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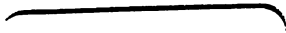
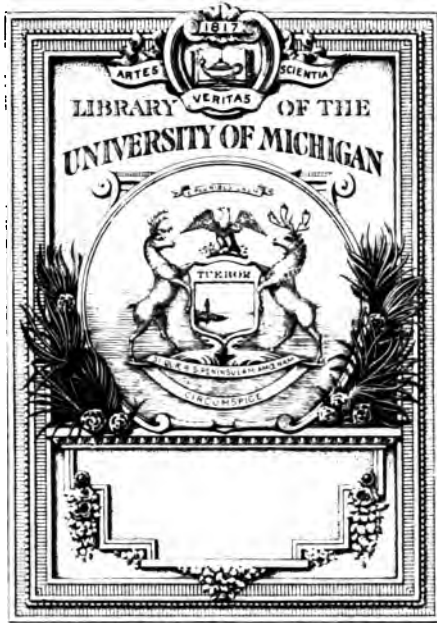
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**THE EFFECTS OF TROPICAL LIGHT
ON WHITE MEN**

THE EFFECTS OF
TROPICAL LIGHT
ON WHITE MEN

798-299

Auth'd BY
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PREFACE

THIS work had its origin in an attempt to prove or disprove the theory announced by von Schmaedel in a paper read before the Anthropological Society of Munich in 1895, that skin pigmentation of man was evolved for the purpose of excluding the dangerous actinic or short rays of light which destroy living protoplasm. It gave, at once, the reasons for the evolution of nigrescence and blondness, the reasons why Europeans have always failed to colonize in the tropics and why blonds disappear when they migrate from their northern home, and finally gave rise to practical hygienic rules for white men compelled to reside in the tropics. The suggestions were of such inestimable value, providing his theory was correct, that a systematic search was instituted for data, and as these discoveries proved the correctness of the theory, a synopsis was presented to the Manila Medical Society, March 7, 1904, but the full paper grew to its present size, as it was necessary to prove the theory conclusively. Our anthropologists have not so far taken the matter up exhaustively, though every now and then there is a short paper on the subject. Medical literature has ignored the matter almost exclusively, although it is of the greatest importance to all blonds in the United States. Popu-

lar scientific literature still ignores the real issue. For instance, there is a discussion in the *Scientific American* of August 20 and October 15, 1904, as to the reason for man's pigmentation and not one of the writers has touched on the effects of the shorter sun's rays, and consequently they are wholly unable to reconcile the facts with theories as to absorption and radiation of the longer rays of the red half of the spectrum and the infra-red.

My thanks are due to Lieutenant Frank T. Woodbury, Assistant Surgeon, United States Army, for revision of the manuscript and proofs and for valuable suggestions, and to Sergeant S. A. Weir, Hospital Corps, United States Army, for arranging the index.

CHAS. E. WOODRUFF.

PLATTSBURG BARRACKS, N. Y.,
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THE EFFECTS OF TROPICAL LIGHT ON WHITE MEN

CHAPTER I

ZOOLOGICAL ZONES

Adjustment to Environment

NATURALISTS discovered long ago that living forms were distributed in zones whose boundaries were isothermals.¹ A species is sharply limited in its northern and southern extensions and though it may be found over longer distances east and west it is never found out of its zone. Migration would be followed by extinction sooner or later for acclimatization is not possible. A great deal of study has been given to the explanation of this law and though comparatively little or nothing is known of the use of the vast majority of the characters of living forms, yet enough has been discovered to prove that natural selection has been at work preserving variations which render each species fitted or adjusted to its environment. Hence if it migrates to another zone it may be so far out of adjustment as to perish at once, as in the case of palms carried to the arctics, or it may be injured more slowly and live nearly its usual

¹ Smithsonian Reports, 1891.

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span of life, or finally it may last several generations before the accumulated injuries are fatal.

When there is a survival of the descendants of a migrated form it is due to the fact that natural selection has been eliminating the most unfit, and preserving those best fitted to the new environment, so that finally there is produced a new form different from the migrated ancestor—that is, there has been the origin of a new species. This is the only way that acclimatization is possible—destruction of the old unacclimated or unadjusted form, and the selection of a new adjusted or acclimated one.) Living species are thus found to be like glaciers—rigid and apparently unchangeable, generation to generation, yet molded like clay if the forces are sufficient; for heredity holds a form to its parental type, and yet, by the selection of variations in any given direction, it takes a new form. It is like a hedge also, or a tree or a vine, which can be grown into a new shape by destroying certain branches and selecting others for survival.

The same laws apply to migratory birds, which are strictly limited in their annual movements by changes in temperature and secondarily, of course, changes in food. They cannot stay north after the weather has frozen their food, or frozen the water in which they live, or rendered it too cold for the protection they possess. Their zones are merely extended, and this extension is, according to Professor Brooks, a result of the survival of those types which have gone farther from home to breed so as to escape

heat or other enemies. In this sense they have very restricted physical, but extended geographical, zones. They must, however, remain in their seasonal zones.

Human Adjustments

It was found, also quite early, that man obeyed these natural laws like every other living form, and that the human type found in one zoological zone is found nowhere else. One character, say tallness, may be found in different zones, but so combined with other characters as to make a separate type in each zone.

Until quite recently, naturalists would not admit that man was under the guidance of all natural laws. They acknowledged that if his head was severed he would die, and that he must have food and water, but in the matters of his origin and separation into types they all believed the more primitive theories of the theologians. Hence such great men as Agassiz taught that, acclimatization being impossible, there was a separate divine creation of each type of man, a curious illustration of the rule that men who make great revolutionary discoveries are often incapable of understanding later revolutions in thought.

It is now universally accepted as a fact, that man evolved from one or more anthropoid types by the law of selection now operative, and that he gradually spread to new environments to which he became adjusted by this same law of the survival of the fittest variations. Hence arose a separate type in each zoological zone, and each type is unfitted for resi-

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dence in any other zone markedly different from the ancestral one.| Man's intelligence permits him to appreciate the dangers of a climate and avoid most of them by proper protection, so that he survives longer than other forms out of their zones, even as long as two generations in the case of white men in India, but here, with all his care, a third generation is unknown. In lesser changes he survives longer still, as in the case of our negroes, but here extinction is inevitable, for we know that the lesser change from the Soudan to Egypt is always fatal in the long run—that is, in a few centuries. The only type fit for survival in Egypt is the peasant Fellah and he is identically the same now as his peasant ancestor shown on the oldest monuments—unchanged in eight thousand years.

Purpose of Variations

The latest work of our anthropologists is a careful study of each of the characters of each type of man with the purpose of discovering why that character is beneficial in that zone and why a different character arose in a different zone. It is of vital interest to us now, for it explains why races always fail to colonize in a zone markedly different from the home land and it teaches us how we can avoid these causes of death if we are compelled by business to reside temporarily in a climate to which we are physically unfitted.

For instance, the shape and size of the nose and position of the nostrils are now fairly well proved

to be a matter of selection of fittest variations. In the tropics where the air is hot and therefore rarefied, more of it is necessary and it is essential that there should be no impediment to the air currents, so that the nostrils are open and wide and the nose very flat. Such a nose is unsuited for cold countries as it permits masses of cold air to flood the air passages and irritate the lining membrane, so that the nose must be large and have much warming surface, and the nostrils therefore are slender slits to admit the air in thin ribbons easily warmed. The air being cold is concentrated, and less of it is needed than in the tropics and the slender nostril is no disadvantage. The nasal index, or extreme width of nose divided by the extreme length, gradually increases as we go from colder to hotter countries, where we find some races with nose index much greater than one thousand, i. e., width greater than length. It is now many years since it was first pointed out that the open tropical nostril was one reason for so much pulmonary trouble of negroes out of the tropics. Hence there must have been a natural selection in cold countries of one kind of variations—large contracted noses, and a selection in hot countries of the other extreme, so that the various types gradually arose.

The great Biblical Pharaoh Rameses II had a prominent, slender nose, not now found in any Egyptians, and it is a positive proof of the recent arrival of some ancestor from the north. He was like Lord Cromer—a northern type ruling a native type.

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Simia means snub-nosed-one, because nearly all simians, being in the tropics, have snub noses. Human babies have simian or snub noses, which are necessary to permit breathing while at the breast. Maternal protection given to the infant obviated the necessity of early evolution of the nose in infancy. There was no destruction of life from this defect and therefore no selection. Hence the growth of the nose is deferred until long after the other simian characters are outgrown and babies are still most carefully protected from cold. Women leading indoor lives have less need of protection from cold air, and have therefore not evolved the big nose so common in men. They even are frequently simian or snub-nosed.

Law of Radiation

(In no character is natural selection so evidently at work as in the amount of pigmentation of the skin, hair, retina, and iris.) Color has long been used as a means of classifying man as it is so evident and so different in divers races and it is a most important character for many reasons. As soon as we discovered that it was an advantage we began searching for the benefit. (At first it was thought that blackness was an assistance in radiating heat in the tropics and blondness an advantage in conserving it in cold countries by the physical law that dark bodies radiate invisible heat faster to cooler bodies than do bright ones. The water in a black tea kettle for instance will cool off far quicker than that in the bright

teapot. Hence blondness enabled 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 an anthropologist has given this as the reason why blond Teutons in the tropics may have a temperature of 100° or even 102° 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 this theory, 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 stifling 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 frostbite. This law of radiation is undoubtedly also a contributing reason for the evolution of blackness in tropical animals and whiteness in the arctics, for nearly all black animals are in the tropics and white ones in cold places.

Law of Absorption

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 tea kettle 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

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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. 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 Arabs. These facts apply to black men also, and the increased heat received in the short time he is exposed in 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 perspiration, etc., make 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. It is remarkable how all classes in the Philippines disappear into their houses in the middle of the day. In Java the natives do not dare to work in the fields from 9 or 10 A. M. to 3 or 4 P. M.

When exposed to a high degree of dark heat, as in kitchens and fire rooms, 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 he is nocturnal to a large

extent and does not expose himself any more than necessary.

Protective Coloration

The law of protective coloring is a great cause of coloration of animals. By this law animals which resemble in color their surroundings are concealed and have the advantage in escaping detection by their enemies or are unseen by their prey. Natural selection of the best fitted goes to such an extreme that the resemblance to the background may be exact. Tawny animals are on the yellow plains, and unless they move it is almost impossible to detect them even when in full view. The tiger has vertical stripes like the lights and shades of the tall grass, forest animals are mottled like the shadows cast by the leaves, and so on. Similarly animals on the snow are best concealed if white and the nocturnal animals are best concealed if jet black. But this law does not apply to man for he must wear clothing in cold countries, and also in hot climates, as habit and custom demand. Again, his intelligence in escaping enemies or stalking his quarry makes concealment by coloration unnecessary.

Sexual Selection

Sexual selection may modify man's coloration, as it certainly does in case of birds, first noted by Darwin, though his explanation is not wholly accepted. In Europe and America there is a wonderful tendency of blonds to marry brunettes where both types

exist, and this must unify the type in the long run. In addition we can well see that where the healthiest and best are of a certain complexion that color will be most attractive to each sex, and selection be along that line—intensifying it. This may be a contributing reason for the intensifications and unifications we see in long-settled places, as in Asia and Africa, but it is only a modifying element after all. I have observed this sexual selection among Maryland negroes who ridicule the half-breeds as something unnatural, priding themselves on purity of blood. Hence pure-blood negroes marry their kind, and help to eliminate the unfit mulattoes. In India, China and Japan also the half-castes are despised by the pure-blooded natives who marry their own color. In the Philippines we find the same hatred between Malay and Mestizo, and in Haiti the negro has ostracized and practically excluded the mulatto.

Law of Opacity

Von Schmaedel was the first to describe the real reason for the evolution of man's pigmentation. In a paper read before the Munich Anthropological Society in 1895 he showed that it exists by reason of its beneficial effect in excluding the dangerous actinic rays of light—those of short wave length, the violet, indigo, and blue and the ultra-violet rays. The less actinic rays at the other end of the spectrum—green, yellow, orange, red, and infra-red—are more or less harmless, and penetrate more or less deeply through the skin. In dark skins the ultra-

violet rays are almost wholly absorbed. / Dr. R. W. Felkin was the first to call attention to this fact in English journals.²

Within recent years it seems as though a mania had taken possession of some biologists, leading them to assert that parts whose uses are unknown are useless, and all kinds of theories are being built up to account for their survival. All this is wrong, and gives rise to protracted controversies waged over conflicting theories based on incomplete observations—controversies which cease on the discovery of the missing facts. The list of characters which are apparently useless will grow less and less, until few or none are left, and we will abandon our present theories as to their retention.

The appendix in man is a case in point. It is an article of faith among physicians that it is a useless vestige of a once useful organ, and they base their claim on the fact that long life is possible after its removal—a very curious system of reasoning, for to be logical they would have to conclude also that man's right hand is useless because long life is possible after its amputation. The presence of lymphoid tissue in the appendix is giving rise to a suspicion that the organ has a use, though we can get along without it. Many, indeed, are inclined to declare the stomach of minor importance since we can live without it, and we could multiply the examples to include every organ except the vital ones, such as the heart and brain.

² Journal of Tropical Medicine, September, 1900.

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Our rule, then, should be to keep on investigating until we do find the use of every character which man possesses, and never assert that any one is useless. The whole future trend of anthropology is now in the direction of finding out the use of every separate variation. It is hoped that this enquiry proves that human pigmentation has a use, and a vital one, as described by von Schmaedel, and is not a useless character.

