SHOULD DARK OR LIGHT CLOTHES BE WORN ON HOT DAYS?

Interesting Experiments by Government Experts on the Effect of the Color of Garments.

The Roosevelt Party Adopted Light Clothing for the African Weather.

PHOTO. © CLINEDINST WASH D.C.

Co. George W. Goethals.

The United States Army Uniforms f or the Tropics are Light in Color.

Lt. Col. Charles E. Woodruff of the Medical Corps, U. S. A.

MAY the problem of keeping cool be solved merely by selecting a particular shade of underclothing? The simplicity of such a method makes a universal appeal.

A number of interesting scientific theories have been suggested to account for our suffering in excessively hot weather. The subject is receiving an unusual amount of attention this Summer. The theory has been advanced that we suffer more from the light waves than the temperature of the atmosphere. The problem of keeping cool, if this theory be correct, is greatly simplified.

There seems to be no question but that our outer clothing should be very light in color in order to reflect the heat rather than to absorb it, as is commonly the case. Beneath this layer, however, we are told the clothing should be opaque, in order to prevent the light rays from reaching the body. If we select a shade of underclothing which will cut off the dangerous rays, we are told, the temperture of the body will instantly fall.

The problem of the undergarments has been taken up by the Federal Government very seriously of late and exhaustive tests have been made. The experiments have been carried out on an elaborate scale recently in the Philippines, where a thousand men have been used in the tests which have been carried on for upward of a year. If the soldier can be made to march further, carry more weight, and fight better in hot weather merely by changing his shirt, naturally the United States Government wants to know all about it.

These tests are obviously of the utmost importance to the average layman as well. If it be possible to gain comfort by so simple an expedient as asking one's haberdasher to show us another shade, every one will be anxious to profit by the Government's experiments. There has been an immense amount of highly interesting theorizing about the effects of heat, but now for the first time it is possible, with the aid of the Government, to get at the actua facts in the case.

In making the tests the Government experts first looked carefully into the scientific values of all possible shades. Some time ago an experiment was made by putting a number of soldiers in underclothing of a light chocolate color, not unlike the regular khaki. The colored underclothing did not prove particularly good or bad. Weight for weight, it seemed to serve as well as ordinary light underclothing, but not appreciably better.

The recent tests were made very exhaustive. After canvassing all possible colors, it was decided that an orange color was the best, theoretically at least, for repelling the dangerous light waves. The shade was similar to that of the glasses commonly worn for protecting the eyes in very bright light.

The somewhat gaudy looking underclothing was prepared for 1,000 men. The garments were worn for nearly one year. The effect of the orange underclothing was tested in every conceivable manner. It was not left to chance, nor did the authorities depend merely upon the personal impressions of the men. The test was thoroughly scientific.

The soldiers thus dressed were put through routine drills, marches, in short, exactly the same experiences as they would encounter in the field. The temperature of each man was taken at regular intervals. These observations would be made at the end of a march or at the close of the day's work and the results carefully tabulated. An immense amount of carefully scientific data was thus accumulated.

As a further test the men were bled and their blood subjected to careful microscopic tests. It will be seen that literally nothing was left to chance. The appearence of the men wearing the new underclothing was also observed by medical experts and carefully set down from time to time. If a man was overcome by the heat the case was carefully recorded, to be compared with the proportion of heat cases among men wearing the regulation underclothing.

In addition to the regular work in the field the men were subjected to extreme tests. They were sent to take hot baths, for instance, and the effect of the orange underclothing on men before and after taking this treatment was carefully observed. The records thus prepared were compared with similar observations made with men wearing white underclothing.

Throughout these tests the food eaten by the men was also carefully recorded. The exact weight of the men was taken at regular intervals. The proportion of men who fell sick during the tests, especially those complaints brought on or increased by heat conditions were made the subject of further analysis and comparison. No test which ingenuity could suggest was neglected to thoroughly demonstrate the effect, whether good, bad, or negligible, of the orange-colored underclothing.

The results of all these experiments have been prepared and submitted to the War Department at Washington. It is not yet known if the Government will act upon them, and adopt orage-colored underclothing for the entire army, or even that part of it stationed in our tropic possessions, but it is believed it will not. The tests, while extremely interesting, it seems, did not demonstrate that orange-colored underwear was cooler or more healthful than any other shade.

It is too early to predict the course of the Government. The results of the tests have not yet been made public. Meanwhile an interesting opinion has been expressed by Col. John Van Rensselaer Hoff, Surgeon General of the Department of the East, who was in the Philippines during the tests.

