Dress, with reference to heat : being a lecture written for, and published by the Australian Health Society / by Walter Balls-Headley.

DRESS,

WITH REFERENCE TO HEAT;

BEING A LECTURE WRITTEN FOR, AND PUBLISHED BY THE

AUSTRALIAN HEALTH SOCIETY.

BY

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PREFACE.

THE following lecture is divided into two parts: The first treats of the theory of the subject; the second contains some plain directions for guidance in dress. It is hoped that the paper is not of excessive length.

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Dress, with Reference to Heat.

PART I.

It is, perhaps, not so well known as is desirable, that the temperature or heat of the human body in health is uniform; that is, that, whether heated by exercise, or chilled by cold on a frosty morning, so long as we are in health, our heat as taken by the thermometer is practically always the same, and is quite independent of our sensations of cold and heat. Our natural temperature, which may be called our normal blood heat, is 98½ deg.; and in health, under no circumstances practically, do we go more than one single degree above or below this point. It seems surprising that the body heat of the Greenlander in his Arctic winter is the same as that of the Central African or the Australian aboriginal in a tropical summer; yet so it is.

The extent of the range of heat of the human body, consistent with life, in health and disease is 15 deg.; and it is but in rare cases that such extreme ranges as these are met with. Personally, though for 10 years I have paid great attention to the subject of medical thermometry, I have never known the temperature of the human body to sink lower than 95 deg., that is 3½ deg. below the normal, and that in only one case; nor to rise higher than 107 deg., that is 8½ deg. above the normal; both of which cases ended fatally. This is a range of only 12 deg., and that in extreme illnesses.

Similarly among the lower creatures: birds have a higher blood heat than man; and among them is a great difference of heat, the cock having a temperature of 104 deg., and the Guinea fowl of 111 deg.

Among the mammifers, or animals which suckle their young, the horse has about 97 deg. of heat; the she-goat, 104 deg.; the porpoise, from 97 deg. to 100½ deg.; and the sea-cow, from 102 deg. to 104 deg. It will be remarked that the porpoise and sea-cow inhabit water.

Again, among reptiles, the viper is 9 deg. hotter than the surrounding atmosphere; the lizard 2 deg.; and the turtle is about 6 deg. hotter than the water it inhabits.

Of fish, the eel is 2 deg. hotter than the water; and the shark rather more, being 2½ deg.

Now the temperature of the atmosphere in the shade during the day at the present time is about 60 deg., and in the sun about 85 deg.; while the sea has a heat of about 52 deg.

Thus we find that birds are about 40 deg. hotter than the air, when its heat is 70 deg., which we call temperate; suckling animals, inhabiting the land, about 30 deg.; those of the sea, 50 deg. above that of the water; while lizards, snakes, and turtles range from 2 deg. to 9 deg. of heat greater than their surrounding medium; man being about 30 deg. hotter than a lecture-room, or the shade on a temperate day in summer.

It having been now shown, that animals of various kinds are hotter than the element in which they live, it follows that they must have some internal arrangement, by which this additional heat is produced.

Those who lecture on the subject of food will tell you, that food is, roughly speaking, of two kinds; the 1st, that which provides material for the repair of the higher structures, as the brain, nervous system, muscles, bones, skin, &c.; and the 2nd, composed of fat, starch, and sugar, which conduce specially to the production and preservation of heat. Now these substances consist largely of carbon and hydrogen, which, when combined with oxygen, effect a chemical combination with production of heat. This process is in action with every altering condition of our bodies; in the action of our brain, as in thinking; in our muscular action, as when we walk; in the muscles of our chest and internally, as when we breathe, and our hearts beat; every

such act causes destruction of a definite quantity of tissue, and every such destruction causes the simultaneous production of a definite amount of heat. The appetite for these kinds of food is regulated by the demand of the climate for heat production.

Again, as these used up materials are eliminated by the lungs, heat is produced; and the colder the air breathed, the greater is the formation of heat: for the oxygen therein present, occupying a smaller space, is in larger quantity, and therefore can enter into chemical combination with a larger quantity of effete material, with simultaneous production of heat. In summer the oxygen, being in more expanded form, is in less quantity, and less heat is formed. Most heat is thus formed, when most is required.

Without doubt, however, the heat of the body is regulated to some extent by nerve influence. Thus, if the brain be cut off from the body, or be under the influence of a narcotic, the body cools more rapidly than it would, were the creature killed, or animation were suspended in some other way. Again, a paralysed limb is usually cooler than the corresponding sound one. On the other hand, if the spinal cord in the back be divided, the parts below the seat of injury are usually increased in temperature. Such increase or decrease in temperature appears to be due to the kind of nerves divided; greater heat resulting if they have been of the kind which presides over the dimensions of the arteries, which thus become dilated. The effect of nerve influence over the size of the smaller blood-vessels is not uncommonly seen in "blushing."

The effect of food in heat production, and of nerve control, is illustrated by experiments made on birds. When kept without food or drink, they showed their diminished capacity for heat formation, not so much by a sudden fall in their temperature, as by a greater and daily progressive rate of variation. Thus, whereas in health their heat would vary at different times $1\frac{1}{2}$ deg., when starving the daily variation was 6 deg., and in such a manner that the average heat was $4\frac{1}{2}$ deg. lower than the natural. On the last day, when the bird died, its heat rapidly fell 25 deg., making in all $29\frac{1}{2}$ deg. from the commencement of the starvation.

This sudden fall of heat, or absence of capacity for heat formation, was the immediate cause of death.

But if the bird be fed three or four hours before it would have died, its heat is not increased, till it have digested and absorbed such food ; and, in consequence of excessive weakness, this process may take many hours, during which time the creature may die.

While, however, by experiment, the bird, dying from the cooling of its body from inability to form heat from previous starvation, does not for many hours receive the benefit from the food thus supplied, in the form of increased heat formation, the application to it of artificial heat at once restores it ; and, previously at the point of death, it is when thus warmed able to fly about and take food ; ultimate recovery depending upon whether the artificial heat be maintained, until the creature has had time to digest the food taken. If artificial heat be so maintained, the creature lives ; if not, it presently dies.

It thus seems, that artificial heat is of more immediate value to the starved man at the point of death, than food ; since he dies at the moment, not of want of food, but of inability to make the heat necessary for the continuance of life ; while food is essential, that the internal heat formation may presently be in progress.

From previous considerations it will be seen, that, assuming the supply of food to be sufficient, the amount of heat formed is apt to be regulated by the amount of exertion, and therefore of chemical change in the tissues. Whence it results that, under many circumstances, as in the very young, and, to a less degree, in the old, the heat production is much below what is necessary to existence. We recognise this fact, of the necessity of external heat to life, in the cooling and dying of the life in the egg, when the hen ceases to keep it warm with her body ; yet, when artificial heat is supplied, as when the egg is placed in a suitably constructed and heated oven, not only will the egg hatch, but the young thrive and grow. Similarly, young birds and animals, many of which indeed seem to be almost entirely without independent power of heat production, die, if deprived of their mothers before they have arrived at an age to produce their own heat. To a

considerable extent the same is the case with young children, in whom it is interesting to note that the average heat of sixteen puny children, from one to seven days old, was only 98 deg., while that of seventeen strong children of the same age was 99⅓ deg., which is a difference of a degree and one-third. On the other hand, we find that in those young animals which run as soon as born, as in the Guinea pig, there is a proportionate formation of heat. In the old, too, the same deficient power of heat production occurs; so that the effects of a cold season upon them, is that they die much more extensively.