It should be remarked that the layer of pigment cells just beneath the outer skin is present in all normal men, the differences in color being merely differences in the amount of the pigment. So that every race has some protection from the light, varying with the intensity of the pigment. There are no unpigmented races, and lack of all pigment—albinism—is a serious defect of development due to degeneration.

CHAPTER II

ETHER WAVES

Corpuscles or Electrons

IN order to understand the actinic action of the shorter ether waves a few words as to the character of these waves are necessary. It is rather hazardous for any one to give definite explanations at the present time, for the discoveries of the properties of radium have put scientific theories in a state of flux. These and other recent discoveries have come in such rapid and bewildering succession that no physicist seems yet to know where he stands, and theories as to what matter itself is are bound up in the theories of the ether waves produced by matter and the action on matter of the ether waves.

It is now generally granted that we must abandon the old idea that the atom of the chemist is an indivisible ultimate particle of matter and we must substitute the newer idea that atoms are composed of much smaller particles called corpuscles, which are also said to be electrons or units or atoms of negative electricity. They are so small that Sir Oliver Lodge states that if an ordinary-sized church is imagined "to be an atom of hydrogen, the electrons constituting it will be represented by seven hundred grains of sand each the size of a full stop, dashing

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about in all directions or rotating with inconceivable velocity.”¹ The number of corpuscles composing atoms of other elements is proportional to their atomic weight.

Under the conditions of a Crookes tube the electric spark causes streams of these corpuscles to be dissociated from the atom and fly off from the negative pole at a velocity of one-tenth to two-thirds of that of light, and these constitute the Cathode rays. Similar streams of corpuscles fly off from uranium and other radio-active substances in the compound rays called, from their discoverer, Becquerel rays. Similar rays are emitted from radium in a much greater degree than from any other radio-active substance known. When one or more corpuscles thus leave an atom, the remnant left can be considered to be an atom with one or more units of positive electricity or, as other physicists state, it is one or more units of positive electricity itself.

Stresses Caused by Electrons

Now when an electron is started to move, or is stopped from moving, it causes a strain or stress in the ether and this strain or stress travels out like a wave and at the velocity of light. These stresses or strains can follow each other irregularly or regularly and at any rate up to thousands of millions of millions per second, and according to their rate they produce different effects and have been given various names. Isolated impulses sent out like a single shout

¹ Sir William Crookes, *Science*, June 26, 1903.

are called Stokesian waves from Sir George Stokes, who fifty years ago described peculiar emanations from certain substances. Stokesian waves, or pulses, are of very short wave length.

Hertzian Waves

The slowest rates we have been able to produce are called Hertzian waves from their discoverer, and these waves are from one thousand to one hundred and fifty feet apart, and the longer ones are utilized in wireless telegraphy. Their rate is from half a million, or less, to four million, or more, per second. Ways have recently been found by Leberew for producing similar waves much shorter, even as short as one millimeter, and they are therefore proportionally more numerous per second. "Lecher and also Larasin and de la Rive showed that the velocity along wires is the same as in air."² That is, current electricity and Hertzian waves are of the velocity of light.

Infra-Red Waves

Shorter waves than these are called heat waves for they produce the phenomena of dark heat. They are stresses set up in the ether by to and fro movements of molecules of matter which are always in motion among themselves, except at the absolute zero of temperature. The more rapid the motion, and the greater the amplitude, the higher the degree of heat. In these to and fro motions, every time a molecule stops or starts it causes a stress or strain in the

² Science, February 5, 1904.

ether similar to those due to the motions of corpuscles. Impinging upon another mass of matter the waves set up motion of its molecules, or impart heat to it, so that every mass of matter is constantly sending out or receiving heat waves. If it sends out more than it receives it cools, and vice versa.

Langley with his bolometer has mapped the infra-red spectrum for thirteen times the width of the visible part. Dubois and Rubens have produced longer infra-red rays than the longest ones we receive from the sun, but there is still a gap between them and the shortest Hertz waves.³ But we have isolated infra-red rays of every length from these up to those just below the red which are about thirty-three thousand to the inch.

Light Waves and Ultra-Violet

If the vibrations are slightly more rapid than this they have the power of influencing the retina and optic nerve, giving the sensation of red, and for one single octave higher they give the other colors—orange, yellow, green, blue, indigo, and violet. The waves shorter than violet are ultra-violet and are not capable of influencing our retina, though Huxley and others have experienced a light sensation when ultra-violet rays have been concentrated on the eye. There is considerable evidence, however, that some of the lower animals appreciate these waves, as well as the infra-red, as light, and that they can see in a room which would be absolutely dark to us. M. A.

³ Science, February 5, 1904.

Forel states ⁴ that, by special powers of their eyes, all ants can distinguish the invisible ultra-violet rays of light, which, by the way, seem painful to them.

A mass of white-hot iron, giving out waves of all rates of vibration, will gradually bring to a white heat any smaller masses around it; but any substance which is destroyed by a lower temperature would disappear into its elements before white heat is produced. We also believe that these shorter waves, which we call light waves, impinging on a body, will set its molecules in motion, at first slowly, and then more and more rapidly, until they eventually would cause the same rate of vibration as they themselves possess.

Actinism

Finally we find that the short rapid waves, the violet and ultra-violet, have the power to set up very rapid molecular or atomic movements, dissociating certain unstable substances, without their passing through the lower rates of motion or becoming heated, and this is called the actinic effect. As a rule the shorter and more rapid the wave the greater is this actinic effect upon atoms without the production of the slow heat motions of molecules. Hence we find it very marked in the ultra-violet rays of the spectrum, though we can make photograph plates which are more sensitive to the yellow than the blue or violet, and in many other instances we find that the greatest effect is by some other color, even as low as the red in certain plants.

⁴ "The Sensation of Insects," Paris, 1902.

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On account of the greater actinic power of the ultra-violet frequencies upon some photographic plates, and of the possibility of obtaining waves from one locality of the spectrum which can therefore be focused to one spot without aberration, it is found that they are particularly useful in micro-photography. Cadmium electrodes are used, as they give out ultra-violet rays to which the plates are particularly sensitive, and the lenses, slides, cover slips, and condenser are all made of quartz, as glass destroys the short waves. Focusing is done by an ocular containing a fluorescent screen, as the rays make no impression on the retina. The detail in such micro-photographs is said to be remarkably good.

Sir John Herschel long ago discovered the actinic effect of light upon iron salts and proved it to be a deoxidation, and we use this effect with ferrocyanic salts in "blue printing." But it was not until Daguerre that we had a practical application of actinic effect in other substances.

It is not strictly correct to say that the sun's rays contain heat rays, light rays, and actinic rays, for all these rays are identical except in their rates per second and distances apart. They all can set up the slow vibrations we call heat, they all can cause actinic effect in some substances, and one octave of them can act on our retina in addition. The red and infra-red cause heat vibrations better than the others, and the violet and ultra-violet can, as a rule, cause more actinic effect. We get violet and ultra-violet rays from bodies which are very hot and are giving out

all other rays in addition, and we can filter out the long rays and get a light which is comparatively cool, though an absolutely cold light is probably impossible. In time even the ultra-violet and shorter rays would cause lower rates of molecular movements in some substances on which they impinge, and thus warm them up. The cold light of fireflies is yet to be explained, and we do not know whether it is absolutely devoid of heat.

Roentgen or X-Rays

Until 1895 we did not know that there were any ether waves shorter than a few octaves of ultra-violet. The discovery by Professor Roentgen of X-rays of so short a wave length that they can pass through the interstices of many substances without impinging on molecules came as a great surprise. These waves must be exceedingly short to pass through substances which will stop light waves. Dewar found that the "relative opacity" to the Roentgen rays was in proportion to the atomic weight of bodies, and it is reasonable to believe them to be so exceedingly short as to pass between the molecules of substances of low molecular weight. How short they are we do not know, but they are considerably shorter than our shortest known ultra-violet ray, though there is a belief that there is no gap between the shortest ultra-violet from the sun and the longest X-ray of the laboratory.

X-rays are produced in the same way as other ether waves, that is, by the alterations in the move-

ments of corpuscles. The stream in the Cathode rays, both at the pole on starting and when stopped by collisions with atoms or molecules, sets up ether strains or stresses in exceedingly rapid succession. The Roentgen waves are not necessarily equidistant, because the corpuscles in the Cathode stream are not equidistant. Hence while the light waves can be likened to musical tones the X-rays are likened to noises or shouts in keys higher than the keyboard of the pianoforte. W. C. Sabine has described the various rays and their effects.⁵ Not all the corpuscles of the Cathode rays are stopped by the glass tube as the physicists once taught. Sir Oliver Lodge now says⁶ that some penetrate the glass and emerge.

In a gas like nitrogen (or the atmosphere) the molecules are in number about ten million millions to the inch, and each molecule may occupy only one twentieth or even one five-hundredth of the space between it and the next, and in these intervals there is a free road for such minute waves as the light rays, having such minute width of oscillation. Transparency in liquids and solids depends also upon other unknown conditions as to arrangement of molecules, but, as a rule, the denser the material, or closer together the molecules, the more do they obstruct the waves by taking up their energy upon themselves. Hence we see how exceedingly short must be the X-ray which can penetrate a great thickness of a substance which screens out the violet or even ultra-

⁵ Boston Medical and Surgical Journal, August 11, 1904.

⁶ Archives of the Roentgen Ray, April, 1904.

violet. The penetrability of X-rays depends, by the way, on their shortness, and Crookes tubes, which have very rapid streams of Cathode rays and therefore very short X-rays, are able to make radiograms in so short a time that the protoplasm of the tissues is not injured to any appreciable extent. Crookes says,¹ in speaking of corpuscles or electrons, "the extreme minuteness and sparseness of the electrons in the atom account for their penetration, while the more massive ions (molecules holding electric charges) are stopped by intercollisions in passing among the atoms, so that they are almost completely arrested by the thinnest sheet of matter, electrons will pass almost unobstructed through ordinary opaque bodies," though it is proved that the rays of radium, composed of corpuscles or negative electrons, lose more than half their energy in traversing five millimeters of aluminum.

Radium Rays

Radium has been shown to emit two streams of material particles, named alpha and beta. The B rays are composed of negative electrons or corpuscles moving at great speed, probably two-thirds of the velocity of light, or even faster. The A rays are composed of positive electrons, which are very much larger than corpuscles and comparable in size with hydrogen atoms. Each is probably about one thousand times bulkier than the corpuscles, and they move much more slowly, probably only one-tenth as fast—sixteen thousand miles per second.

¹ *Science*, June 26, 1903.

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These two streams give rise to ether stresses when the particles composing them are changed in motion as when they impinge on other bodies. These are called the gamma rays and are identical with X-rays, only of much shorter wave length. Some of the particles have a speed greater than those in the Cathode stream, hence they must bombard at more frequent intervals and give rise to exceedingly rapid waves. So short are they, and consequently perhaps so limited in transverse extent of influence, that they can pass between the molecules of substances to a far greater distance than X-rays, experiments showing that they have penetrated as much as one inch of some of the metals. The slow-moving alpha particles are stopped by the glass tube containing the radium, the beta particles traverse a limited distance through glass or aluminum, while the gamma rays, which are stresses, will penetrate one hundred times further with no more loss. The slow positive stream of course gives rise to much longer ether waves than the negative or beta stream. The *Century Magazine* of January, 1904, has a popular article on the subject by Mme. Curie, the discoverer of radium, and there are very clear and excellent but more technical accounts by Dr. Henry G. Piffard in the *New York Medical Record*, June 18, 1903. The gas-like emanations from radium, which are apparently helium, do not concern us here.

It is often said that Becquerel rays, from uranium, radium, polonium, and other radio-active substances, are ether waves like X-rays. This is a mistake, for

the Becquerel rays are streams of particles exactly the same as the Cathode rays of the Crookes tube. The X-rays are ether stresses set up by these particles when they lose velocity by impinging upon dense substances.

The N-rays, which are announced by M. Blondlot as discovered in his laboratory at Nancy, were first said to be of long wave length, below the longest infra-red of the solar rays, but he subsequently said they were shorter than the shortest solar ultra-violet. Other physicists have grave doubts as to whether Blondlot really has discovered any new rays at all.⁸

Similarity of All Rays

Hence all ether waves, Hertzian, infra-red, light, ultra-violet, X-rays, and radium rays, are of the same kind, and produced by the same cause, i. e., changes in motion of the atoms of electricity called corpuscles, which corpuscles probably compose all forms of matter. All these radiations are therefore electrical phenomena, and there is a general acceptance of the electro-dynamic theory of light first announced by J. J. Thompson in 1881. As chemical phenomena have been reduced to an electric common denominator, and all life processes are chemical, we can reduce all life phenomena to terms of electricity.

In discussing the effects of these rays on living protoplasm then we can merely refer to short, or actinic waves, knowing that the effect of the X-ray

⁸ Whithead in *The Electric Review*; Lummer, *Scientific American*, 1904.

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is of the same character but more intense than the ultra-violet which, in turn, is more intense than the violet rays, and these again more intense than the red or infra-red.) But we must keep constantly in mind that they are ether stresses capable of producing motions of corpuscles or atoms upon which they impinge, even to the extent of dissociating the atoms of a molecule, or the corpuscles of an atom. Their power to do this diminishes from the source in the ratio of the square of the distance. They are *not* actual movements of the ether, for the ether, about which physicists know more than they do of any other kind of matter, is immovable, and has no inertia. The older physicists held that light waves were actual transverse vibrations or motions of the ether, and the majority teach so yet perhaps, but the new view, now becoming generally accepted, is that the waves are transmitted stresses. We can liken the matter to the stress on an upright bar of iron by placing a weight on it. It instantly transmits the stress to its base, without moving, and though we know as little about the nature of gravitation, and this stress, as we do of the ether stress, yet we cannot deny either.