"I am inclined to believe," said Col. Hoff, in discussing the experiments, "that the physical discomfort is more the result of the temperature of the heat than of the light rays. I do not know what the Government will decide to do in the matter, but it seems probable that it will make no changes.

"Taking weight for weight, I think that white underclothing is as good as the orange-colored underclothing, under all conditions. The tests in the Philippines were very exhaustive. We left nothing to chance, but recorded every detail of the experiments with scientific curiosity and accuracy.

"The claim that colored underclothing reduces the effect of heat is important if true. Put to actual test it did not prove to be true, or, at least, the beneficial results were not enough to warrant continuing the practice. The theory that the orange color cut off the shorter light rays may have some basis in science, but we are after practical results in the army, and in this case we did not get them.

"We did everything possible to test out the new underclothing. The temperature readings were made, the men's blood was carefully examined, their exact physical condition before and after taking exercise in the sun in the orange-colored underclothing was all carefully noted. The test was made exhaustive, since it was carried on in the tropics at all seasons of the year. In a general way the results noted in the Philippines would apply to our conditions here at home. The result of the tests gave me the impression that the heat has more effect on one than the light rays."

Doubtless no American has had greater opportunity for observing the effects of heat upon men under extreme conditions than Col. George W. Goethals. The task of putting through the great canal at Panama in record time, while employing men who for the most part were unused to the conditions of the tropics has been carried out, however, with conspicuous success. The lesson of the observations of the effect of the heat upon workmen and others on the Isthmus has, of course, an important lesson for the sufferer from the heat in New York.

"There is a very general misapprehension about the heat of the tropics," said Col. Goethals. "I have Panama in mind, of course, where it seems to me that the heat is less oppressive than here in New York at this season. On the Isthmus we count a temperature of 80 or 85 degrees very hot indeed; it is rarely hotter, in fact. The average heat, you know, is only 74 to 76 degrees, taking the temperature for each hour and striking an average.

"During a heated spell in New York you have an appalling number of deaths and prostrations due to the heat. We have practically no sunstrokes on the Isthmus. If I should take several thousand of our men from the Panama Canal and set them to work digging in the streets of New York, we doubtless would have a number of heat cases. It is common to suppose the exact opposite to be the case.

"I attribute the greater danger of heat prostrations in New York, for instance, to the reflected heat. Our men, who get along well enough in the tropics at all seasons, could not stand the reflected heat of the streets of New York.

"Then again, we prepare for the heat in the tropics better than in the temperate zone. Our men lay off for two hours in the middle of the day, that is, from 11 to 1 o'clock. There is plenty of daylight earlier in the morning or later in the evening to allow for this rest.

"Another important factor are the houses in which we live. In this climate houses are built not for Summer, for comfort in the hottest weather, but for comfort in the coldest weather. We live here in arctic houses, and in the coldest weather they afford ample protection. When the hot weather comes, and it is hotter in New York than in Panama, people must suffer accordingly.

"Our men go from their work to houses especially built to afford good ventilation, which are open to any breeze which may be stirring. In New York a great many people must go to the tenements, where they pass much more uncomfortable nights than do the workmen in the tropics. The morning finds our men in the tropics refreshed and ready for the day's work, while many must start in our northern cities without this preparation.

"I have never made any tests with the color of underclothing, either the outer garment or the under garment. It has not seemed necessary. Our khaki is cool enough for conditions as we find them, especially if it is not too hot—that is, buttoned up over the chest and warn too tightly. My personal experience indicates that white clothing is cooler than any other. It is universally worn in the tropics, you know. Even our shoes are made of cloth, which is far cooler than leather.

"The secret for the good health nejoyed by our men in the tropics—in Panama, I mean—seems to be due to the fact that we dress properly, house our men intelligently, and feed them well. If more attention were paid to these conditions here at home there would be less suffering from the heat.

"The tropics, and I speak only of Panama, seems to me to be a more healthful region than the temperate zone. We have, of course, done away with the infectious diseases. But even with the heat, which many dread, the average of health is better than here at home."

A special investigation of this general subject has been carried out covering several years, by Lt. Col. Charles E. Woodruff, A. M., M. D., of the United States Army during his service in the Philippines. Dr. Woodruff has collected an immense volume of interesting material regarding the effects of heat, both upon the native and the American under all conditions. He is a strong advocate of the value of epaque under clothing, and it has been largely as the result of his work that the recent test of the orange colored under garments has been carried out. His theory of radiation as applied to the heat conditions in the tropics is very interesting.