The result of this deficiency of heat formation in the young and old is, that in Brussels it was found that, of children not more than a month old, 700 died during the six winter months, compared with 520 during the six summer months; which is more than a quarter more during the cold weather. The excess of deaths in cold weather diminishes, till we come to those between twenty-five and thirty years of age, when the numbers are nearly even; while, from 50 to 65 years, the death rate is nearly as excessive in winter as in the young babies, 680 dying in the winter months against 519 in the summer, which is nearly a quarter more; and, in those over ninety years of age, the deaths in January are more than two to one of those in July.

I have troubled you with these figures to show you, how comparatively incapable the young and old are of producing sufficient heat in their bodies to maintain life, in comparison with those who are in the perfection of their muscular vigour.

While then heat is thus produced, and in quantities proportionate to the vigour of the age, it is evident, since we live in a medium of air which is usually much colder than ourselves, that we must be constantly losing our heat to the air which is about us: that is, that our production of heat must be such, that we may be enabled to lose as much as the air about us takes, and still maintain our bodies at 98½ deg. Again, it has been shown that heat is produced, among other modes, by muscular exercise; when we run, or otherwise exert ourselves vigorously, we form an increased quantity of heat; but our bodies never in health exceed

the normal temperature, so that the superfluous amount must be rapidly disposed of.

This is effected by exhalation and evaporation, and happens thus: When we breathe, we draw in a certain quantity of air at a temperature say of 70 deg. on a temperate day; this air we breathe out at an additional heat of 30 deg.; a process which occurs about 20 times a minute, when we are at rest. This is exhalation.

Again, our skins are constantly forming and sending to the surface perspiration, composed mainly of water; and, in the process of conversion of water into vapour, a great deal of heat is absorbed in the form of what is called latent heat—that is, heat which is really present in that vapour, and by which its form of vapour is maintained; but it is not discernible, except in the transition back to water. We avail ourselves of this action, when we cool butter or water by evaporation. Thus the butter is put in an empty basin, the bottom of which stands in a shallow dish of cold water; a wet cloth is laid over the basin, its ends dipping into the water in the dish, which it constantly draws up by capillary attraction. Evaporation now occurs; which can only be effected by the appropriation of additional heat, which is thus taken from the basin and butter, which latter thus becomes cooler and harder. Similarly with water coolers, the degree of coldness is dependent upon the rapidity of evaporation: thus in such as are made of canvas, through which moisture can rapidly ooze, the water becomes much colder, if the bag be hung in the sun. The heated head too is cooled on the same principle, when a single layer of wet cotton material is laid over it, and a few drops of water frequently spilt on it.

Similarly the perspiration, provided on the surface of the body, evaporates; and in this vaporization a large quantity of the heat of the body is consumed and removed. This is evaporation. So too in the breath, which is laden with the vapour of water removed from the body. We can see something of this process on a cold day; for when, after sharp exercise which has made the skin perspire, the clothes are taken off, the body appears to steam.

What has happened? The perspiration has been supplied to the surface of the skin; the heat of the body has evaporated it; and the cold air without has removed so much of the heat, that the vapour is unable longer to maintain that form, and returns to the form of water; which in our breath, under similar circumstances, we find deposited in drops on the moustache or muffler.

With regard to the quantity of heat so removed, it is a matter of great importance, whether the outer air be dry or moist; that is, whether it already contains a considerable quantity of vapour or not; for, if saturated, it can receive no more, and evaporation ceases. This condition is well known to laundresses, since, when the air is thus saturated, though it be hot and rapidly circulating, as in a wind, wet clothes on a line will not dry; that is, their moisture will not evaporate. So on a hot-wind day, when the air is full of moisture the perspiration cannot evaporate, and we sit in wet clothes, and are greatly oppressed by want of removal of our superfluous heat.

On the other hand, so long as heat be perfectly dry, we are able to sustain an enormously high temperature. Thus iron founders have, in the ordinary course of work, entered a furnace at a temperature of 350 deg., of which the floor was red-hot; and Chabert, the "Salamander," at a temperature of from 400 deg. to 600 deg.; it being remembered that water boils at 212 deg. The safeguard in all these cases was the dryness of the air, and consequent capacity for evaporation from the body.

The condition of rest or motion of the surrounding air much influences our sensations and capacity of endurance. Thus, if the air be still, we can endure a temperature much below what otherwise would affect us greatly to our inconvenience. Thus, in Norway I was able in winter to sleigh with comfort in a temperature 45 deg. below the freezing point, so long as the air was still: but if there were wind, even above this heat one lost sensation in one's extremities, though clothed in furs. So if suitably dressed, we are warm in a still, open air temperature 20 or 30 deg. below that of the room we have just left; but are

chilled by a wind, which, in fact, is not so cold: because it is constantly carrying away additional heat.

While the admirable arrangements of evaporation and exhalation enable us to dispose of our extra heat, formed by exertion, so rapidly that the temperature of the body is not increased thereby, it is to be remembered, that, comparatively speaking, we are but seldom in such excessive exercise as to produce such extra heat: and, to go still farther, we are generally in such cold, that it is necessary to life, that some means should exist, by which the heat formed may not be removed too rapidly by the colder medium about us; and especially at times of sudden changes of the temperature of the air, as from the heat before a thunderstorm, and the coolness succeeding it; between changes of wind from a hot to a cold, when the thermometer may fall 40 or 50 deg.; between the day and night; between the heat we experience in the sun, and that in the shade; and particularly in leaving a hot room at night, and going out into the cold air.

To this end nature has provided what are called non-conductors. A non-conductor of heat is a material more or less incapable of conducting heat from the part on one side of it, to that on the other side. The most universal non-conductor of heat in the animal kingdom is fat. Thus in those suckling animals which inhabit the water, whose temperature is some 50 deg. higher than the sea, as the whale, the porpoise and the sea-cow, a dense layer of fat, known as the blubber, lies within the skin; and, it may be, is also incorporated with the other tissues of the body. Through this non-conductor the heat cannot pass more rapidly than the body can, in a state of health, form it.

Among land animals we still find that fat is a most important element. The bear, which lays itself up in a half insensible state for, and does not eat during the winter months, is at the commencement of his sleep laden with thick fat: but by the spring he is lean and scraggy; having, during the interval subsisted and maintained his heat by the use and consumption of his fat. So also the dormouse, the horse, the sheep and cattle, in the summer, eat more than sufficient fattening matter; so that, in

cold weather, their loss of heat is restrained; and, when greater necessity for heat formation occurs by increased cold, supply is there afforded.

So in man: in the colder countries we find a thicker layer of fat under the skin, as in the Esquimaux; and indeed a generally fatter state of the whole system. By their appetites too this necessity is evidenced; for these people take it as a great luxury to drink seal or whale oil: and a scandal was commonly reported of certain Russians, who visited England in the days before the invention of gas, that after a State dinner, they climbed the posts, and drank the oil from the street lamps.

While we thus find, that man is protected by a layer of fat next his skin and fatty deposit in his structures, he farther uses oil or fat as a non-conductor of his heat, by rubbing the surface of his skin therewith; so that a series of layers intervenes between the outer colder medium and his body. This cooling of the body has always been the main cause of the failure of man to remain alive long in the water; and it remained for Captain Webb to be the first to swim across the English Channel, a distance, as he went, of about 43 miles. He is a man with a considerable fat development; but, in addition, he rubbed himself over with a thick layer of porpoise grease, which, being of a dense and gluey character, forms a peculiarly suitable medium for the prevention of the outward passage of heat. In this case the exertion is comparatively small in comparison with feats on shore, where the heat is not so readily abstracted: for, whereas Captain Webb swam 43 miles in $21\frac{3}{4}$ hours, Weston walked 435 miles in 144 hours. From these considerations we may derive the axiom, that, in shipwreck, a man is wise to rub his skin over with much oil.