Actinism a Chemical Effect

Now the fact that all these ether stresses or waves cause phenomena in the field of chemistry, has led to the view of the identity of all these forces, and indeed Crookes says,⁹ "we have actually touched the borderland where matter and force seem to merge into one another." Many physicists have elaborated

⁹ Science, June 26, 1903.

very convincing theories that matter (corpuscles or atoms) is really but a form of energy in the all-pervading ether. Hence we must not be surprised that in dealing with the highly penetrative short waves, we shall get effects which we formerly believed could be obtained through heat alone, or through chemical means.

In speaking of the nature of nerve stimulation and changes in irritability¹⁰ Professor A. P. Mathews, of the University of Chicago, says: "It is well known to all that the vibrations of the ether will produce those changes in protoplasm which the ions (molecules charged with electricity) produce, and further the character of the change in protoplasm produced by light varies with the wave length or the number of impacts per second. Violet light or the ultra-violet rays stimulate protoplasm, while the red rays as a rule do so very feebly or inhibit movement. By the electro theory of light the ether disturbances which we call light must be due to the movements of electrons or charges in the sun, either constituting a part of the sun's atoms or associated with these atoms. . . . I see no escape from the conclusion that it is not the charge but its motion and its sign which ultimately determines its action. In other words, chemical stimulation and light stimulation are identical."

Phosphorescence and fluorescence are merely light rays emitted from certain substances either from some internal source of energy or as a transformation of other rays from an external source. The internal

¹⁰ *Science*, March 28, 1902.

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form is called phosphorescence and the latter is also called phosphorescence if it persists after the source of energy is removed and fluorescence if it reacts only while the cause acts. These rays, as a rule, are somewhere in the green-yellow area of the spectrum, though a few substances phosphoresce a red ray; that is, they all tend towards the slow end of the spectrum. As they have little or no actinic effect they do not concern us here except secondarily as we shall see.

CHAPTER III

ACTION OF ETHER WAVES ON PROTOPLASM

Dissociation of Matter

THE molecules of matter, except at absolute zero, are in constant motion among themselves, at high speed, say one-half mile a second. The difference between gas, fluid; and solid is perhaps merely a difference of the extent of path or orbit of individual molecules. Every chemical substance has a range of temperature within which it shows its properties as a separate substance, and as soon as we raise its temperature beyond this range, the atoms of its molecules dissociate by reason of the rapid motion and the substance disappears into its components. It is believed that if we could only heat the elementary substances high enough, we could obtain a motion so rapid as to dissociate even the corpuscles of the atom and resolve all matter into one form (protyle of Crookes). Indeed in radium we see this actually taking place, and therefore elements of much greater atomic weight than radium cannot exist at terrestrial, though they could at much lower temperatures. Hence when we increase the heat of any substance, or increase the rate of to and fro movements of its molecules, in any other way (by light, electricity, etc.), we change its behavior or its

chemical or physical properties. Generally increased movement means more intense activities and hence as a rule we might say that the substance is first stimulated and later ceases its particular activities, but if the cause is more intense and more continued the substance is destroyed.

There is no great mystery about the matter, for identical phenomena are well known in regard to sound. Glass resonators, for instance, can be made which will vibrate to only one note, and will take up the motion of the air waves when that sound is produced. Moreover it is possible to dwell on that particular note, on a violin for instance, until the resonator vibrates so violently as to be bent beyond its limit of cohesion, and shatters into pieces. We can imagine the same conditions in a molecule, and can think of the atoms as taking up vibrations from ether stresses until they vibrate so far as to go beyond the limit of their chemical cohesion or attraction, and the molecule is shattered. Likewise the shortest waves may shatter the atom from a too great motion of its constituent corpuscles.

Instability of Protoplasm

The degree of heat necessary for this varies with the chemical composition, the simpler compounds such as iron oxide requiring a high degree, while more complex ones are destroyed by a temperature harmless to others. Living protoplasm—one of the most complex of substances—is destroyed by a very low degree, far below the infra-red and as a rule far be-

low 212°; though a few organisms can live in boiling springs. The protoplasm of our nerve cells is so very complex and unstable that it will not function except at about 99° or 100° F. and is destroyed promptly by a temperature of 120° F., though a temperature of 105° may take some days or weeks to break up the molecule.

The basis of protoplasm is nitrogen, and all nitrogen compounds are noted for their instability, some even exploding on exposure to light, a slight shaking or a spark. Nitrogen is the basis of all modern explosives, and is the foundation of modern photography. Hence we must expect protoplasm to be seriously disturbed by vibrations which cause its molecules to move faster than the rate due to a temperature of about 100° F., and as for the short ether waves it is difficult to imagine why they should not destroy protoplasm.

This is very nicely shown in the experiments on protoplasmic streaming in plants by Dr. Alfred J. Ewart, of Birmingham Technological Institute. He found that while weak light may accelerate it under certain conditions, strong light retards it. It is said also that red light restricts it, hence we can assume that Ewart's experiments would have given still more marked results had he used the colors in various intensities. On the other hand, Dr. R. A. Katz¹ states that experiments by Trivus in the Psychological Laboratory show that all colored lights have depressing effects on the rate and volume of the pulse

¹ Roussky Vratch, September 7, 1902.

wave of animals, the violet rays affecting it most and the yellow least, but he does not mention whether this was weak or strong light.

Destruction Due to Radium

The radium experiments in Paris in 1903, at the Pasteur Institute and at the Sorbonne and St. Louis Hospital, prove conclusively that the radium rays in small amounts are remarkably stimulating to all forms of life, the hair for instance being stimulated to increased growth, and sea-urchin eggs developing without fertilization. In greater amounts they are disturbing, causing monstrous forms of developing eggs of frogs and other animals, and in still greater amounts are invariably fatal. For instance, three days' exposure of white mice causes their death within a month, preceded by blindness, though during the time of exposure and for some days later they showed no ill effects whatever. Radium is so powerful that a case is reported² in which it was kept applied to the fingers seventy-two and one hundred and twelve hours respectively and it resulted in ulcers persisting six months and in permanent contractures of the fingers. Professor Curie reports other cases of blisters and burns of fingers from handling it, also the case of a persistent ulcer of the skin of the abdomen from carrying a small tube containing a tiny amount in the vest pocket for one hour. Danysz³ found that these rays could de-

² *Annales de Dermatologie et Syphilis*, 1902.

³ *Journal of the American Medical Association*, August 7, 1903.

stroy the skin, but subcutaneous tissues were less involved as the rays were evidently partly filtered out. He found the nervous system very sensitive, for a sealed glass tube containing salts of radium, if placed on the spine of young animals, is fatal, but in older animals the bony covering protected the cord. Larvæ and embryos are profoundly modified, even producing monstrosities, or killed outright. Bonn also found that the effect of the rays is specially intense on cells in the stage of proliferation, certain eggs developing without fertilization in the same manner we can cause by certain chemicals.

In the case of four species of bacteria Van Buren and Zinsser⁴ found that an exposure to radium of less than nineteen hours produced no effect except a slight retardation of growth in one.

Cell coverings or contents may be composed of far more stable substances than the protoplasm which has made those substances. Thus bony tissues may not be injured yet the living bone cells destroyed. Also cells which have ceased all life processes and have become mere mechanical armor, such as those in the upper layers of skin, hair, nails, horns, etc., are very stable and may be uninjured at the very time they permit the rays to penetrate to lower layers of unstable living and proliferating cells. In the case of X-ray burn these upper cells slough off as a result of the death of the lower layers.

Robert Abbe⁵ reviews some of the literature of

⁴ American Medicine, December 26, 1903.

⁵ New York Medical Record, August 27, 1904.

radium. His microscopic examination of cells which have been acted on by radium for some hours, shows complete necrosis, but in the surrounding zones there are merely inflammation and leucocyte infiltration with some thrombosis of the smaller vessels. All this indicates that these short rays actually tear apart or disintegrate the molecule of protoplasm without the production of heat. He has verified the work of foreign investigators and states that three or four hours' exposure of young mice caused a "dopy" condition, progressive paralysis of the hind legs, convulsions and death, the post-mortem showing congested and inflamed brain and cord. He also shows that seeds exposed to it a few days and then planted, either do not grow or show feeble power, and that ten days' exposure killed all. Meal worms if not killed were retarded in development and did not become beetles.

Corpuscular Bombardment

The above noted effects of radium may be caused by the X-ray set up by the stopping of the corpuscles impinging upon the tissues, yet there is a belief that the corpuscles themselves may be the destructive agent. Dr. Henry G. Piffard is of opinion that the effects on the skin are chiefly due to the electrons (B-rays) and not to the ether waves.

The corpuscles have far greater penetrating power than such large masses as ions, yet they can be stopped by solid substances which allow the waves to proceed. As before explained the corpuscles bear the

relation to the atom, of a grain of sand to an ordinary church, or as others say of a small billiard ball to St. Paul's Cathedral—so small indeed that the number flying off from a square inch surface of radium in ten million years would weigh but one grain; yet they possess terrific energy on account of their tremendous velocity, one-tenth to two-thirds the velocity of light. Hence when they bombard they must do damage of themselves when being deprived of motion, though most of the energy is transformed to ether waves which travel on as far as the substance permits, and these in their turn do the rest of the work. No wonder that Curie states that a pound of radium in a room would probably kill every one present by the blasting force of its rays. If their energy is proportional to the square of their velocity, we can well imagine the destruction they must cause when they meet such a relatively huge mass as a molecule of protoplasm.

It might be stated that physicists are puzzled to account for all this energy; radium for instance warms up surrounding bodies, keeps them constantly higher in temperature than the rest of the room, and will melt its own weight of ice every hour. They are solving the problem slowly as it is not a case of perpetual motion and a violation of the law of conservation of energy, but merely an instance of the transfer of energy from the air or other surroundings in an unknown manner. Crookes has offered a reasonable explanation.

Destruction Due to X-Ray

The destructive effect of the X-ray has been summarized as a degeneration of epithelial cells, and to a lesser extent of the cells in glands, blood vessels, muscles, and connective tissue, though bones are but slightly affected or not at all. The secondary effect is the usual infiltration of all inflammations, preceded by dilatation of vessels and serous effusions. The cell degenerations are in both nuclei and cell body, the details showing great destruction of protoplasm.

The superficial destruction formerly wrought by the prolonged application of X-rays before we learned how to produce shorter, more penetrating ones photographing quickly, are too well known to enlarge on. It is interesting to note in these cases that while the superficial tissues may be actually destroyed, the deeper tissues may be injured to a point short of necrosis yet sufficiently to interfere with function, and it is suspected that these deeper chemical dissociations are a contributing cause of death in the fatal cases. Dr. Maurice Rubel gives literature on this subject in the *Journal of the American Medical Association*, November 22, 1902. More recently there has been the death of a man who was injured by X-ray in Edison's laboratory some years ago.

At the meeting of the New York Medical Association, 1904,⁶ there was a discussion by Franklin, Coley, Beck, and others of the great damage due to

⁶ New York Medical Record, December 3.

the X-ray improperly applied and one speaker believed that the present situation was truly alarming. It is even possible for X-ray to cause cancer to appear in the damaged tissue, showing what we will try so much to impress on the reader, namely, that a moderate amount of short rays is harmless or beneficial and excess is dreadfully destructive.

Destruction Due to Ultra-Violet

More work has probably been done upon the pathology of sunburn, and electric light burn, the lesions in each case being the usual ones of an ordinary inflammation, and the subsequent pigmentation. In glacier burn the pigment is due to an actual effusion of blood coloring matter into the intercellular spaces, and even red blood cells themselves, so intense has been the irritant, so that the yellowish-brown pigmentation is different from that in ordinary sunburn. It is, by the way, almost entirely prevented by dark pigments applied freely to the skin of the face and exposed parts. The pathological effects above described have been conclusively shown to be due to the short rays of the sun and not the longer.

Animal Reflexes Due to Light

There is a great deal of experimentation now going on to prove that smaller animals are strongly influenced in their actions by light or darkness. Swarming bees move to the light, and if the exit of the hive is dark while the upper part of the hive is

light they do not emerge. Male and female ants at mating time also move toward the strongest light. Many insects move to or from the light in search of food. So strong is this reflex that it is believed by some experimenters that very many of the actions of lower organisms which we formerly considered instinctive or intelligent are purely reflex and show no intelligence whatever.⁷ There is no evidence of sight or light sense in the cutaneous nerves of animals unprovided with eyes or optical centers. The skin merely reacts to a stimulation, many animals being very sensitive to the short frequencies in a purely reflex manner.

In Cleaves' work on "Light Energy"⁸ there are several chapters devoted to the recorded actions of lower organisms, plant and animal, to the influence of light, to which the reader can refer for greater details. What we desire here is merely to give enough data to prove the profound influence which the short rays can have on living protoplasm.

Effect on Young Animals

Innumerable experiments, showing the effects of light on developing animals, particularly on ova, larvæ of the lower animals or the young of higher animals, have been made during the past century and it would be impracticable even to epitomize them here. Cleaves has noted very many in "Light Energy." It is apparently a hopeless task to un-

⁷ Science, November 27, 1903.

⁸ Rebman Company, New York.

ravel the discrepancies in the results published, but from the mass of evidence the following tentative conclusions can be formed. As a general rule the experiments show that the red-yellow rays have the least effect, and in some cases no appreciable effect, but that the blue-violet rays have an undoubted stimulating effect, hastening the time of development. Some animals seem to be adjusted to this stimulation and depend on it, so that when kept in the dark, or in red rays, their development is retarded. In a few cases no effect was noted by any ray, but the cases are so few in number and the chances of the protoplasm being protected by pigment of some sort are so great, that there is justification for the conclusion that some effect will be found in every organism in the way of a stimulation which may be so great as to be harmful or fatal even in cases where a slight stimulation is needed.