"At first it was thought," writes Dr. Woodruff, "that blackness was an assistance in radiating heat in the tropics and blondness an advantage in conserving it in cold countries, by the physical laws that dark bodies radiate invisible heat faster to cooler bodies than do bright ones. The water in a black teakettle, for instance, will cool far quicker than in the bright teapot. Hence blondness enables men in the north to save heat and to keep warm, but was a disadvantage in the tropics, as it kept men too warm, even feverish, and many have given this as the reason why blond Teutons in the tropics may have a temperature of 100 degrees or even 102 degrees without infection, and as this temperature destroys nerve tissue it is only a question of time when exhaustion and collapse occur.

"There is much truth in the theory," he continues, "and we do know that the negro in the North has much greater difficulty in keeping warm than the white man. Not only does he require more clothing and warmer houses, which are stiffling to us, but he avoids outdoor work as much as possible in Winter, inclining to house labor for warmth, but when he does go out he is more easily overcome by the cold and suffers dreadfully from frost bite. This law of radiation is undoubtedly also the contributing reason for the evolution of blackness in tropic climates and animals and whiteness in the arctic, for nearly all black animals are in the tropics and white ones in cold places."

It would seem to be a natural conclusion that dark or opaque clothes would be logical for hot weather. We know, however, from actual experience that dark clothes are hotter than light ones. Dr. Woodruff makes the situation very clear. He says:

"The law of radiation must not be confounded with the law of absorption. By the latter law dark bodies absorb heat from hotter sources much easier than light bodies. The dark teakettle heats up when on the stove more quickly than a bright teapot. But this law is of little effect in evolution, because the dark tropical animals are nocturnal, as a rule, and therefore at no disadvantage. Likewise, in the arctics the small amount of heat which could be received from the sun's rays is insignificant compared to the advantage of heat conservation of white fur."

Dr. Woodruff reaches the following conclusion as to the logical clothes to be worn in extremely hot weather: "Tropical people have found out that black clothing is comfortable from the fact that it radiates better; hence they incline to black clothing very markedly when they are not exposed to the sun's rays. When exposed to the sun they wear white or light colors, to avoid the heat of absorption, as we see in the case of the Arabs. These facts apply to black men as well, and the increased heat received in the short time he is exposed to the sun is more than compensated for by the advantage of being able to radiate at other times. Indeed, our means of disposing of heat by perspiring, &c., makes it exceedingly difficult to absorb too much even if the skin is black! Nevertheless, protection is not perfect, for, as a rule, all tropical people hide from the midday sun whenever they are able to do so."

The difference between the effect of heat under the direct rays of the sun and when experienced indoors according to this theory is very striking. "When exposed to a high degree of dark heat," continues Dr. Woodruff, "as in kitchens and firerooms, an environment wholly unlike his natural one, the negro is at a greater disadvantage than a white man because he absorbs more. I have seen a negro collapse from a heat stroke in a ship's galley and his white companions escape. In his native state the negro is nocturnal to a large extent and does not expose himself any more than is necessary."

The importance of a dark or opaque skin, according to Dr. Woodruff, is very obvious. He argues that it exists because of its beneficial effect in excluding the dangerous actinic rays of light which are those of short wave length, the violet, indigo, and blue and the ultra-violet rays. The rays which are less actinic, such as orange, red, green, and yellow, at the other end of the spectrum are less harmless and penetrate more or less deeply into the skin. The ultra-violet rays are almost wholly absorbed in dark skins.

An immense amount of evidence has been cited in the working of nature itself to show that animals exposed to intense light are provided by nature with more or less opaque skin. It is pointed out that not only man who lives in the tropics is given a dark skin, but that all tropic animals are protected in some such way. All animals which are exposed to the sun are provided with an opaque pigment or covering of some sort, which is in direct proportion to the intensity of the light. Tropic animals, again, dread the light even more than the heat.

It is interesting to note in this connection that ordinary sunburn is believed to be due to the short rather than the long rays of light. Both sunburn and tanning are caused by the action of actinic or short rays and not by the long rays. When one is exposed to intense bright light nature quickly divides this dark pigment to prevent the short or dangerous rays from penetrating the skin. It is argued, therefore, that sunburn, is not, as is generally supposed, necessarily a sign of healthiness, but is merely nature's precaution against injury.

The conclusion reached by Dr. Woodruff has been that the discomfort we suffer from heat and the actual danger of sunstroke in extreme conditions is the result of the action of light rays. He believes that he has succeeded in analyzing these rays and separating those which are dangerous from those which are not. By regulating the color of the underclothing he would merely cut off these dangerous short rays from penetrating the body. The color of the underclothing need not be black; in fact, orange will do the work as well, and thus make of the human body a kind of photographic darkroom which may only be reached by the longer or reddish rays, which are not harmful.

The New York Times
Published: July 17, 1910