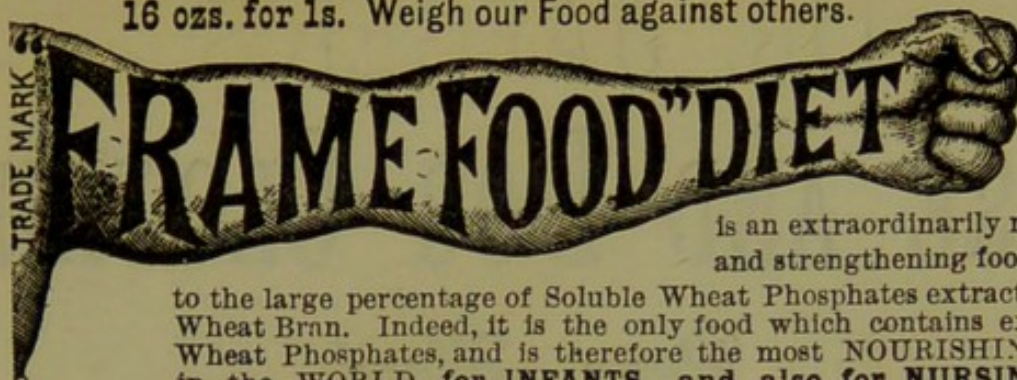
Usually a few minutes suffice to effect this, but in very large rooms two or more "Odoricides" may be required.

To extinguish the glow, the glass cover should be replaced, and should be left until the ODORICIDE is again required, as otherwise the spirit will evaporate.

A few drops of Eau de Cologne or other good perfume added to the spirit will be continuously imparted to the atmosphere.

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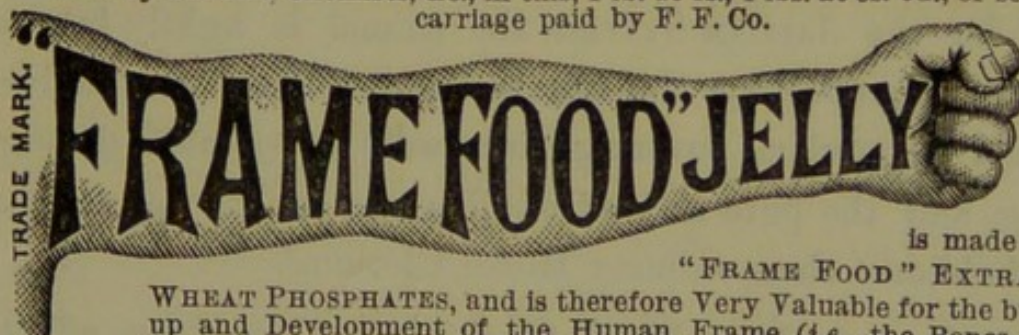
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