Air, when motionless, is an admirable non-conducting medium, with which the insterstices of our clothes are filled: thus it happens, that a very close fabric does not convey the same degree of warmth as a looser cloth of the same weight. My feet have been frozen when wearing two pairs of thick worsted stockings inside a pair of thick boots, whereby the material was compressed, to the exclusion of much intervening air; but no such trouble

occurred, after one had put on the second pair of stockings outside the boots, whereby much air could be included. Again, in Captain Boyton's swimming apparatus a bag of Indiarubber, or other water-proof material, includes a quantity of air in a state of perfect rest; which intervenes between the body and the colder water, preventing loss of heat by the man.

Besides fat, animals have various kinds of hair or fur, dense in proportion to the climate they inhabit and their requirements: being hair in various grades of development. Of such may be mentioned the hair of horses, the wool of sheep and such like, which increase in length and thickness as the cold affects them, and fall off in the spring. Those animals which live in very cold climates, as the sable, and the seal, which inhabit the Arctic Seas, have a secondary, densely developed coat nearer the skin, which we call fur. Birds have a form of hair development, which we call feathers; different from that of mammals in being larger and longer; but the transition is gradual, as in the apteryx, the cassowary, the emu, the ostrich and the penguin. The feathers of birds, when lying closely one upon another, are admirable non-conductors, or media for retention of heat: and this is increased, as in hair and fur, by the presence of minute quantities of still air, which are retained between them. Water birds still farther supplement this power by thoroughly, frequently and carefully dressing them with oil; whereby heat retention is still more increased.

In some countries too, in which the cold is very excessive, where the surface of the earth is covered with snow, and is thus uniformly white, animals in winter change the colour of their coat and become white, as the hare, the fox and the ptarmigan; which again, as the summer approaches, become of some kind of brown colour. Similarly, we find that the peoples who are descended from those of the Northern countries, as ourselves, are, comparatively speaking, white: and that, as you gradually approach the equator or tropical regions, you find the colour of the skin assume a darker hue. Graduations of this kind may be noted in the Swede, the Norwegian and the Saxon, who are fair; in the

people of the south of France, who are dark-haired ; in those of Italy, who are dark-complexioned, so that a red-haired girl is a curiosity to them ; while the Spaniards are olive-complexioned ; the Moors, Asiatics and American Indians more or less copper-coloured ; and the Central Africans, Australian Aborigines and Samoans tolerably black. The cause of this appearance is due to the production in the skin of a more or less thick layer of pigment cells, in character resembling those of the eye ; where the iris of the Albino is without colour, and of another person black.

Why is it, that the animals of a very cold climate turn white in winter, while indeed some, as the men and Polar bears, are always white ; and that those people and creatures, which inhabit a hot climate, are dark : while creatures inhabiting the Northern seas are not white, nor change their colour? The answer is I think obtained from a consideration of two points. The first is the action of the pigment of the eye. This membrane lines the interior of the eye, and its function is to absorb all rays of light, not otherwise required. Accordingly we find that Albinoes, who have pink eyes, being without this pigment, see best in a dull light. Now, by the correlation of forces, light is equivalent to heat ; as, for example, we know that, when we have most light from the sun, we have most heat. Thus black or darker colors are capable of absorbing an amount of heat much greater than white or lighter colours. The second point is derived from the experiment of placing a thermometer under and touching a piece of black flannel, exposed to the sun's rays. In one such experiment, which may be taken as a fair sample, the temperature in the sun was 86 deg. ; but when the black flannel was placed over and close upon it, the heat was found to be 98 deg., that is 12 deg. higher ; while, if an interval of air was left between the two, it fell to 83 deg. Now taking man in the cold climate ; if his body, or, in the case of the animal, its fur, which is part of itself, were black, from immediate contiguity a large amount of heat would be drawn from the body, and at once absorbed by the colouring matter of the skin : but evaporation, as has been shown, is constantly in process ; and it would follow, from the moisture attracted to the surface by this heat, that a constant and

considerable current of perspiration would be continually evaporated, and the body would thus be deprived of heat, beyond what is compatible with life. This however is not so ; and the evaporation is small, since the heat of the body is not especially attracted to the surface.

Similarly with the black man of Northern Australia, his heat is attracted to the surface from the interior of his body ; and, as superfluous light is absorbed by the pigment or colouring matter of the eye without discomfort, so heat is absorbed by the pigment of the black skin ; perspiration is constantly in progress, and evaporation rapid, whereby large quantities of heat are removed from the surface and interior of the body. The black man, however, takes care to anoint his body regularly with oil, whereby another element in the argument is introduced ; for this oil, being a non-conductor, prevents the blackness of his skin from absorbing so much heat from the hot external air, and from cracking from the constant evaporation of perspiration ; while it in no way interferes with the exudation and final evaporation of moisture from the pores of the skin.

This argument of the colour of skin, feathers, or other organs forming part of the body, does not in the same way apply to the colour of clothes ; for here it is to be borne in mind, that more or less layers of still air, as well as of materials, intervene between the skin and such outer covering ; and that by these non-conductors the heat of the body is prevented from passing to the outer surface of the clothes ; at the same time that nothing prevents such outer clothing from absorbing heat from without in proportion to its colour. Thus the temperature of a thermometer immediately under and touching white flannel was 87 deg. ; while that, similarly placed under black flannel, was 98 deg. Now, were the body in the place of the thermometer, it is evident, that it would be proportionately heated, as well as what layers of clothing and still air intervened ; while, from the difficulty of the passage of air through wool, evaporation would be slow ; and therefore the inherent heat of the body would be maintained, and not diminished.

Thus we find, that in cold climates people are white, and are clothed with the strongest non-conductors, that evaporation from the surface of their skins may be as slow as possible; and that they wear dark clothing, that as much heat as possible may be absorbed from the outer air: while in hot climates, the people are black, that as much vapour, and therefore heat, may escape as quickly as possible; and that if they are clothed, they wear white or light-coloured clothing, that as little heat as possible may be absorbed from the outer atmosphere; while, in texture, such cloth must be so thin as not to interfere with the process of evaporation.

To show the effect of the presence and absence of light, which in the case of the sun may be held, by the correlation of forces, to be strictly equivalent to heat, one may quote an extraordinary instance of change of color in a negro, related by Dr. Hutchinson in the "American Journal of Natural Science," the truth of which seems to be strictly reliable. A negro slave in Kentucky, up to the age of 12, was perfectly black, being born of black parents. At that time a portion of the skin an inch wide all round the head, but just within the edge of the hair, gradually changed to white; and the hair also, which grew therefrom. A white spot next appeared near the inner corner of the left eye; and from this, the white colour gradually extended over the face, trunk and extremities, until it covered the entire surface. The complete change from black to white occupied about 10 years; and but for his hair, which was crisped or woolly, no one would have supposed at this time, that his parents had been, or shown any of the characteristics of the negro; his skin presenting the healthy vascular appearance of that of a fair complexioned European. When he was about 22 years of age, however, dark copper-coloured or brown spots began to appear on the face and hands; but these remained limited to the portions of the surface exposed to light.

Similarly, in process of generations, we may constantly notice, that different tribes or even families of the same original stock vary in colour, according to the nature of the climate of the land in which they live, and the degree and mode of their dress; that is

the extent to which their skins are protected from the sun and heat.

Freckles are of the same character as the coloured skin.