Nerve Paralyses

The function of the sensory nerves can be temporarily destroyed by short waves, without apparent harm, the motion of the molecules being great enough to destroy the usual properties of the protoplasm but not dissociate it. It is like heat destroying the hardness and rigidity of ice but not affecting the chemical composition of the molecule, which resumes its hardness when the heat is again taken from it. A Russian physician (Minim) has introduced this as a practical anæsthetic. His No. 4 lamp, for instance, held at eight inches distance for twenty minutes,

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causes sufficient anæsthesia for minor operations. He also uses the lamp to ease the pains of burns, acute myositis, rheumatism and pleurisy. Other forms of electric lamps are now on the market, and we can apply any wave length we wish, either the blue and violet (B-V-rays) or the dark ultra-violet. Dr. Henry G. Piffard has invented one which he exhibited to the New York Academy of Medicine, February 19, 1903.* As far as known the green rays are inert therapeutically and physically.

Sunstroke

The paralysis of nerve protoplasm by short waves is undoubtedly the basis of many—but not all—cases of sunstroke, the etiology of which condition is still *sub judice*. Colonel Charles R. Greenleaf, late Chief Surgeon, Division of the Philippines, says that the heat exhaustions in the tropics are due to something more than heat for “though often overcome on the march by the heat, real heat stroke and lasting heat exhaustion are remarkably rare” (1901 report).

There are numerous theories, but it is practically impossible to find out any one cause which will account for a disease in which there is such a variety of unclassifiable forms. Pneumonia on account of its numerous forms was similarly an enigma until we learned that such a diseased condition may be due to any one of many causes. In sunstroke there is every

* See also New York Medical Record, March 7 and January 23, 1904.

conceivable variety from the cases without fever to those with so high a temperature that our clinical thermometers will not register it. There may be coma coming on slowly or rapidly, or no unconsciousness at all, and the disease may appear during exposure to heat or light or many hours later. Andrew Duncan¹⁰ attempts a classification of (a) *heat collapse* without fever or complete loss of consciousness, coming on suddenly while at work, (b) *heat stroke* of many *direct* varieties, in which there is more or less fever, unconsciousness coming on suddenly or slowly, and with great headache. The *indirect form* of (b) is when the patient is attacked after exposure perhaps several hours after he reaches home.

No wonder there are so many alleged contributing causes, such as meteorological conditions, plethoric habit, intemperance, overcrowding, nature of soil, etc. Duncan discusses as direct causes: (1) *The heat theory*, simply the disturbance due to high body heat alone which cannot be dissipated by natural means and which thus injures the nerve tissue. (2) *The auto-toxic theory*, or the absorption of toxins resulting from a high temperature of the body. Then there is (3) *the microbic theory* of Sambon, in which it is thought to be due to bacterial invasion when resistance is reduced from other causes, and (4) *the chemical or actinic theory*, that in which the harmful results are said to be due to the violet and ultra-violet rays.

Perhaps in light, which causes protoplasmic par-

¹⁰ Edinburgh Medical Journal, March, 1903.

alysis or destruction, we do have an auxiliary cause for this most complex condition. The heat theory is undoubtedly correct also, such as in those cases of both collapse and actual heat stroke which occur in hot fire rooms and kitchens, and in experimental thermic fever, in all of which the rays are all the longer infra-red. The writer has seen such a case and in a black negro at that, whose skin excludes most of the violet and perhaps all of the ultra-violet rays. In other words, all ether waves of this order from infra-red up to ultra-violet do injure protoplasm, if not destroy it, if the waves are sufficiently intense for the amount of protecting pigment.

The auto-toxic theory is also a decided factor as has been discovered among American officers and soldiers in the Philippines, due to the fact that sufficient water cannot be carried along on the march. Perspiration is profuse and fluids are so drained off that there is not sufficient left for the use of the kidneys to dissolve the waste products. These are therefore retained and cause numerous nervous symptoms. The concentrated urine inflames kidney, bladder and urethra, and even lights up old inflammations of their mucous membranes. It is a physiological necessity to drink much water under such conditions and Da Costa and others long ago taught that such profuse drinking would ward off sunstroke, prevent the suppression of urine so apt to occur in such conditions, and supply perspiration fluid to carry off heat by evaporation. But it is a physical impossibility in war to carry enough water along, so we teach

the soldiers to conserve their water supply and drink as little as possible on the march. We know full well when we tell them this and train them to it that many will suffer from sunstroke, but that is inevitable. Certain officers who do not know why we so teach the soldiers have imagined that it is a physiological necessity and we constantly read in papers and books that soldiers are in better health and stand the march better if they drink little or no water. No greater error was ever written, for it is the opposite of the truth. To be healthy in such conditions soldiers should drink freely and often, but as such is impossible we do the next thing and tell them to preserve the valuable water as long as possible by drinking sparingly. Rubner of Cameroon¹¹ emphasizes the need of much water in the tropics,—four and one-half quarts daily, though some of this can be taken in fruits. Statistics which I have elsewhere published¹² show that men who drink alcoholic liquors in moderation in the tropics are better off than the abstainers, and there are many explanations of this remarkable fact, but it is likely that the excessive amounts of water thus taken are a benefit of themselves. It has recently been reported from Singapore¹³ that those who abstain from alcoholic liquors suffer from the effects of the heat more than the drinkers, and it is probably a result of a deficiency of water.

¹¹ *Archiv für Hygiene*, XXXVIII, p. 154.

¹² *New York Medical Record*, December 17, 1904.

¹³ *Journal of Tropical Medicine*, December 15, 1904.

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Sambon's microbic theory of sunstroke has so few adherents that we may dismiss it with the mere statement that the fevers do not necessarily indicate infection.

No doubt the lack of perspiration due to little drinking prevents radiation and the body warms up. If it does not heat up very much the protoplasm is merely weakened in activity, but a few more degrees will paralyze it entirely and cause coma. Similarly paresis and paralysis can occur from the light rays, so that we can have prompt coma without fever, and indeed any combination of symptoms. Add to this the undoubted auto-intoxications and we have a very complicated condition with many expressions.

In another paper ¹⁴ Dr. Duncan, himself a victim from sunstroke, describes how he and another sufferer, an engineer, in India, prevented further attacks by wearing orange-yellow shirts and flannel of this color under the blouse and as a lining for the helmet. He entirely prevented those distressing and prostrating headaches and other symptoms which he formerly had every time he was exposed to the sun. He advocates a layer of tinfoil in the helmet to exclude actinic rays which he and the engineer believed to be the cause of sunstroke, and he cites the habit of all tropical natives who exclude these dangerous rays by elaborate headdresses and hats.

In exceedingly rapid cases, when death is sudden, we find an explanation not only in the very high temperature, 115° to 125° F., which dissociates the

¹⁴ *Journal of Tropical Medicine*, August 15, 1902.

atoms of the molecule, and therefore destroys the nervous protoplasm as a chemical substance, but also in the identical effect of the short waves which can thus cause the cases which are rapidly fatal with little or no fever. Professor Finsen, of Denmark, by concentrated cold light, has caused death in five to eight minutes of bacteria which survive five to eight hours in electric light, and the same effect occurs in man no doubt.

We must remember the Paris radium experiments in which the animals after three days' exposure showed no bad results for several days afterwards, but subsequently became blind and then died. This explains the curious fact that in the tropics men frequently show no ill effects of the light stimulation for a long time. The sunstroke may come on from twelve to twenty-four hours after the exposure, and in the milder degrees of exposure it may be months before the parietic symptoms are noticeable—even after return to temperate climates. It seems as though the slow rays induce molecular movements which are immediately more or less destructive of function, while the very short rays induce atomic movements in the molecule which thus change the chemical composition of the protoplasm and cause its function to fade gradually.

There is then a period of latency, after the application of short waves, during which no effect is seen. Infra-red rays cause almost instantaneous effects (burn), but in sunburn and electric light burn there may be an interval of several hours. In X-rays and

radium rays it may be several days before the results show themselves. Freund¹⁵ states that this period of latency varies inversely as the wave length or, as Piffard states, directly as the frequency. These observations certainly point to the reason why in certain cases of sunstroke there should be such a long interval between the exposure and the appearance of symptoms, and why other nervous phenomena to be described later as occurring in the tropics should not be noticed for so long a time after the cause—even months.

Retinal Irritation

The chemical effects of light waves (R to V) should not be confused with the illuminating power which is greatest at the yellow area of the spectrum, nor the heating power which is greatest at the red area and in the infra-red; finally, and most important, it should not be confused with the irritating effects on the retina which are marked in the violet, greatest at the red and apparently least at the middle or green area. This latter has brought a great deal of confusion into all discussions of light.

It is a matter of natural selection, that animals, having been enveloped in green rays from surrounding vegetation for so many millions of years, should be adjusted to these rays and be unharmed and un-irritated by them in their vision. This is accomplished by the survival of those individuals having the proper colors in the retina to destroy the rays

¹⁵ Quoted by Piffard at the New York Dermatological Society, April 26, 1904.

which are most numerous in the kind of light to which that species of animals is habitually exposed. Hence we find that in each species of animal there is an arrangement of the retinal pigment which distinguishes that animal from all other species, the difference between genera is more marked and the difference between families is enormous. A cat's retina or a dog's, for instance, is totally different from man's. Mr. Arthur Head, F. Z. S., collaborating with Dr. Lindsay Johnson, has made a life study of this subject since 1885, and has painted the retinae of all the wild animals he could secure—even fishes and reptiles.

Physiologists describe the human visual purple, which is a mixture of red and violet, in the retina. It undergoes changes under the influence of light, but returns to the normal in a few minutes, and may be wholly destroyed by too much light. These coloring matters in man are probably evolved because they neutralize the colors reflected from leaves, blue to yellow, which combined give some shade of green.

A plant leaf absorbs bands in the red and violet which are "stepped down" to some other form of energy, probably electrical, for the destruction of the carbonic oxide of the air. Hence we have less retinal protection from the rays absorbed by the leaf. The ends of the spectrum, both violet and red, are irritating, one, by the way, being nearly half the wave length of the other. There are many people who cannot sit in a room having red lamp shades, without being so irritated as to have a resulting con-

conjunctivitis, headaches and eye strain. The other colors are less marked in this retinal irritation. Yellow being the best for illuminating among all the colors, is usually selected for lamps for comfort. All the other lamps which have violet rays (arc light, Welsbach, etc.), are less comfortable, cause eye strain and are rather shunned because of this, although from their yellow, blue, or green rays they make rooms very bright. The best lamps are the yellow lights with a very faint tinge of green in the shades. The new mercury vapor electric light of Peter Cooper Hewitt, of New York, is wholly devoid of red rays and is found by experience to be soothing to the eyes, permitting much longer and more severe work than can be accomplished by ordinary daylight.

Color Blindness

The most frequent form of color blindness in man is red blindness, and it seems to be a mere shortening of the visible spectrum; the ocular nerve apparatus from some congenital defect does not respond to the longer waves which cause the sensation of red in ninety-nine per cent. of mankind. It is quite likely that there are a few men who see slower rates than the great majority, and that they see a color at the junction of the red and infra-red which gives to others no light sensation at all. In the other form of color blindness, which is the next greatest in frequency, there is a defect which prevents a few wave lengths near the green from eliciting any response. It is as though a person were deaf to an octave in the center

of the pianoforte but heard all the rest. Whether this green or blue blindness is a nerve defect or a pigment defect has never been explained—indeed no theories of color blindness are satisfactory.

Certain colors combined are very pleasing because they produce harmony of wave lengths in the same manner that certain sounds combined are pleasing chords. It is due in each case to the relative length of waves, so that they correspond and do not by "interference" cause additional grating vibrations. Red and blue or violet thus cause a distinctly rich and pleasant chord called purple, but it irritates and tires a sensitive retina. Harsh tones and harsh colors have irregular interferences.

All these speculations are introduced to call attention to the fact that though colors at the red end may pain the eye they have but little injurious actinic effect on the body chemistry to cause exhausting oxidations. The alleged stimulating effects on the nervous system of the red to yellow are referred to later.

Metabolism

One set of experiments apparently proves that light increases the oxygen carrying capacity of the red blood cells, and therefore influences the oxidative processes of the organism (Cleaves). As elsewhere stated, other experiments show an increased exhalation of CO_2 , when the animals experimented on were exposed to light, and this increase was supposed to be due to stimulation of the protoplasm, but it is probably due to both the stimulation and the increased

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supply of oxygen. Adult animals are therefore fattened more easily in the dark as there is less combustion, and moreover they eat less than those in the light.

On the other hand, young dogs and cats developed in darkness are retarded, because, it is believed, the stimulation of light creates increased appetite, and those developing in the light are known to eat more than those in darkness. This corresponds to many of the investigations with lower animals developed in the light and darkness respectively.

It is therefore a clear deduction, that whereas a moderate light may be and is beneficial to young and old animals, the extremes of no light and too much may be harmful. Anyhow, we have a clear explanation of the reduced vitality of negroes in the north and excessive oxidations and exhaustions of white men in the tropics.

It may be remarked here that we have not the slightest clue to the reason why one wave length should have actinic power in one substance and another length be effective in others, as in photographic plates, nor why red or violet is useful in the work of the plant leaf; why yellow and green should be ineffective, even soothing now and then to protoplasm, yet red irritating and exciting; nor why the violet is irritating to the retina, but soothing or even paralyzing to the nervous system. It all has some relation to the molecular composition of the substance acted on, which is "tuned" to one set of light tones and not to another.

CHAPTER IV

DIFFERENCE BETWEEN PLANTS AND ANIMALS

Light Injurious to Bacteria

IT is necessary to digress at this point to clear up some popular misconceptions as to the effect of light upon plant protoplasm for by so doing we can better understand its effect upon animals. It is generally believed that living plant cells are dependent upon light and the recent evidence that they are so injured by it as to be compelled to function in the dark comes as a great shock to the old ideas. Of course we have known for a long time that light is fatal to nearly all forms of pathogenic organisms—a matter so well known that it would be a waste of time to record here the details. It is sufficient to note that the bacteriologists have determined how long an exposure to direct sun's rays is necessary in each locality and for each species of bacteria, how long the ultra-violet will require and how long the X-rays. Some bacteria, molds and yeasts are destroyed by only a few minutes' exposure to weak light while others require many hours of strong light like that of a tropical sun. All experiments seem to confirm the original observations of Downes and Blunt in 1877 that the effect is due to the B-V-rays and ultra-violet, but that the longer rays, infra-red to yellow, are harmless, and that the

ultra-violet rays are much more powerful than the B-V-rays, whether from the sun or electric arc. Even when B-V-rays are not immediately fatal they attenuate virulence, and the evidence seems to prove also that though the R-Y frequencies are harmless as compared to the shorter rays, yet they, too, if sufficiently concentrated and applied sufficiently long, will attenuate or destroy many forms. The discrepancies in the experimental results can all be harmonized by accurate measurements of the intensity and the time applied of each frequency experimented with.

Sunlight has become our safest and best disinfectant for all surfaces and also all fabrics into which the rays can penetrate, such as sheets, thin blankets and clothing. But it comes as a shock to learn that the same law applies to every plant, there being only minor differences in different species, due to slight differences in the chemical nature of the protoplasm of different kinds of cells.

Identity of Plants and Animals

The botanists are gradually unraveling the tangled skeins of threads of knowledge as to the chemic effects of light on the protoplasm of growing plants, and as this protoplasm is now believed to be identical with the protoplasm of animal cells, they are bringing forth generalizations of immense importance to anthropologists. Professor J. Reynolds Green in the Presidential address to the Botanical Section of the British Association for the Advancement of Science at the 1902 meeting in Belfast¹ mentioned numer-

¹ Science, December 12, 1902.

ous facts derived from recent experiments showing "the probability of the transmission of stimuli through vegetable tissue along the protoplasmic threads extending from cell to cell," and that there has been "established a very close similarity between the vegetable substance and the nerves of animals." These observations strengthen considerably the view of the identical nature of animal and vegetable protoplasm which has in recent years come into prominence, and which is receiving more and more support in all directions.

Both forms of protoplasm require their nutriment in solution, though the animal organism and the fungi among plants get their food in solid form and are able to digest or dissolve it through the action of certain chemical substances, called enzymes, which are produced by the protoplasm. On the other hand the vegetable organism gets all of its carbon and hydrogen from gases or fluids, and also its nitrogen. But in each case the protoplasm, plant or animal, eventually receives its nutriment in solution. We must not confuse this side of the discussion with the fact that while both organisms must have energy to do their work, the animal organism receives it in potential form while the vegetable receives it in kinetic form.

Chlorophyll and Hæmatin

It is in discovering the methods by which the vegetable organism builds up its nutriment from lower to higher forms by means of kinetic energy

that the botanists are making considerable headway. The details of the transformation of the carbonic oxide and water into starches through the stages of carbon monoxide, formic acid, or formaldehyde, etc., do not concern us here, a synopsis of them can be found in the above paper. What immediately concerns us is the action of the chemic rays of light. In the first place there is a growing list of facts showing at least a wonderful similarity between chlorophyll and hæmatin. The former is the pigment in the plant cells called chloroplasts, and is the engine for those interchanges of gases, carbonic acid and oxygen, in the work of building up its nutriment from simple to higher forms. The hæmatin is the pigment in the animal cells called red blood cells and is the engine for the interchange of the same gases in the work of tearing down nutriment from higher forms. One takes part in deoxidation and the other in oxidation. Both depend upon iron as one of their ingredients, as a part of their molecule in hæmatin and suspected to be in the chlorophyll molecule also. There is "a remarkable series of resemblances between derivatives of both; for instance, by removing iron from them we obtain hæmatoporphorin and phylloporphorin respectively, and these two are almost identical in composition, chemical derivation, in their spectra and in the physical characters of their solutions." The living stroma in which these pigments are dissolved or united is proteid, and it probably holds the pigments as a sponge holds water.

So closely do the two substances resemble each other, that we find a few lower animals quite well provided with chlorophyll and evidently living both as vegetable and animal—vestiges of a time when vegetable organisms were changing their chlorophyll into hæmatin.

Now the botanical deduction so interesting to anthropologists, is due to the increasing number of facts leading numerous botanists to have serious doubts as to whether it is the light rays at all which cause these deoxidations resulting from their action on the chlorophyll. They point out the fact that the light rays are stimulating to the vegetable protoplasm and if in excess they are destructive to it. Indeed some state that the use of the red coloring matter *anthocyan* found “in the young leaves of shade-loving plants when they become exposed to illumination exceeding the intensity which they normally encounter,” and found in greater amounts in the epidermis of *tropical plants* (sometimes in the mesophyll as well) is simply for the purpose of protecting “the delicate cells from the destructive action of too intense light, or to avert the evil of overheating from the solar rays.” Hence they suggest that the light rays are changed into some other form of energy, some inclining to the view that they are “stepped down” into heat rays, others to the view that they become electrical energy and that the resulting deoxidations are identical with those caused by electrolysis in the physical laboratory. The point for us to remember is that light according to its in-

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tensity is known to be stimulating or destructive to all plant protoplasm.

A most interesting result of the spectrum analysis of the light from chlorophyll is the fact that it is composed of the light from the middle of the spectrum, i. e., of blue, green, and yellow which combined form a shade of green, while the rays utilized constitute wide bands in the blue and violet and two bands in the red end, which are the rays irritating to our retinæ, and not absorbed by the visual purple. Indeed if plants are exposed in rotation to all the regions of the spectrum, some of them eliminate some oxygen in the violet band, *but eliminate most in the red band*, showing that the slower vibration is better in some cases than the double rate of the violet. Below the red where there are slower heat rays, there is no elimination of oxygen, showing that it is too slow, and is not utilized by the chlorophyll. In some plants (bamboo) the amount of deoxidation of CO₂ is strictly proportional to the amount of calorific effect of the ray to which it is exposed. This is very significant for it upsets some of our former conceptions as to the kind of vibration needed by every plant, and proves the red to have very great actinic power with certain kinds of protoplasm.

The manner in which proteid is built up in a plant is, by the way, wholly unknown. We have been solely discussing the deoxidations of water and carbonic oxide. The cells must receive the results of these deoxidations from the leaves and the nitrogen from the rootlets, but how they are combined is en-

tirely unknown. They are probably absorbed into the protoplasm exactly as in the case of animal protoplasm. Chlorophyll is as wholly unnecessary in one as the hæmatin in the other. In other words, for the assimilation of nitrogen and other foods light is not needed by the plant protoplasm. About the only thing we know with certainty is that the plant cell requires oxygen for its chemical changes, exactly as the animal protoplasm, and can be asphyxiated by deprivation of oxygen. The oxygen thrown off by the leaves is that derived from the deoxidation of carbonic oxide, but the oxygen used by the living protoplasm comes from the air circulating in the wood. Plant cells breathe exactly as animals, and use oxygen.

Animals are Modified Plants

In a paper on the evolution of terrestrial plants, Professor D. H. Campbell,² Chairman Section of Botany, American Association for the Advancement of Science, also explains that there is no fundamental distinction between plants and animals, so we can group all living organisms into one class. If they have to seek their food they are motile, but if their food is brought to them by air or water they become fixed as the terrestrial plants and many marine animals, and with this fixation there are appropriate changes in form, for all living things were originally motile and aquatic. Terrestrial forms are adaptations to changed conditions of water supply and to save themselves from death by drying. Some have

² Science, January 10, 1903.

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developed chlorophyll so as to utilize the sun's rays in assimilating carbonic oxide, but all others, whether animals or fungi, are dependent on the energy of organic foods. The fungi, he says, are probably of recent origin because of their dependence on organic food although they are borderland types once able to subsist on inorganic food, but becoming saprophytic or parasitic by selection. Indeed all animals can be considered to be descended from plants which have taken on carnivorous habits.

Omitting, then, the few cells whose green chlorophyll is able to neutralize the dangerous red and violet rays, or reflect the less dangerous yellows and greens, it is evident that all living tissues are equally affected by light rays. Plant and animal cells both must function in the dark, and while some may be adjusted to the effects of a little light or a little heat, they are all destroyed by too much light or too much heat. They arose in the oceans, protected from light, and must be protected from light forever.

Phototropism

Von Sachs has demonstrated the movements of plants to adjust the leaf surfaces to the rays of light coming from one direction and of moderate intensity. The stems bend parallel to the rays and the leaf surfaces become perpendicular to them. Some plants turn toward the light (positively heliotropic or phototropic) and some away from it (negatively heliotropic or phototropic). He showed that it was only the blue and violet rays which caused this and

that they acted as a stimulant in some way, but of course under intense light there are different effects. Jacques Loeb did the same with lower animals and found the same phenomena with violet rays as Sachs did with plants. He used nearly one hundred varieties. They arranged themselves with long axes parallel to the violet ray as though to escape the irritation as much as possible, it being a purely reflex movement, due to the stimulation of the muscles, for it occurs also in headless and brainless animals. The more nearly the ray fell perpendicularly to the surface the greater the stimulation. It was surmised that the stimulation resulted from some chemical changes produced by the light. Perhaps it is an electrolysis. Some of these animals were positively heliocentric—they moved toward the source of light even if it took them to the shade,—and others were negative—moving away from the source.

Several observers have reported that this effect of light in causing movements of animals is found in all colors, being very feeble in the red and increasing with the refrangibility, but Dandero² says the maximum is in the blue, decreasing slightly in the violet. In *Science*, February 5, 1902, there is a synopsis of a paper by Holmes, of the University of Michigan, in which there is much evidence of the powerful effect of light on *Ranatra*s.

² *Science*, November 6, 1903.

Photo-synthesis

Dr. D. T. Macdougall, Professor of Plant Physiology, University of Minnesota, explains⁴ that all vegetable organisms must use kinetic energy in some form to build up complex chemicals from their food; usually it is light (photo-synthesis) which, acting through the chlorophyll, tears the oxygen from the carbon of the dioxide and thrusts it out. Some obscure organisms, bacteria, etc., can use other forms of energy (chemo-synthesis, electro-synthesis, and thermo-synthesis), but their food materials used in the construction of complex substances are originally formed by green plants by photo-synthesis. If the light exceeds a certain intensity, the blue-violet rays exert a disintegrating effect on ferments and nitrogenous plastic substances.

As before mentioned, there is some unknown relation between the colors absorbed by chlorophyll and the particular work which those rays perform in the breaking up of carbonic acid. Perhaps longer or shorter waves would not do the work or be capable of being "stepped down," or transformed, to an electric current or whatever form of energy they assume to do their work. Therefore the rays reflected from the chlorophyll and constituting the sensation of green, are the unused part of the total light waves from the sun capable of giving color sensation. It is probable that the above relation will eventually be found and thus the green of vegetation be explained.

⁴ Popular Science Monthly, December, 1898.

Plant Adaptations to Light

Hence there must be adaptations to escape the excess of light. Thus the chlorophyll bodies arrange themselves on the side of the cell from which light comes, but move to the opposite side if the light is excessive. Leaves are either protected from excessive light by hairs, and a tough skin, or they are so arranged that they present the edges, and not the faces, to excessive light; in the tropics they are mostly vertical. Wilting of leaves is for the same purpose in the temperate zones. In massive plants the chemical activities are carried on in the interior protected from the light, but in lower organisms not protected and functioning in the dark, light is quickly fatal as in bacteria and other fungi. "It is a well-known fact," says Macdougall, "that the action of certain portions of the sun's rays actually impedes or checks the increase in volume known as growth, though it does not influence actual division of the cells to any great extent. When this retarding action is eliminated excessive elongation ensues." This action is best seen in the stems of vines which are shielded from light. Excessive growth occurs, but the tissue is weak and brittle from elongation of the cells and the waxy appearance is due to the substance, etiolin, which replaces the chlorophyll. Light is thus considered to be formative and a tonic for plants, but like all other tonics it is deleterious or even fatal in excess.

A later work on the influence of light and darkness

on plant growth by Dr. Macdougall details the results of darkness in suppressing the green color of the leaf blades, and in elongating the internodes of the stem and other modifications. It also shows that continuous light which extinguishes the daily "resting period" does not seem to do any harm to plants but merely exaggerates growth.

In *Nature* (Paris, 1904) there is an account of the successful transplantation of trees at night in full foliage. This cannot be done in daylight. It was formerly necessary to wait until fall or winter, but these new experiments show that there is a fatal factor in the light.