From the above considerations it appears, that fair people are adapted by colour to a cold climate; and it follows, that, if they choose to inhabit a hot one, the character of their dress may and should be regulated by the degree of change of colour, which their skins individually undergo, a condition which we familiarly know as being "tanned;" but should regard as the degree of adaptibility of the individual to become acclimatized. Thus the bronzed bushman bears the hotter climate far better than he who will not tan; and may therefore be differently dressed.

And now with regard to the artificial dress of man: and from a consideration of the various modes of dress worn by those inhabiting different climates, which we may call natural, as distinguished from those which are governed by fashion, as among ourselves, we may most conveniently judge the special characteristics of each.

In the far north, as in Greenland, we find the Esquimaux wear loose clothes of fur. The hair with its still air, being a non-conductor prevents excessive escape of heat; while the skin of the animal bars the passage through it of the icy cold wind. Such garments it is usual to line on the inner side with wool or fur; or to stitch together the bare surfaces of two fur skins. Such a garment then, counting from without, affords a non-conductor in the hair, two layers impermeable to air or wind in the skins, and a dense non-conductor again in the hair within. When the individual is outside in the cold, his extra heat escapes in the vapour of his breath; but within his heated house, he must remove his skin coat, else the moisture, evaporating from the surface of his body, would soon so impregnate the layers between his own skin and that of his coat, that he would be in a vapour bath. This condition of things will be recognised by those, who have worn a waterproof macintosh coat on a hot day, or waterproof non-ventilating boots.

Travelling a little south, the Highlander weaves the wool of the sheep into a dense fabric; soft, from the fact that the fibres are not too closely matted together; but shedding the rain, and an

admirable non-conductor of heat by the thickness of the material. This material protects him alike from cold wind and searching rain ; yet in a manner much less effectually than would the furs of the Esquimaux, which however would be to the Highlander unsuitable, since his employment about his native mountains requires of him much muscular exertion, and consequent increase of formation of heat ; which finds its direction of removal chiefly through the pores of the skin. Such evaporation is hindered by the Scotch or Irish frieze much less, than if the skin of the animal were worn attached to its wool. Moreover he carries with him his woollen plaid, which he can put on or off according to the degree of comfort or discomfort produced by too great evaporation and loss of heat from insufficient clothing ; or too little evaporation of the extra heat formed by his exertion, from the thickness of the non-conducting cloth. The name of this frieze is derived from Friesland, a province in the north of Holland whence it was first imported ; of which the make, as well as name, was afterwards adopted.

In the colder countries the head is warmly protected ; whence it probably follows that the hair is thin and straight, compared with the dense crisp curly mat of hair of the uncovered heads of the natives of hotter climates. Thus fur skins are usually worn as caps or hats, whereby the popular use of seal skin was first introduced from the North. Beaver hats were much in use, and were very heavy and warm ; until, from the demand upon the beavers, they became scarce, and our black silk hat was introduced as a substitute ; which, while admirably adapted by its shape and colour to a cold climate, we colonists have introduced, as the proper wear of a gentleman, into the hottest lands of the earth.

Through all mountainous countries we find the same kind of clothing in use ; but as we travel south, those who live in hotter climates adopt a lighter form of dress. In Turkey the dress is unique, but admirably suited to the climate. The head is encircled by long rolls of white calico arranged in a coil called a turban ; a shirt and loose trousers of calico cover the body ; while around the waist is rolled a woollen scarf. Thus while the mass of the

body is cool, and ample opportunity is given for evaporation of perspiration, considering the idle life these people habitually lead, the great nerve centres are well protected; the brain being well shielded from the sun, and the great solar plexus of nerves, which preside over the functions, and regulate the actions of all the viscera of the abdominal cavity, protected by the waist scarf. Now we have already seen, how much influence the nervous system has in the production and expenditure of heat; and therefore the careful protection of the situation of these most important nerves is a point of greatest necessity.

These nations however do not always manufacture their own woollen scarves; for when in Smyrna, I searched in the Persian Bazaar for such a cloth, and selected one from a bale having the true Persian pattern and style of make, while the camels outside were yet groaning and roaring, as far-brought goods were unloaded. On after examination, however, my Persian scarf was found to have a Glasgow ticket in the corner.

While the Turk wears these cotton garments, it is to be remembered that he does not work; or if he should, he presently takes a bath, of which there is such ample provision, and dries or changes his clothes. The real workers are more or less dark skinned and uncovered.

The swarthy Bedouin is similarly dressed; but, being more exposed to variations in the temperature of the air, he always has with him his woollen Burnoose or scarf, as an additional protection. Being always on horseback, he takes much exertion; whereby much heat is produced, equally quickly removed by his rapid motion through the air, which, separating his clothes from close contact with his skin, favours evaporation.

The central African and the Australian, alike black, have their heads protected from the sun by a dense cluster of curly hair; which some races, as the Fiji mountain cannibal tribes, strange to say, increase in size by interweaving with their own hair that of other people. I fancy false hair so worn, though people have usually plenty of their own, is called "pads." It is probable that this fashion of the Fijian cannibals is of very ancient date, and

that the false hair so worn was that of their enemies, whom they had slain and eaten. It is said, that some European nations have followed the fashion of these cannibals to the extent of wearing other people's hair. These blacks cover their bodies with oil, as has been before mentioned; and in warm weather wear little beside. For change of temperature, however, they have the skins of various animals, which they sew together as opossum or other rugs; these have the qualities of the fur coats of the people inhabiting the coldest regions of the earth. Others of them make woollen cloth, which they use in the same manner. These races are all very susceptible of cold.

We now come to the consideration of ourselves. We are a mixed people of various nations. We are white, and therefore, by our colour, adapted to a cold climate; but we inhabit a country, of which the natives are black, and who, in their natural state, having had no fixed place of abode, were able to move from place to place as varying temperature indicated; while they were always provided with fur rugs, which have been shown to be in use among the inhabitors of the coldest Arctic regions, and therefore of the most heat-retaining kind. Now the climate of this country is remarkable for two things: one is the extent of its heat; and the other its sudden fall of temperature. Let us see what action these two conditions have upon our bodies.

On a hot day when the air is dry, the extra heat of the body, in a state of rest, is rapidly removed by the evaporation of the perspiration, as before described. Now if the body be naked, this moisture passes into the surrounding air, and is thus dissipated. Not so to the same extent however when clothes are worn. If a calico shirt only cover the body, the vapour from the body is condensed on its inner side, and is again evaporated from the outer suface by the external heat. This process is so rapid, where the calico is single and thin, that no discomfort is experienced, if the moisture of the body be small in quantity. Not so, however, where folds occur; or where adjacent surfaces of the body are so closely in contact, that evaporation does not readily ensue. The calico thus becomes saturated with moisture. This condition

exists as long as the heat; but presently, from the decline of the sun or change of wind, the temperature falls, and the requirement of evaporation, for the regulation of the necessary health temperature of the body, ceases. Yet now, under the same clothing, since the external temperature of the air is much less than that of the body, the heat given off is proportionately much greater; that is, the drain of heat from the body is, proportionately, much greater. At the same time the wet parts of the clothing can only be dried by conversion of the water therein present into vapour: but this process can only be effected by the addition to the water of a quantity of heat, called latent in the vapour, which must be derived from some source; and, since the body has the highest temperature at hand, this heat for the conversion of the water into vapour, is drawn from the body.

Again, during the hot term the body was weakened and depressed by the difficulty of getting rid of its superabundant heat, demonstrated by the damp linen; but now, with the sudden change on the thus enfeebled system, not only is the heat supplied at once removed in the ordinary manner in the evaporation of perspiration, but also a drain of heat is on the system to evaporate the moisture present in the calico: thus the body, previously chilled by damp linen, is apt to be over-chilled by its evaporation.