Reasons for Green Color of Plants

The green color of the plant chlorophyll bears some direct relation to its ability to absorb the rays of the wave length needed to break up the carbonic oxide of the air. If the chlorophyll were of a color at the other end of the spectrum, yellow, orange, or red, there would be a disturbance of this function—perhaps by absorbing too much of the short rays. When the violet and blue rays are not present, as in the sea, which reflects them, there is less and less need of green color. In the littoral zone (beach covered at low water) the plants are green or brown or red. In the sub-littoral (to a depth of forty meters) the browns disappear and the reds increase in number with the depth, until all are red in the elittoral zone, from forty to one hundred and forty meters. They seem to take a color which, in

this subdued light, will absorb all the actinic rays available. Below one hundred and forty meters there is so little light that there are extremely few species, though it is said an alga has come from one thousand to two thousand meters. The mopane tree of Mashonal, Africa, has leaves which are red at first, soon changing to a rich autumnal brown, and then assuming a brilliant green. This has some unknown relation to changes of light.⁵

We know that nearly all plants use the red rays, but why red should be used by some terrestrial plants to exclude this wave length in excessive light and yet used by deep sea plants to facilitate absorption of other rays in the dimness of the ocean is not known but will be worked out in time.

Definition of Plants and Animals

Now see what a difference there is between living organisms, or plants using kinetic energy (light, heat, electricity, or chemical activity), and the animal organism which depends exclusively on chemical activity of stored energy (potential energy). Plants must have the actual energy itself, animals must have it presented in bulk, or in stored form, to use at their leisure. Plants grow only when the energy is delivered to them, animals grow at all times as they carry their stored energy with them. There is the same difference between the two classes of machines as there is between a steam engine using stored energy of its food (coal) and a trolley car using kinetic

⁵ Popular Science Monthly, December, 1895.

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energy delivered to it. All kinds of definitions of plants and animals have been suggested but the above is as good as any. Plants store up energy from the sun and deliver the stores to animals.

Haeckel says, "The whole marvellous panorama of life that spreads over the surface of our globe is, in the last analysis, transformed sunlight." That is, sun's rays are the source of all our energy or force even if we expend it in the dark. The kinetic energy, then, which is necessary for plants, is wholly unnecessary for animals, which can function in absolute darkness. Not only this, they must be protected from the rays which will destroy their protoplasm. Whereas plants are so disposed as to capture a moderate amount of actinic rays, animals resort to all kinds of schemes to avoid these same dangerous rays. Indeed, as before explained, the higher functions of plants must be conducted in the dark carefully protected from actinic rays. There are halfway or borderland organisms difficult to place in either class by any definitions. There are also times when plants reverse their processes and use up the energy they previously stored. Nevertheless the definition is fairly good and useful. In doing work plants use kinetic energy, animals use potential energy.

Origin of Life

What is generally understood as the origin of life, occurred at a time long ago, when the earth was much hotter. Probably the first steps were taken when the temperature was over 212° F. and the water of oceans

existed as steam in the air, and when chemical combinations could occur which are now impossible, except in the laboratory under artificial conditions. Chemists have gone into the details of this, but they do not concern us here, except to say that it was by means of light, or shorter rays, that finally certain combinations could be made perpetual, and *this is life*.

The first life therefore was believed to be vegetable, kept up by some form of kinetic energy, and we gain our first sight of animals much later—and all of them were in the water. For millions of years all animal forms were marine, and none were on the land as far as we know. Woods Hutchinson says that all animal cells “outside of the lung are still absolutely and necessarily aquatic in their habit, and marine at that; they cannot live except when constantly kept bathed in a normal salt solution.” The lowest forms became adapted to terrestrial life by hardening of the exterior, i. e., became crustaceans, but the point is this—animal life arose in the water protected from the light more or less. Vertebrate marine animals arose much later but as soon as they took to the land they too had to hide from light or protect themselves by an armor. Hence the immense majority of animal forms pass their whole existence in the dark.

Water absorbs ultra-violet light to a very great extent, so that even in transparent streams the fish are thus protected and need little pigment. Experiments show that even two and one-half centimeters

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of water, used to absorb the heat rays in applying light to diseased conditions, will reduce the bacteriocidal power to one-fifth.

Cleaves ("Light Energy"), after reviewing the known data as to the action of light on plants comes to this conclusion: "From all this mass of experimental data, the paramount importance of light energy on the vegetable organism is evident. Vegetable life is not possible save in the presence of light, [excepting of course the bacteria and other transition forms between plants and animals]. Chlorophyll assimilation [decomposition of carbonic acid] or the fundamental phenomenon of plant life is only possible in the presence of the energy of light. The frequencies of the spectrum influencing this function are the red, orange, and the violet. Nor is the rôle of light confined to this phenomenon of vegetable cellular life above. It plays another most important part in the life of the plant. In connection with geotropism, it rules the direction of the growth of the stem, the leaves, their position, the position of the flowers—in short, it determines some actual movements of the three parts of the plant." Greater details can be obtained in the above book, but we have given sufficient for our purpose to show the great influence of light and the more important fact that every plant possesses some means of escaping or neutralizing the fatal effects of too much of this powerful agent on the naked protoplasm.

CHAPTER V

NATURAL DEFENSES OF ANIMALS FROM LIGHT

Animals Live in Darkness as a Rule

WE have been so overwhelmed with literature alleged to be scientific in which it is repeatedly told us that sunlight is absolutely necessary to animal life, that it is well to examine the facts and see if they do fit into the above detached observations so freely quoted from so many sources. Then we can apply this knowledge to man.

Professor Morgan in his work on "Regeneration"¹ states that there is only one animal (endodrium, a hydroid) in which light (violet) is needed for regeneration of a new animal from a part, and it is one of the few animals in which light has an effect on growth. In all other experiments it was immaterial whether the animal was kept in the light or in the darkness. He does not mention whether he tried diffused light, direct rays, or concentrated rays.

The vast majority of land animals live in absolute darkness, in the soil, in cracks of rocks, crevices, trees, caves, burrows, and under boulders, some never coming to the surface at all. Some spend the days hiding from the light and come out only at

¹ Macmillan. P. 30.

night. These are followed by carnivorous enemies, and there is a night carnival of feasting which ends at dawn.

The dread of light by tropical animals is so remarkable that our soldiers have frequently been astounded at the dead and deserted appearance of tropical trails in the daytime, at places where night work is well-nigh impossible for the plague of insects and the animals preying on them. I have ridden for hours on such trails in the daytime and the only animal life seen was a few butterflies with black wings and thus protected from the light.

Protection from Light

If any animal ventures abroad in the daytime, we find that it is provided with an opaque pigment or covering of some sort whose opacity is directly in proportion to the intensity of the light to be excluded. For this purpose, color is wholly immaterial, providing, of course, it is opaque, the color being for concealment, sexual purposes, or some other advantage unconnected with this point. Indeed a day animal exists solely because its opaque armor keeps out the deadly arrows of light and the ultra-violet, by destroying them or reflecting them.

Experiments in proof of these statements are so numerous now that the fact must be accepted as settled. Cleaves states that pigmentation of animals "should be interpreted as a defense against the action of light, especially against that part of the spectrum of such intense chemical affinity." There is a wealth

of evidence that even a very moderate layer of pigment is sufficient to stop the ultra-violet and even much of the blue-violet rays by transforming them to slower rates which are harmless or perhaps beneficial. Indeed Leredde and Pautier suggest that pigmentation in the skin of animals and man may actually "step down" the light rays to frequencies which can be utilized as energy by the organism, but this is all pure speculation without foundation of fact.

Even white feathers and fur are opaque because they reflect all the rays. R. M. Strong, of Haverford, Pa., has investigated this point as to white feathers and his work has been commented on by *Science*² as follows: "No white pigments have been found in feathers; the white color has been explained as due to a total reflection of the incident light from air spaces or bubbles in the feather structure. White feathers do not differ essentially in structure from gray, brown, black, red, orange or yellow feathers, except that no pigment of any kind is present. Though some of the white comes from the walls of the air-containing medullary cells of the barb, the larger portion is produced by the barbules which have no air spaces of sufficient size to be of any significance. The white effect, as with snow or powdered glass, is dependent upon the small size of the structural elements. These have a large number of surfaces so placed for any position of the eye that the angle of incidence equals the angle of reflection with a maximum reflection to the eye. There is almost no absorption by the unpigmented feather substance,

² February 13, 1903.

and the amount of light transmitted through the feather from objects behind is so small as to be imperceptible to the unaided eye in the intense reflection of light."

Pigments

Of course the surest color is black for it destroys all the short rays, but as it transforms them to long rays the animal would be put in jeopardy from the heat. Black is thus like a reducer in electricity transforming a high-tension current to a low tension of equal energy. Hence black animals are almost always nocturnal, their color in great part being evolved for concealment. Thus black leopards hide in caves or hollow trees, elephants in the densest jungle, the hippopotamus, crocodile, and carabao in the dark muddy waters of ponds or in mudholes.

~~X~~ The negro is really a nocturnal animal, like the other black animals of the tropics. Left to himself he behaves like the cat—inclined to sleep all day, hiding away somewhere, and becomes lively, energetic and active at night. In the Southern States the plantation negroes can be heard all night long, prowling about, shouting, singing, courting, and chicken-stealing. Their dances, camp-meetings, and household habits are based on this nocturnal instinct to hide from the light even if they are better protected than we.

The absorption of the longer rays of the sun by black feathers in the tropics is more or less harmless because the heat never reaches the skin but remains on the surface, feathers being very efficient non-

conductors or insulators of heat, conserving internal heat and excluding external heat. Perhaps black fur acts in a similar manner should the animal occasionally be exposed to the direct sunshine. Nevertheless crows and tropical animals seek the shade more or less, and show a marked contrast to the white birds such as the white carabao bird and white cranes which remain in the sunshine safely all day long.

In the case of white arctic animals, as before mentioned, color is for concealment, and also to assist in heat conservation, for there is too little heat to be of consequence at any time. There is no light to exclude for some months and there is sufficient opacity of the fur during the rest of the time. It looks like a curious paradox that nature should select white in the tropical day animals to exclude heat and in the arctics to conserve heat, but it is true and in accordance with physical laws. It is to be noted also that white animals, whether in the tropics or arctics, are heavily pigmented on exposed surfaces—nose, iris, legs, feet, etc. *

Day animals also generally incline to colors near the lower end of the spectrum, for they thus reflect the rays which are most heating, and absorb and change into heat the less heating short waves. That is, day animals incline to be red, orange, and yellow—a few being green and, very rarely, blue. Some combination of these colors makes the animal inconspicuous in its particular background, the commonest color being shades of yellow, with black markings.

Abbott H. Taylor announced³ the law of graduation of colors: "Animals are painted by nature darkest on those parts which tend to be most lighted by the sky's light and vice versa." So that there is practically a uniform tint when we look at them horizontally and the concealment is more perfect. It is to be noted, nevertheless, that there may be an assistance in excluding light rays, although it is to be confessed that the coat is opaque no matter what its color.

When the outer coat is not thick enough to exclude the light, but is merely colored to facilitate concealment, then the skin underneath is apt to be pigmented, as we see in many animals with white hair but no fur. This rarely occurs in birds for the feathers are opaque already. In all naked animals, elephants, rhinoceros, etc., the rule seems to be that a jet black pigment takes the place of the hair, an evolution which no doubt took place as the hair disappeared. Domestic animals preserved in artificial environments by man must be protected, or they revert to feral types very soon if they survive at all, because the colorations produced by artificial selection have less relation to utility in preserving them.

Ants in the tropics vary quite markedly in their pigment protection and act accordingly. The black ants do not seem to care if they are in the direct sun's rays or not. The dark brown and red ants can stand diffused daylight but shun the direct rays. There are very light colored ones which cannot stand

³ The Auk, April and October, 1896.

the daylight and work only at night. The white ants have no protection at all and keep in absolute darkness, building ingenious tunnels at night where necessary to go from nest to food. I collected some once and, though they received only the diffused light of the room, they died in a few hours. It is said that they are killed by only a few minutes' exposure to the direct rays of the sun.

Likewise, the grubs of wasps, bees, etc., are wholly unprotected, for they are reared in dark cells or in nests protected from all light except it be very faintly diffused. I experimented with a wasp nest once, removing it to the sunshine and restoring it after about forty-eight hours, but every grub was dead, and I witnessed the remarkable spectacle of the wasps devouring the dead grubs which they had lately been rearing so tenderly. Larvæ which assume the pupa state for their transformation, do so in the dark, or else they make the pupa case perfectly opaque.

Marine Animals

In the sea, sunlight is supposed to extend not below two hundred fathoms, but for some sixty fathoms above this it is too dim for plant life to exist. Below the layer of surface animals and plants called the pelagic, there is believed to be a zone with little or no oxygen and therefore absolutely free of all life, both animal and vegetable; but the floor of the ocean is thickly provided with animals which subsist ultimately on the bodies of the pelagic creatures which have died and sunk, there being of course

carnivorous larger and larger species just as on land. The currents carrying oxygen are at the surface and bottom, the latter coming from the arctics. "These deep-sea fishes are, as a rule, dark colored, particularly those hiding in the ooze in the bottom. Many of the crustaceans, starfishes, and crinoids are quite brilliant. The comparative scarcity of high colors in the majority of bottom animals is doubtless due to the absence of sunlight. It is possible that the brilliant colors that some of them have were acquired by their ancestors under the influence of sunlight (i. e., protective resemblance to the high-colored corals and vegetation of surface life) and have never yet become obliterated."

It is also possible that the existence of colors is directly related to the existence of phosphorescent light. "It has the actinic [visual] property of rendering conspicuous the reds, yellows and greens which predominate among the deep-sea animals."⁴ Though there is no sunlight in the deep sea, and as a consequence many species are blind, it is certain that there is some kind of light there, because a few animal forms brought up by dredges have eyes which in some cases are very highly developed. In animals living in dark places the eyes invariably undergo involution and eventually are entirely absent. This light may be quite abundant in some places because many of the forms have gorgeous and brilliant colors which we can safely presume are not for any other purpose than a beneficial one, aiding the animal in

⁴ C. H. Townsend, *The London Magazine*.

some way in its struggle for existence, and we cannot now imagine any other purpose than that of reflecting faint phosphorescent light either to make the animal conspicuous to its friends or to conceal it among similarly colored fixed forms, as among the colors of shallow water where the brilliant fish resemble the brilliant background.