But such changes generally occur in the latter part of the day, when the sun is at least beginning to get low, and the colder time of the day commences: so that not only is the body then subjected to the drains on its heat above mentioned, but, still more, to those resulting from this additional heat drain. Is it wonderful then, that the system should find itself unable to cope with such a sudden demand for heat, and that secondary consequences of a character adverse to health should result?

The next process is such a removal of the heat from the surface of the body, that the blood-vessels there situated are chilled. Now the result to any blood-vessel, when cold is applied to it, is to produce contraction of its muscular coat. The muscular coats however of the arteries, or blood-vessels coming from the heart, are much stronger than those of the veins, or vessels which carry

the blood back to the heart ; which indeed are unable to maintain their contracting power for more than a short period at a time, when dilatation ensues : these arteries and veins communicate by means of very delicate vessels called capillaries, having no muscular coat at all. It is not therefore to be wondered at, that the heat withdrawn as above described should produce such an effect by its absence, which we call *cold*, that the powerful muscular coat of the surface arteries drives the blood out of themselves through to the capillaries and veins ; the blood in which latter vessels, being always blue as seen on the backs of the hands, gives the colour to parts chilled. Thus we speak of a man's nose as blue with cold. The excess of this kind of blood in a frozen or mortified part is the cause of its appearing black. Now the proper course of this blue blood in the veins is onward to the heart : by the heart it should be forced into the arteries of the lungs, to receive oxygen and be deprived of its carbon, forming heat in the process, by chemical change : thence back into the heart in a perfect state, to be by it forced through all the arteries of the body. Now, supposing the arteries of the surface of the body to be chilled by the removal of heat, and therefore contracted as before mentioned, and, similarly, that the vessels in the lungs be at the same time subjected to chill by breathing cold air, and to contract, it is evident that it must be somewhat difficult for circulation to continue in the same regular mode as before ; for, while the arteries are forcing blood into the veins from behind, these tubes are, by dilatation of weariness after previous contraction, unable to maintain the onward current of the blood : thus they become clogged, and the capillaries behind them engorged. This condition may be likened to that of a thoroughfare, when the traffic is suddenly hastened in one part, but stopt in front ; it is evident that a block must result. Medically, we call such a blocking of the blood-vessels a congestion ; and it depends upon the situation where this happens, as to the effect thereof. For instance, if it be in the blood-vessels about the nose, we call it a cold in the head ; if in the large air tubes of the lungs, we say we have a cold on the chest ; if in the

finer tubes, we call it bronchitis; if on the walls of the delicate chambers of the lungs, where the chemical changes are effected, it is inflammation of the lungs; similarly in the bowels or elsewhere, to each individual in the part which in him is peculiarly his somewhat more delicate, or less strong situation; and this is first congestion, and presently inflammation of this or that particular part.

Now all this misery and more or less dangerous illness result from the removal of a little too much heat from the body: that is, the system spent a little more heat than it was able to afford: now this kind of extravagance in our heat, that is, in our strength of body, like some others we are very disposed to indulge in, and for the same reason, that it is very agreeable, is apt to turn to our loss: but there is this difference; that if our extravagance in money is beyond what we are able to afford, we may always have at least the chance of repairing our loss by making more; whereas, in the matter of health, the very loss is by disease the cause of increased expenditure, and, from our beds of sickness, we never rise so young or so strong as we were before. It therefore becomes us, if we have any appreciation of corporeal economy, not to risk such waste; but to dress in such a manner that, while in our precaution we are only following the example of the aboriginal of the country, we may serve to reduce in our own persons the death rate of the colony.

It is not the custom of the blackfellow in his native state to wear calico fitting so closely to adjacent parts of his body, as that it becomes saturated with perspiration: he may have a piece of calico wrapt round him, but not fitting into all his corners. Next when change of temperature occurs, or, which is practically the same thing, when he ceases to make an increased quantity of heat by exertion, he either makes a fire and sits by it, or wraps around him his opossum rug, and he generally does both: by these means he either again increases the temperature of the external air, so that his body heat shall not be removed from him, when his nervous system is enfeebled and his capacity for heat formation is reduced; or he puts a powerful non-conductor, in the form of his rug, between him, the warm object, and the cold outer air. Thus the wild man

wears little clothing, when the air is warmer, or exercise is more vigorous; and covers his body with furs, or lights a fire, when the air is cooler. The difference between the condition of man in his wild state, and the same man in a state of more or less civilization may be seen at Corranderk: where the normal conditions of aboriginal life being absent, and the required habits of care in dress against taking cold not having been acquired, the mortality is increased, and deaths occur from diseases formerly unknown or rare.

But the colonist in Australia rarely takes the precautions of the wild aboriginal. The workman, who has toiled in a factory, comes out in his shirt sleeves from the heated close air of the building, to sit in the shade outside, and eat his dinner; rejoicing in the pleasure of the cold air, neglecting the hint given him to cover himself from the increasing chilliness of his body, from his unwillingness to take the trouble to rise and fetch his coat: the man who drives, starts on a hot-wind day, when the clothes he wears seem too much; neglecting to regard the prospect of change of wind, or fall of day; and only regrets the fact, when he feels the keen wind eat into his very marrow at perhaps 3 p.m.; when it is not so much that the temperature is low, as that a change of from 30 to 40 degrees has suddenly occurred: so he, who walks in warm weather, reaches his destination hot and tired; he sits down in the shade in a pleasant breeze or draught, and has a long drink of something cold or iced, which of itself absorbs from him much heat; the passing air rapidly removes such superabundant heat as has been formed, while the cessation of exertion at once stops his increased heat formation, and chill results. Similarly with the cricketer; and still more with the rower; in whom the exertion and subsequent nerve depression are so much the greater: the shopman after his weary work in a close shop on a hot day, damp with perspiration, gladly rests himself in the cool evening breeze: the labourer lazily retains through the evening his wet shirt; or on a rainy day neglects to change his wet clothes, boots and socks. What however shall we say of the young girl, from her earliest childhood protected from every chill; and much more susceptible to the effects of cold than man, who, half clad in thin muslin, goes to a ball? On her

way from her home she is usually well covered by her cloak, and the room she enters is perhaps more or less warm: presently she dances, going through such exertion, that she is thoroughly heated; she takes an ice, and seeks the draught of an open window, a cosy staircase, a cool conservatory, or draughty verandah; despising her mother's directions to put on her cloak or be careful. But we doctors know of the frequent results; but say nothing of our patients' troubles, for doctors are, or should be like dead men, who tell no tales; and whereas women should, from the nature of their protected life, be the most healthy part of the nation, as they are the longest lived, they form the mass of the doctors' patients.

Similarly with the child: he goes out, runs unceasingly, so that he is wet with his heat; and, returning home, bathes in the river, sits gossiping on the stone door step, or chills himself pleasantly at the open window: what wonder that he is restless and feverish at night, and is found to have taken cold? Or the half-naked child, whose mother so clothes him, delighting in his chubby legs: perhaps too hot at midday, yet, with change of wind, his bare limbs are chilled; the blood is driven to his body, and he has an attack of such disease as he may be disposed to, whether croup, diarrhœa, rheumatism, convulsions, or other.

The only wonder is that the system is so frequently able to sustain these manifold strains by its natural elasticity and tendency to maintain the balance of health: but the aboriginal inhabitants of a country do not risk so much for an hour's pleasure, when the trifling precaution is so easy.