Dr. Alex. Agassiz mentions numerous cases of sea animals which can scarcely be distinguished from the parts to which they cling. The light is no doubt phosphorescence, and in some of these animals it is exceedingly brilliant, leading to the impression that there must be brilliantly lighted areas. A shark brought up by the *Albatross* from one thousand three hundred and sixty fathoms emitted a greenish vivid light from the entire under surface of its body, while its upper surface was dark. Perhaps this is the way it seeks prey at lower levels than itself. Other animals have phosphorescent spots to lure their prey, as described by Professor Hoyle of the *Challenger* expedition.

Now it is suggestive that the colors are mostly from the red half of the spectrum, scarlets, reds, oranges, yellows and greens, the reds being very numerous, and the blues and purples being rarely mentioned. This would seem to indicate an absence of rays at the actinic end, and therefore the animals, as far as actinism is concerned, are in the same position as though they were in relative darkness. The black color of many would indicate that this is merely to escape notice, in the mud, and indicates in addition

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that if there are any actinic rays these black fish get none.

Even if there were actinic rays, it does not seem reasonable that the animals would expend energy to produce rays which are to do no good from their actinic effects alone. It seems merely for the sole purpose of seeing, and the rays giving most light effect are probably the only ones produced. We are sure there are few heat rays for the deep-sea currents are colder than 32° F.

Among the lower animals which are nocturnal or subterranean in habits, there are a large number of species which produce phosphorescence. In the former it is purely for seeing or leading the males and females together, but in the latter the use is not yet discovered. In all of them we can dismiss actinism as in the case of those of the deep sea.

Now when we consider the fact that the ocean covers three-fifths of the earth's surface, and that these animals on its floor exist in as great if not far greater numbers than those on the land surface, some patches being a mass of living things, we can well assume that the majority of animal species live and die in regions of absolute darkness, never exposed to actinic rays, and their ancestors have done so for untold millions of years. This should dispose forever of the old notions that all animals need light.

Finally, we find that surface day animals, which formerly we thought depended upon sun's rays to be healthy, can often be completely shielded from these

rays for many years and still be perfectly sound and vigorous, as in the case of mules and other animals kept in deep mines and never brought to the surface, and as is also evidenced by the fish and other inhabitants of caves. These latter, by the way, formerly lived on the surface but wandered into the new environment, becoming blind through the law of involution of useless parts.

As for the color of animals, irrespective of "protection," "mimicry," "sexual purposes," etc., we have positively no information as to their significance. If they are opaque, the color is immaterial as far as the protection of the underlying protoplasm from light. Since they turn the absorbed light rays into slower infra-red rays, or even some other form of energy, it is quite likely that they will be found of extreme utility in that direction. Even in the case of colored animals which pass most of their lives in the dark, it is possible that the colors have some relation to transformation of energy absorbed from other sources or radiated from themselves, or even some benefit in conserving the energy of the animal itself. It is an exceedingly complicated topic of which there is an immense literature, a summary of it being published in a paper by Charles W. Hargitt, of Syracuse University.⁵ We will in time find out why there are certain brilliant colors on animals which spend their lives in the dark, but at present there is not the slightest reason for Hargitt's statement that these colors do not result from natural selection. They must be beneficial to be so carefully.

⁵ Science, January 22, 1904.

selected by nature and it is our task to find that benefit.

Production and Changes of Pigment

J. Loeb ⁶ states that melanin production is a peculiarity of certain epithelial cells and that such cells continue to produce it after transplantation to places where non-pigmented cells exist. It is a specialization from a long evolution, but the method of the production of the pigment is wholly unknown. It is surmised to be an oxidation and condensation, and if this be true it probably requires light for the purpose.

Cleaves notes numerous experiments in lower animals showing that pigment is produced by exposure to light, and that certain species can be decolorized by some months' confinement in darkness, and, strange to relate, there are a few opposite cases where darkness causes pigmentation—a matter wholly unexplained. In the case of the chameleon and similar animals the reflex changes of color are wholly protective, by increasing the resemblance to the background, and due to the changes in the depth or shape of the pigment filaments. But no matter what the external color becomes, the pigment is a protection from the short rays as it is always present.

Exner, of Vienna,⁷ reports that the human iris changes markedly in color when the person goes from the dark to the light, yellow-green eyes becom-

⁶ Journal of the American Medical Association, July 23, 1904.

⁷ Medical Record, October 22, 1904.

ing gray-blue; dilatation of the pupil also causes the iris to become thicker and darker. It was generally known that the iris changes in color from time to time but the reason was not known. It appears to be a phenomenon similar to the changes in the chameleon, but unlike the changes in that animal it is not for resemblance to the background but to grade the protection according to the degree of light.

It is quite probable then that evolution of pigmentation of animals follows the law which is so universal throughout the whole living world, namely, that the environment modifies the organism, and that if this new character is an advantage the organism crowds out others less fitted. Hence there is no other conclusion except that pigmentation has been and is a necessary evolution.

CHAPTER VI

KNOWN EFFECTS OF LIGHT ON MAN

Men Who Live in Darkness

IN the case of man there is already a profusion of literature on the subject of the effects of light on his cell protoplasm, and nature has been at work for so many thousands of years eliminating the unfit and selecting proper types in each zone that we have a wealth of data as to the gross results.

Man's protoplasm being the same as that of other animals and of plants, it follows that he is under the influence of the same laws as to light as all other living things, that is, he can do without it in spite of our fanatical faith in its utmost necessity. Dr. Arlidge, an English physician, has shown that miners who spend so much time in the dark are healthy and live to a good old age, generally. We must explain in other ways the anæmia and poor condition of prisoners who are confined in dark dungeons. Insufficient food, exercise and oxygen are amply sufficient to account for it. The tuberculosis so awfully prevalent in prisons may be a direct contagion in people who are of lessened resistance not only from the above reasons but from that congenital susceptibility to this infection so remarkable in the degenerate classes.

It is one of the curiosities of medicine that the employees engaged in the Paris sewers, in spite of the foul gases they breathe and the germs they encounter, are as healthy as, or healthier than, the people who work in the streets. The darkness instead of injuring them has apparently helped them, for they have not been damaged by light rays like the street workers.

There are no data at hand to compare the health of the employees of the London, Paris, or New York subways, but of this we can rest assured, they will be better off in summer than those exposed to the surface glare of the streets.

Dark Houses the Rule

Residence in dark houses is practically harmless, even for brunettes, who are adjusted to more light. There can scarcely be hardier races than those who now live in Scotland, and yet their dwellings have always been small and dark. The early cave dwellers of Europe carried on the human species for millenniums in perfect health. The Eskimo is practically a cave dweller now and so is the Russian peasant and the people of Siberia, and millions and millions of city dwellers also. Not only do yellow Chinamen thrive best when huddled together in cellars, but swarthy European races also. In St. Petersburg 250,000 people live as parasites in the cellars of the wealthier classes.¹ The underground population of London and New York is very large, but of course nothing to compare with this. The

¹ Collier's, January 9, 1904.

contagious diseases which flourish among these people are mostly due to overcrowding and are always found where people are crowded to the same extent into lighted rooms above ground.

At the present time the homes of the poorer Irish peasantry are described as "little better than caves in the hillside," differing in minor degree only from the homes of the ancient cave-man. Nevertheless if he is not starved the Irish peasant, in spite of this lack of light in his home and out of it too—for the average cloudiness is very high—is a type of great physical vigor and is the instrument by means of which Great Britain rules so much of the world. Without her Irish soldiers, sailors, judges, and civil servants, England's power would wane. Dark houses have not injured them, for they have always lived in cave-like hovels, differing in no respects from dark stalls for animals, often with no chimney or fireplace, and, of course, no stove, and into these places are huddled many people.

Edward Eggleston,² describing the primitive dark houses of our earlier settlers and the frontiersmen, mentions that in parts of New England, New Netherland and Pennsylvania, the first-comers began the New World as cave dwellers, in cellars formed by digging into a bank, just as the frontiersman does at the present day in our western country. He mentions that these "dugouts" were not new things, but were mere copies of what were common dwellings in the midland counties of England and parts of France, the people living in subterranean

² *Century*, April, 1885.

caves and cabins of mud. So it is quite likely that the cave dwellers are with us yet—a habit of living which has lasted some two hundred thousand years harmlessly, and a dark house is therefore not as harmful as the present generation of sanitarians assert, except as it is a healthy place for bacteria as well as man.

The people within the Mediterranean zone live in dark, cave-like houses, especially designed to keep out the light, and they have remained unharmed thereby for many thousands of years, as healthy now as in prehistory. It is in accordance with natural laws that their babies must be carefully hidden away in these dark cells, just like the young grubs of bees and wasps in the dark, cave-like cells of the hive or nest. We moderns of the intelligent classes alone violate the mother's instinct to hide away in the dark with her baby, and we ruthlessly thrust it out into the sun's rays—actually strapping the poor little sufferers into their carriages and torturing them with the direct rays of the sun pouring down into their faces. Every now and then a physician has to call attention to the damage done to babies' eyes by this senseless practice. We might allow a short exposure to diffused light, the head being shaded from the direct rays, for the stimulation may be as beneficial as the similar short exposure ants give to their eggs. But we are not likely to find that ants will let their eggs remain out all day unless they want to kill them. We must remember that our babies have been in almost complete darkness for the nine months prior to

birth (veritable cave dwellers), and are unharmed thereby, and that for a few months more they need a similar habitation, shaded, clean, free of disease germs, and with plenty of oxygen and means of disposing of carbonic oxide. Dampness, if warm, will not injure them—they were quite damp for nine months. Chilling is fatal.

We are the only people who have gone daft on the subject of admitting streams of powerful light into schoolrooms and nurseries—far more than is necessary to see well. We are apt to seat the children so that the light glares right into their faces, and then we wonder why they develop sore eyes. We are now daft on the subject of letting the light stream into the living rooms and consequently suffer from all kind of nervous effects wholly unknown to our ancestors, who were so careful to keep the blinds closed and the houses darkened. The only room into which floods of light should stream is the water closet, but for that we generally select the darkest, foulest, and least ventilated corner of the house, some hotels even putting it into the cellar where the guests must grope around in the dark.

It is the duty of the pediatricists to find out how much of the curious modern nervousness of children is due to excessive stimulation of the "light-baths" of the nursery, perambulator or schoolroom. They will find why so many children come home from school daily with a headache and an attack of "nerves."

Sunburn

Charcot in 1859 was the first to show that sunburn was due to the short and not the long waves. Others have made sunburn appear by applying cold electric light, and X-ray can also produce a similar pigmentation. Hence the erythema due to heat (burns, scalds, etc.) is entirely different from that brought about by actinic and X-rays. Finsen showed that light caused a prolonged dilation of blood vessels and his assistant, Bang, demonstrated a marked accompanying leucocytosis.

Both Finsen and Whitmarsh demonstrated that sunburn and tanning were caused by the actinic or short rays and not by the long or heat rays. Tanning was nature's method of preventing these short rays from penetrating blond skins.

Penetrability of the Skin

Finsen, long ago, that is prior to 1894, also showed that violet and ultra-violet rays if concentrated can penetrate quite a distance into our bodies. Borden³ mentions that they had been shown to pass entirely through, and Drs. W. S. Gottiel and M. W. Franklin proved that they pass entirely through the body, if strong enough, and affect photographic plates.⁴

Many experiments have been made to test the penetrability of the skin to violet and ultra-violet light, and the reports are quite discrepant, but the

³ National Medical Review, March, 1901.

⁴ New York Medical Record, April 9, 1902.

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discrepancies are all cleared up if we take into consideration the amount of light, its concentration and the degree of pigmentation. Thus a black skin will stop rays which will pass through a brown skin and the latter will exclude those passing easily through a blond skin. Hence a moderate degree of ultra-violet is stopped by the skin, but Freund proves that concentrated light passes through all skins as before mentioned. Similarly the longer the wave, the more easily does it penetrate all skins, and while the violet sun's rays pass with difficulty through pigmented skins, the ultra-violet of an equal amount of sun's rays may be stopped.

Systemic Effects of Light

In the higher animals light causes a marked increase of the exhalation of carbonic acid indicating increased metabolism. Dr. Heinrich Stern, of New York,⁵ mentions the power of sunlight to increase metabolism, and refers to the great increase in weight of live stock by keeping the animals in the dark, in addition to enforced rest, over-alimentation and castration. He refers to the fact that hibernating animals may lose but little weight in their dark hiding places. It is also true that those lower races of men, Eastern Russians and Eskimos, who can sleep long periods in their dark houses in the long dark winters, lose very little weight.

Guido Holzkrecht⁶ describes a systemic disease

⁵ Medical Record, October 25, 1902.

⁶ Archiv für Dermatologie.

with chills and fever lasting from a few days to three weeks, following X-ray dermatitis. It may be accompanied by an exanthem of the whole body resembling scarlet fever.

H. E. Schmidt⁷ describes a peculiar erythema which now and then appears within a few hours after an effective application of the X-rays. He calls it "Frühreaktionen," and shows that it is entirely different from the X-ray dermatitis which does not appear until eight to fourteen days. This erythema is undoubtedly a symptom of a vasomotor paralysis, differing in no respects from the anæsthesia of ultra-violet applications. The dermatitis is, on the other hand, a symptom of an actual injury of protoplasmic vitality, or chemical composition, followed by an actual inflammation.