Nor are old people so careful as they should be; especially as it has been already shown, that more than twice as many deaths occur among them in the coldest month of the year, as in the warmest. They go out on cold nights; the old gentleman stays in the garden, smoking his pipe, after the sun has set, or a cold wind has sprung up; and the old lady goes out without her bonnet; or presently leaves a public room at a temperature of 70 deg., and goes into the cold outer air, which is perhaps 25 deg. colder, without having an extra shawl to wrap round her shoulders; and to-morrow will complain of growing pains in her bones, which

some people call rheumatics; indeed, she is fortunate, should she escape an attack of bronchitis, or something worse.

Now, when we undergo such sudden changes of temperature as have been above mentioned, one of three things must result.

Firstly. We may rapidly lose heat to the colder outside air. In many of the cases supposed, the person, having made an excess of heat by extra exertion, allows it by after inaction to be evaporated, and so removed as before described: and this is well enough, provided the abstraction of heat is stopt at the right moment, when just enough is lost. This however is often not the case, and more is removed than can be afforded: but exertion is followed by a proportionate depression, and the body is not in a condition to rally and make additional heat. This being so, the system is weakened; and some kind of cold or inflammation, in such part as is weakest in the particular individual, results.

Secondly, on going out into the colder air, we may by exertion produce heat in proportion to what is taken away by the outer air. The person may be supposed to have been heated in a warm room, and then to have gone out into the cold air; and it is possible for him to make much additional heat by exertion. The result depends upon whether he can make additional heat, as fast as it is removed: and this again is regulated by various conditions. 1st, if the air be dry and still, as well as cold, and he walks fast, it is probable that, without extra covering, he will not suffer; for he makes by his exertion new heat, which is evaporated from his body proportionately. 2nd, if however there be a cold wind, the air, rapidly passing by him and penetrating his clothes, takes large quantities of heat from him; so that he feels, as he says, the cold eat into his marrow. This man will probably feel after results of such chill according to the locality of his special weakness. 3rd, but if the outer air be moist, evaporation is more difficult, the clothes become more or less saturated with perspiration, chilling him at the end of his walk by their dampness: a condition increased by the extra production of heat from the rapidity of the breathing from want of due removal of heat formed, evaporation and exhalation being insufficient.

In the third case an additional protection, as an overcoat or shawl, which may be called clothes of emergency, is worn, whereby the heat of the body is less easily removed; and no sudden or excessive heat drain occurs.

Now, in the cases before mentioned, it is much safer not to run risks; for be it always remembered, that a man may have a dozen fortunes; but whoever he is, he has but one life; and if he be unhealthy, his life has lost its charm. Such risks may be greatly avoided by dressing ourselves suitably with non-conductors of heat. All kinds of clothes are non-conductors, and may be classed in two divisions: those we habitually wear, and those we put on in emergencies.

Generally speaking we may say that our clothes are composed of calico and of wool; and between them there is a great difference. Calico is made of cotton; and cotton is a vegetable fibre, composed of a number of small cells, capable, as are all its congeners, of absorption of water in its every part. Moreover calico is made close; or if not so made, it soon becomes so by use; thus the quantity of minute globules of air enclosed in its meshes, which are powerful non-conductors, is less than if the texture were more open; in which case, however, the fibres would break, and the cells separate more readily, whereby the material would be destroyed.

On the other hand, woollen materials are composed of a kind of hair, and therefore are derived from the animal kingdom. A hair is a tube formed of animal matter; it does not absorb water, nor become saturated with it; the utmost of which it is capable being, that fluid may enter the tube; which, however, is probably rare. The textures into which it is made are more or less loose, and therefore contain much air. A piece of dry flannel is therefore an animal substance, having air in the tube of each hair, and enclosing much air in its meshes; and, if wetted, the hairs cannot become saturated; but such water can only be retained in the meshes, where previously were globules of air. Whereas calico can be saturated in its every fibre, as well as water held in its meshes; whence it follows, that woollen fabrics can

never be so chilling to the surface as calico, for all their material is always dry ; and moisture can only exist in the interstices.

Silk is in character similar to wool, but very much finer ; and, being far more valuable, is used more sparingly, and the fabric is made closer, thinner, and harder. Its own non-conducting powers are not largely increased by the presence in the texture of so much finely divided air.

When then we wear woollen fabrics, we use a material specially adapted by nature for retaining the heat in animals similarly situated in this particular to ourselves ; of which, to some extent, the same may be said of silk : and when we wear cottons, we are using an artificial material of very inferior heat-retaining power, and very absorbent of moisture.

The effect of these differing conditions of wool and calico is that different results accrue in experiments. Of course their original temperature in the same air, is the same.

For instance, if you wring a piece of calico and a piece of flannel together out of hot water, and then, as quickly as possible and at the same moment, take their respective heats, you get different temperatures. In such an experiment, the hot wet calico was 90 deg., and the hot wet flannel only 83 deg.; that is, the fibres of the calico were at once saturated throughout, whereas the hairs of the flannel were only somewhat warmed by the immersion in water, and therefore did not rise so rapidly in heat. Nor did the flannel cool so quickly as the calico ; for in 30 minutes the heat fell only 16 deg. in the flannel, in comparison with 27 deg. in the calico ; which commenced cooling at 7 deg. higher, and in this time fell to 4 deg. lower. Now had the body been inside, the shock to the system, from withdrawal of its heat, would have been represented by 11 deg. less in the flannel than in the calico.

Again, in an experiment where one thermometer was placed between two layers of flannel, and another between two layers of calico, and then both subjected to the steam rising from the same source, the heat of the flannel thermometer was 84 deg., as compared with 78 deg. of the calico thermometer ; showing that a heat of 6 deg. was retained by the flannel more than by

the calico; and even after three hours of cooling, it was 3 deg. in excess.

From such and many other experiments it is evident, that wool is a much better non-conductor than calico, and that, from wool not being liable to be saturated, it is far less likely to chill the surface. It therefore becomes desirable, that woollen materials should always be worn next the skin in a climate, where the temperature is subject to rapid and frequent changes; or where the body is, by the nature of the employment or otherwise, so exposed.

A modification of a material composed entirely of wool, is merino, which is made of a mixture of cotton and wool. Soakage of the cotton fibre is much less liable to occur when so mixed with wool, than when it is all cotton; for the effect of juxta-position is not so decided. Merino being made in various thicknesses is particularly suitable to those, whose habits of life do not induce so much moisture of skin; or who cannot bear the sensation of wool touching and tickling them; or who, wearing other clothes, do not find it necessary to work only in their shirts.

Macintosh and other waterproof materials, being impermeable to moisture, prevent evaporation of the moisture of the skin; which, being thus retained, collects in the clothes; and, on removal of the coat, is evaporated at loss of great heat to the body, when it can perhaps ill spare it.

The colour of the external garment has a strong bearing upon the effect produced by the sun. Thus in the sun at a temperature of 83 degrees, while in a quarter of an hour the heat under white flannel was 87 degrees; under red it was 92 degrees, and under black 97 degrees; that is, 10 degrees hotter than under white flannel. Similarly with calico; an unglazed surface of black calico was 9 degrees hotter than that of glazed white calico. Again an unglazed material, as unbleached calico, absorbs much more heat than a glazed; so that in an experiment I found the difference to be 7 degrees: and on exposure to the sun of the same piece of black calico, of which in the one case the glazed side was outside, and in the other the unglazed, the former registered only $84\frac{1}{2}$ degrees, in comparison with 89 degrees of the latter. On

removal from the sun to the shade, the temperature falls to the same level. The results here detailed as to colour are similar in the case of various materials.

PART II.

Having now discussed the conditions of heat under which we are placed; nature's natural mode of dressing peoples, or of protecting animals unable to clothe themselves; as well as the effects of exposure to heat and moisture on the materials most available for our use; we may proceed to the practical result, that may be derived therefrom.

First, of the rational clothing of the child. During its earliest days, being incapable of any but the smallest exertion, its power of producing heat is small; and the fact before mentioned, that puny children were $1\frac{1}{3}$ deg. colder than strong children, all being under the age of seven days, shows the necessity of preserving to them what heat they do make. Thus they should first be clothed in a layer of well-washed fine flannel next the skin, the binder being of the same material: the feet and hands should always be kept warm. The remainder of the dress depends upon the season; but when not being nursed and so receiving warmth, and in exercise, a shawl or other warm covering should be thrown over the young baby as an additional protection.

However, babies, when in long clothes, are tolerably well looked after: but it is when they are just commencing to walk and are put into short clothes, that ignorance of the warmth necessary to the young animal is most shown: and when we remember that one child out of every three dies under the age of five; that the young child has a comparatively small power of heat production; that it is peculiarly subject to the effect of cold; and that yet it is clothed in such a manner as no grown person could bear, the necessity of the instruction of mothers in the dress of their children becomes a matter of political economy.

It seems a popular idea, that, to half clothe a child, hardens him,

and the children of northern countries and of the poor, of which the grown up men and women are apt to be so robust, are quoted as examples: but who can tell the proportion of deaths resulting from this hardening process; for it is only the strong that survive.

When then the child is taken out of long clothes, he should be carefully preserved from the chills and changes to which he is now liable. In winter, he should wear a well-washed fine flannel shirt next the skin; then his linen, a flannel petticoat, and a dark-coloured woollen dress over all. Drawers of flannel should be worn as soon as may be. His legs, being specially subject to chill, should be clothed with red or dark coloured worsted stockings, and warm, strong loose boots; or in woollen socks and worsted gaiters. The feet should be felt to be always warm. The head, which it is never necessary to heat, is always to be well protected alike from cold wind, and warm sun: and thus, in winter, the hat should be of felt or some other material not easily penetrated by the wind; and in colour, in our uncertainty of the sun, need not be dark.

In the summer, a thin woollen material, as merino, should be worn next the skin, to prevent chill in the evaporation of perspiration, when a cold change occurs; the rest of the dress being lighter, but the legs well covered for the same reason, and extra clothing used on cold days. Drawers of unglazed calico or thin flannel are always desirable when possible, that chill from wind may not affect the bowels. A hat of several layers of thick white calico or other cotton material, and broad in the brim is most suitable; for the nape of the neck is thus protected from the sun's rays, should the head fall on one side in the perambulator, or the child sleep. Excessive sun should be kept from the head by a hood to the perambulator, or by not going out till its violence is abated. The parts of a child specially to be protected from chill are the bowels and feet; and from heat, the head and neck.

Children, that have played and become wet with perspiration at the decline of day or before prolonged rest, should be undressed quickly, wiped over with a sponge squeezed out of cold water, rubbed dry and put into dry clothes; a woollen material being

next the skin. It is undesirable for boys to become heated with perspiration just before going into school; to counteract this risk, they should wear flannel shirts.

Boys and men in their games in summer should wear white flannel shirts and trousers; a coloured scarf of silk or wool may with advantage be worn round the waist; and the head and neck should be protected by a thick cotton material. Puggarees composed thereof, arranged round and over the crown of a straw hat and hanging down behind, are admirably suited for cricket in this climate; but, whatever be the material of the hat, it should have a hole or holes, through which the hot air generated inside may escape. This is most advantageously placed at either side, an inch below the top of the crown, and should be as large as the tip of the finger; the common wire-covered ventilators are inadequate to effect a sufficiently rapid change of air. In rowing, the neck should be carefully protected from the sun. In all cases, immediately on the cessation of active exercise, an outer coat should be put on; and, as soon as convenient, the damp shirt, &c., exchanged for dry flannel.

In winter, such playing clothes, while of the same material, may be of darker colour; and caps may be worn instead of hats.

Similarly men who labour in the sun, or in the heat under cover, should wear light-coloured woollen, as Crimean shirts &c. in summer, and dark in winter. At the end of the day's work the clothes should be taken off, the body sponged and rubbed, and a dry flannel shirt put on. That which is taken off may be aired and dried, and will do for the following day's work: similarly with the evening shirt. In this way risk of chill and illness is much reduced. Their heads should be thoroughly protected from heat and sun; and particularly the nape of the neck. Caps are therefore entirely unsuitable in the sun; but some kind of light-coloured, well ventilated wideawake with a curtain hanging down behind answers well. A cabbage leaf introduced into the crown is an excellent non-conductor; and indeed a few layers of anything, whether calico or paper, serve to give additional protection from the passage downwards of the direct heat of the sun's rays. In the

shade in summer a cap of cotton or paper is useful, and in winter of flannel or cloth. Those who feel their heads affected by heat should wear one of the hats presently to be described.

Policemen and soldiers, who are so much exposed, should wear in summer Crimean shirts, loose light-coloured outer clothes, and have an easily available outer woollen jacket or coat. Their hats should be large and light-coloured, with free ventilation, and little white curtains for the neck. In winter they should be similarly dressed in dark and warmer clothes, the hats being darker and less ventilated.

Those whose business calls them about the streets, or walking, riding, or driving in the country, should wear in summer some kind of woollen fabric next the skin ; since, if exertion be used, they will with change of wind be liable to chill ; and perhaps still more so if inactive, and especially if driving. For this purpose a merino vest is most suitable, and may be got very thin ; over which a white shirt may be worn. The clothes, or outer coat at least should be of a light colour; and, if not of wool, some light overcoat should be at least available ; for he who is dressed in calico for a hot wind and perspires, runs great risk as he drives home in a southerly breeze : in such case he had better walk.

Perhaps, of all absurdities, the wearing of a tall black hat in a hot sunny country in summer is among the greatest : for this is the introduction of a head covering used with good reason in cold countries. It is most conducive to sunstroke, and heat affection. The hat worn by those who tend toward this kind should have the advantages of the black hat without its noxious influences. Firstly, It should contain a considerable quantity of air. Secondly, This air should be in constant circulation. Thirdly, The hat should not fit too closely around the sides of the head. Fourthly, Its shadow should protect the neck. Fifthly, Its weight should be small ; and Sixthly, Its colour should be light.

The Chinese cork hat, in shape much like an oval dish cover without a handle, meets all these requirements ; and, with a light calico curtain stitched on and hanging down behind, is the very best hat in a hot sun that can be got. The head fits into a narrow

band, which is an inch distant from the outer hat : thus circulation is assured. Those, who have worn this hat, will agree that it is the perfection of a heat protector for the head and neck : and it should be used by those, who are susceptible to the sun's influence.

If white pot-hats be worn, a hole as large as the tip of the finger should be cut on either side below the crown for ventilation ; and a puggaree should cover it and hang down behind.

A white hat of the shape of the common black one is also made, with a head band separated from the hat itself. Two good ventilating holes are wanted high up. These hats are as a rule heavier than is desirable.

If in summer a man will wear a black hat, let him by all means remember, that a shiny hat is not quite so hot as a dull or cloth material ; and that he will be wise to use an umbrella. Of umbrellas, a lighter colour again is to be preferred ; and if it have an inner lining, separated by an air passage from the outer cover, it is much cooler.

In winter, gentlemen will be wise to wear thicker woollen shirts under their white ones ; woollen clothes ; and to take care that their feet and legs always keep warm. A greatcoat is required, to be prepared for cold changes.

The above precautions are specially required by the old, whose heat should be carefully guarded. Besides flannel drawers, it may be necessary to protect their feet from getting cold, when sitting or driving, by the use of a hot water tin or fur foot muff ; even beside a warm rug.

We now come to the consideration of most dangerous ground, that of woman's dress ; of which I am sorry to say, whether in its changing fashions, its style of evening dress, or even in its composition, one can commend little but the effect produced. Nor is it less necessary for ladies than for men to take heed to the occurrence of chill, which their careless negligence so often induces ; whereby, as a class, they are so much more frequently ill or indisposed than men. Most of their ailments result from improper dressing.

The most desirable dress in our style for a woman in summer is a thin merino vest ; then her linen ; very loose stays, with very

little support in them, and a light coloured thin dress; other underclothing of calico; stockings not too thin, and good sound boots. In winter, well washed flannel all over next the skin; other clothes as before mentioned, but a warm dark-coloured woollen dress; worsted stockings, and thicker boots. Women, who work with their muscles and get damp from perspiration, should change their inner clothes on reaching home after the day's work.

Women are wise in the fact that they wear their hair long; for this is the natural covering to the head, which we find prevailing among all native races: and, however dressed, it must protect some part of the head. Pads are said to increase this protection. Since the colour of woman's hair seems in some instances to be capable of varying, it may be as well to suggest that, scientifically, a dull yellow or light shade is desirable in winter, a dark brown or black in summer; while, during the spring and autumn, intermediate shades might be worn. If worn low down at the back of the head, the nape of the neck is protected.

If no parasol be used, the bonnet or hat should be in summer light-coloured and large; so as to cover the head, and shade the neck. It may be composed of several layers of material, and should be freely permeable to air. Large feathers of a light colour, if put in the right place, are excellent non-conductors. It is however certain that the wholesale destruction of small birds of beautiful plumage to be worn in the head dress is of no advantage from a health point of view. On no account in summer should black bonnets or hats be worn, which are well suited to winter.

Sun shades in summer are better than parasols, as being larger. The colour should be light, and they should be lined inside. When a sun-shade is used, the form and colour of the bonnet matters less.

No woman should ever go out in a changing climate without being provided with a shawl, or other outer wrap.

Points specially to be avoided by women are, 1stly, tight lacing. You are aware that the chest, enclosed by the ribs, may be roughly described as of the form of a triangle, of which the apex or point is at the top; this cavity is there closed, but open at

the bottom; so that, if it be in any way diminished in size or its walls contracted, such moveable organs, as it encloses or shelters, can only be compressed, or forced downwards where the outlet is. Thus the effects of tight lacing are, firstly, to press in and deform the ribs. Secondly, to press on the lungs and contract them, limiting their expansibility; such pressure is apt to induce inflammation thereof, when opportunity from chill occurs; or if there be an hereditary blood taint, consumption is apt to ensue. Thirdly, the heart is forced downward, and palpitation and shortness of breath result. Fourthly, the diaphragm, which is the great muscle across the cavity of the chest, separating the lungs and heart from the liver and intestines, is forced downwards; and consequently the liver, stomach, spleen, and intestines have to find room for themselves lower than their normal situations, to the injury of themselves, and inconvenience of other organs; which thus become jostled. Varicose veins are frequently produced by the interruption to the circulation caused by the pressure of tight stays on the organs of the body. What wonder, that girls who lace tightly, do not eat much, for they have no room for food; or that they do not well digest what they do eat: Doctors know how much they suffer for it; and that man is unwise, who marries a girl who can't eat. Fifthly. if the stays be worn tight, they take from the force and action of the muscles, being to some extent a substitute; but, whenever a muscle is brought into action less fully or freely than is natural, it wastes and loses power: thus the muscles of the bodies of tightly-laced women are apt to be deficient in power; a matter of serious importance.

While it is convenient that the figure should be supported, it is injurious, and certainly not elegant, to contract the waist beyond the natural. Stays are of advantage to a woman from the closeness of their material; for therein they partake of the character of the skin of a fur, the wind cannot readily pass through them. For the same reason moisture does not evaporate from the skin so rapidly as otherwise. A woolly material next the skin in woman is therefore the more necessary to prevent chill; which

may however be very thin, because the stays are impermeable to wind.

2ndly, in our list of things to be avoided are tight garters; for they prevent the return of the blood to the body from the feet, and induce varicose veins in the legs, and swelled feet at a later period.

3rdly, Few things are more injurious to a woman than wet clothes, and especially wet feet. In summer, the stockings should not be too thin; and in winter, of good worsted or wool. The boots at no time should have a very thin sole; or, if that be held to be necessary for fashion's sake, a sock may be worn on its inner side. Every woman should be provided with a pair of thick soled boots to walk in, and especially for wet days; long Balmoral or lace-up boots are perhaps the best for this purpose, and may be made very neatly; such should always be worn in winter. On coming in from the wet or damp ground, boots and stockings should be at once changed; and the feet, if cold, warmed. Goloshes, being air-tight, are apt to prevent evaporation, and thus the stockings are damp; therefore it is often as necessary to change the stockings after a walk in goloshes, as if the water had penetrated the boots. Under no circumstances should a woman needlessly go out without proper protection to her feet.

It is, I hope, unnecessary for me to speak of the danger of damping the petticoats, when it is the fashion to tie back the dress; or of wearing so few, that the surface is chilled. Again, while an ice does not hurt a girl warm after a dance, nor a short stroll on an enclosed verandah, it is unwise for her, so lightly clad, to sit or walk in draughts or a damp or cold air; and a cloak or shawl, not formed of lace, should always be at hand.

While we should be thus habitually dressed in a manner calculated to protect us from current changes of the temperature, we should be careful to provide ourselves with clothes of emergency formed of wool or furs, to guard us from sudden chill when leaving hot rooms for the cold outer air; or other such shock.

Those, who go to sea, should always wear flannel, thick and of

many layers in colder weather; furs, since they exclude wind, are a special protection on board ship. In the tropics, the non-evaporated perspiration necessitates wool next the skin, which the oppression of the heat indicates should be very thin: thus merino is suitable.

Swimmers of long distances, or people in time of shipwreck, when about to trust their chances to a life buoy, or voyage in an open boat, should coat their skins with the densest and most adherent oil to be got: or some kind of air-tight dress may be worn, affording the protection of a layer of non-conducting air between themselves and the water.

There is one thing more with reference to dress it is desirable to mention, namely, Corns. The skin is formed of a number of minute papillæ standing up like a bundle of needles, or the tops of a bunch of asparagus: when one of these is specially irritated, as by friction or pressure, it is compressed for the time being; but, presently, on removal of the pressure, as when the boot is taken off, an increased flow of blood to the part occurs, and it grows faster than the adjacent papillæ; the cuticle on the surface also similarly increasing. This we call a Corn.

The boots, of those, who are subject thereto, should never be tight; but neither should they be too loose; they should fit. The leather, of which they are made, should be soft and pliable.

I have endeavoured to lay before you the question of dress from a scientific point of view; considering, first, the circumstances under which our bodies are placed with reference to external conditions; what nature for the maintenance of health requires to be effected; how nature herself, as in the aboriginal and unfashionable tribes, as well as in various kinds of animals, effects this end; in what manner their various kinds of non-conductors of heat act; and, finally, how we, as an artificially dressing race, living in a country different in climate from that to which our system has for generations been accustomed, may best dress for the preservation of our health: for I thought that the intelligent reader would wish rather to know the reason for the advice given, than only to hear an expression of dogmatic opinion.