One form of the periodic headache called migraine is so often due to excessive light that it was once called *sun pain*, and many sufferers find their sole relief in absolute darkness.⁸

Man's Pigmentation

Consequently we find that man is invariably covered with a pigment which acts as an armor to exclude the more harmful short rays, and moreover the amount of pigment is in direct proportion to the intensity of the light of the country to which his ancestors have proved their adjustment by centuries or millenniums of survival in health and vigor. It

⁷ Deutsche medicinische Wochenschrift, May 12, 1904.

⁸ Gould, American Medicine, January 16, 1904.

is a simple matter of mathematics to show that the intensity of light under the zenith sun in the tropics is the greatest, and that the amount of rays per unit of surface diminishes as we go north in proportion to a function of the latitude.) In addition to this, the further from the tropics we go the greater is the layer of air which the rays must pass through and the more of them which are absorbed. Hence we can reach a latitude where there is insufficient light for plant growth even if there could be sufficient warmth. Yet man flourishes in those regions, and so do other animals. Hence we find the greatest pigment in the tropics, among Australians, New Guineans, Negritos, East Indians, and African negroes, some of whom are nearly jet black. As we go north from the tropics we find the complexions gradually lightening, being dark brown in Egypt, light brown in North African States, deep olive in the Mediterranean, olive in Southern Europe, brunette in Central Europe, and blond in the northwestern section of Europe, embraced by a curve passing through Northern France, Northern Germany, and Northwest Russia.

Undoubtedly the negro, when in the shade, is able to radiate heat better than whites and this enables him to keep cool in the tropics, but puts him at a disadvantage in the north where a white man can keep warmer with less clothing and less fire in the house. But it is a secondary cause enhancing the first, because when it comes to a question of light and cold, nature makes no mistake, but selects a color able to

exclude the light. (Hence in all cold light countries, i. e., steppes, plains, and the arctics, there is pigmentation of a color in the lower end of the spectrum, red or yellow, with variations of brown, olive, or copper. As a rule the color is markedly light yellow in cold light countries, as in North China.

In America we had every shade from the black Indians of tropical South America through all the shades of copper and brown to the very light, almost white Indians of the northeastern part of the United States, who had conditions very similar to those suited for the blonds of Europe. In Italy, Spain, and China we find the same thing, for the men of the south are markedly darker than those of the north.

The same law holds in France, Germany, Russia, Persia and India: the north is decidedly blonder than the south, and the same is found in the British Islands but in a much modified way. Even the Ainos in the north of Japan are said to be lighter than the Japanese.

All these red and yellow colors undoubtedly enable the native to conserve his heat almost as well as the white man, and at the same time exclude the dangerous short waves. It is not strange then that man's colors should be of the same order as those of animals, for they evolved for the same purpose of destroying or "stepping down" the short wave lengths from the green up to the ultra-violet, nor is it strange that we find so many reds and yellows in plants for the same purpose.

Efficiency of the Pigment Normally

In Cleaves' work on "Light Energy" there are quoted a number of experiments showing that the skin pigment of man is really perfectly efficient in excluding those short rays to which that man is naturally exposed in his ancestral home. Of course there are apparent discrepancies from failure to note the amount of pigmentation and the degree of concentration of the light. Nevertheless it is proved that blue, violet and ultra-violet frequencies are stopped at the surface except when concentrated, or when the skin is very blond. But even with concentrated light which Freund reported did penetrate, others found that pigmentation noticeably lessened the penetration. It is also known that the pathological effects (sun, glacier, and electric burn) are noticeably less in pigmented skins.

The great efficiency of the skin pigment in excluding the short waves is seen in the literature of X-rays. J. Rudis Jicinsky⁹ shows that the effects of X-rays are the same as those of longer rays of violet and ultra-violet, and he further shows that blonds will tolerate only short exposures at long intervals, while brunettes seem quite immune to the unpleasant results of erythema and dermatitis. Many others have published similar statements and have shown that brunette operators are rarely injured, while blonds had better keep out of the specialty, even if they wear protective masks and gloves. Dr. Carl Beck

⁹ New York Medical Journal.

shows¹⁰ that *all* who were injuriously affected by X-rays were blonds except himself, and he escaped several years. "Blond individuals seem to be specially predisposed."

The bronzing of the skin, after X-ray applications, is found by experience to be an efficient protective against large doses. Leonard¹¹ mentions that the full standard dose is not given until after the skin has been bronzed and hardened by treatment—an artificial brunetteness induced.

If the slight amount of pigment in a Caucasian can be so efficacious, how safe must the negro be, with such a remarkably dark evolution, and hence what a constant bombardment all white men must have in the tropics. No wonder they break down.

Ultra-violet light is completely destroyed by blood or tissues in which blood is circulating, so that compression by a quartz plate is necessary when applying these rays therapeutically. Quartz allows them to go through while glass stops them, but Dr. H. G. Piffard, of New York, prefers adrenalin (1-1000), to which he sometimes adds a di-hydrochlorate of quinine. If this slight redness is so efficacious in the large amounts of light we use therapeutically we can rest assured that the red pigments in the skins of all pigmented races are equally efficacious in destroying the lesser amounts of ultra-violet sun's rays, and also the longer violet rays, which impinge upon them in their native climates.

¹⁰ New York Medical Record, January 13, 1900.

¹¹ American Medicine, December 3, 1904.

There does not seem to be very much difference between a very blond person and an albino, yet the former has sufficient pigment for protection in an environment to which the albino is wholly unsuited. Total absence of pigment is an evidence of degeneration so that albinos have other defects which more or less account for their shortness of life. Nevertheless, the damage due to the light must be largely responsible. The nystagmus from which they suffer, and virtual blindness in a bright light, are both due to excessive stimulation or even anæsthesia of the retina, and similar harm must be done to other structures in time. In the tropics they are said to be blind from 9 A. M. until 4 P. M. They are in the same position as blonds in the arctic summer where the snow glare causes snow blindness, a condition of irritation, with more or less conjunctivitis and anæsthesia (or paralysis) of the retina, and even optic atrophy.

There is a class of light blonds called albinos among the Filipinos. They have light blue eyes, blond hair and reddish complexion, but their other features are so similar to the pure Malay that it seems they are degenerate types like albinos and not half-caste descendants of red blond Europeans. They are generally young, showing short life, and a friend who looked the matter up reports to me that nearly all of them have nystagmus. In one case examined I could find no retinal disease, though the movements prevented accuracy of observation. They are pigmented enough for a northern and darker

climate, but unfit for the tropics. Those who do not have nystagmus have a peculiar retiring manner with downcast eyes as though they were suffering from photophobia.

Miners, by the way, also have nystagmus in quite a marked degree, but here it is some form of eye strain most probably which causes the disturbance.

Eye Injuries from Light

William Rollins¹² mentions numerous cases of permanent injury to the eyes, and even blindness, due to X-rays, and details the extreme precautions to be taken by operators. This applies to radium rays and also to the violet and ultra-violet, so that dark glasses are really necessary for blonds in tropical countries, though we ignore this as a rule and run the risk. Eye diseases cause 15.47 admissions per 1000 to our sick report in the United States, but in the Philippines it is 18.89.

The effect of light in causing sneezing is a well-known phenomenon whose mechanism is not known by any means. There are reported, in addition to this, observations by a Massachusetts doctor, who suffered from hay fever, that somehow strong light brought on the attacks just as in the case of sneezing of normal people. He is said to have succeeded in warding off his own attacks by wearing smoked glasses in the proper season and has succeeded with several patients. Hay fever is rarely, if ever, found except in neurotic people, who need only some such

¹² Boston Medical and Surgical Journal, April 2, 1903.

mild stimulus to cause neurosis, and the report has the earmarks of probability. It would be interesting to find out how many of the hay-fever sufferers are blonds. By present recollection those whom I have known are mostly blonds, and there is likely to be some relation between the disease and lack of pigment adjustment. It seems to be more prevalent among blonds who are living in countries lighter than their ancestral European home.

Nevertheless Cleaves quotes Freudenthal as being quite successful in improving about half of his cases of hay-fever by electric light applications, though ten of his twenty-four cases showed no change or stopped treatment too soon.

The *Medical Review* is quoted as stating that Professor Ferme has found "that exposure to the sun's rays produces symptoms of many diseases which persist for many days after the exposure. This congeries of symptoms seems not very formidable, yet it induces the author to conclude, from the observed coincidences of meteorological conditions, and of certain diseases, that exposure to the sun's rays is a predisposing factor in coryza, influenza, hay fever, and epidemic meningitis. A curious element is the fact that only fifty-three per cent. of the persons under experiment found the exposure disagreeable, while the others, notwithstanding the subsequent ill effects, enjoyed it."

Kreibich¹⁸ has found that on the onset of summer light affects both skin and eyes and that the skin may

¹⁸ Wiener klinische Wochenschrift, 1904, p. 1459.

become thickened and pigmented. Vernal conjunctivitis is often accompanied by swelling of the cervical glands and he thinks that all these result from the actions of the chemical rays, and he finds that opaque glasses or bandages quickly cure the conjunctivitis.

We have a disease in the tropics similar to snow blindness but it is mild, as we never have the great radiation from the ground such as we receive from snow. We also have an affection similar to vernal conjunctivitis which of course is merely a mild form of what in winter we call snow blindness. In both extremes of temperature then, either the arctic cold or the tropic heat, it is due to the light and we can have every conceivable grade of the affection from simple conjunctivitis to paresis of the optic nerve and retina (night blindness) or paralysis and atrophy with permanent blindness. I have examined a case of chronic pigmentary retinitis due to exposure to excessive light in the tropics, and a severe case in a signal officer due to work with sun's rays in the heliotope mirror in the United States.

Hemeralopia (day sight or night blindness) exists as a symptom of many conditions of the optic nerve and retina but the idiopathic form has no pathological signs except xerosis of the bulbar conjunctiva, and is apparently due to a torpor of the retina and nerve, which in turn is due to a lowered vital tone from malnutrition, as in jaundice, fevers, alcoholism, and pregnancy. It is also noticeable in the case of ill-fed inmates of workhouses, jails, and asylums,

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soldiers in the field and sailors, and in these it is often accompanied by scurvy. But it is also often due to overstrain of the retina from excessive light as in sailors who have recently been exposed to tropical light, and it is not uncommon in the spring in northern climates when the sunshine becomes intense. It may also be an accompaniment of the conjunctivitis of snow blindness or the similar conditions in the tropics. I have seen a limited epidemic of it in volunteers in the Philippines, and it occurs in our Southern States among the badly nourished.

Press reports apparently indicate that in the recent British invasion of Thibet many soldiers were stricken with snow blindness—a country where the natives are so brunette. In Manchuria, the same conditions confront the Russians, for the snow glare is so fierce that even the yellow native is occasionally affected, and the need of smoked glasses for the Russian soldier is receiving attention. The Japanese, on the other hand, appear to be amply protected by nature.

All the above facts show the great necessity for pigment in the iris, retina, and choroid, and that the density of the pigment must be in proportion to the degree of light to which that type of man is exposed.

Man's Need of a Little Light

We now come to the opposite side of this matter, —the stimulating effects of a moderate degree of

light and whether or not we need this stimulant. We have already noted that light increases the oxygen-carrying capacity of the blood, increases the excretion of carbonic oxide, and that the shorter waves seem to cause a beneficial stimulation in the young of many of the lower and higher animals as shown by better development, and the idea is growing that though man's protoplasm can function without this stimulation, yet he is better off if he has it and thus reaches his highest vigor and efficiency.

Sir James Crichton Browne in his address to the Manchester Sanitary Association speaks of the tonic effect of light and how necessary it now seems to have this stimulant, but he omits all mention of the destructive effect of too much stimulant.

Dr. R. A. Katz¹⁴ states that the tissues demand some light stimulation, and that there may be an actual "light hunger" as a result of darkness. The black negro seems to suffer from this "light hunger" in the United States, and enjoys nothing better than to sleep in the direct rays of the sun for it gives a feeling of extreme comfort. Likewise, the negro who goes to the Philippines experiences a tremendous increase of this feeling of "well being" and there is a great desire to remain because he is so comfortable. The negro soldiers who remained were nearly all jet black, for the lighter types were not so adjusted nor so comfortable. All new-comers to the Philippines also feel this stimulation, and write home glowing accounts of the excellence of the climate, but in

¹⁴ Roussky Vrach, September 7, 1902.

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their case it results in eventual exhaustion and lessened resistance to disease.

There is a general impression that man's chemistry has become so adjusted to the stimulating effects of a little light as to be now dependent on it, as witnessed by the anæmia of those confined in dark dungeons, and also their lowered mental and nervous tone, though, to be sure, these can be explained on other grounds. Nevertheless men have lived in fairly good health for many years in dark places where little light ever penetrates, and whether they can ever live in such complete darkness as must be the fate of many deep-sea animals is not known, but it is probable that they can. Hence, though we can do without such stimulation, it is quite likely that our metabolism is too sluggish or defective if we do not get it—that is, the machine drags and needs prodding to do its work.

All races need the stimulating effects of tea, coffee, or other nerve stimulants, and certain races seem to be adjusted to the stimulation of a little alcohol, and, though they can do without it, it is quite likely that their chemistry is too sluggish or defective if they do not get it, and are less efficient and of less longevity. In each case—light or caffeine—too much seems to be harmful for they are powerful agents for destruction. This is the mistake made by all advocates of light in the treatment of disease or in health. They seem to think that if a little is good then a great deal must be better, and they run to dangerous extremes in advocating too much ex-

posure. It is as absurd as to advocate a quart of whisky daily to a patient who finds he is benefited by an ounce, or drowning a man to relieve his thirst or cremating him if he is chilly.

The need of the shade of tree or vine is mentioned in all ancient subtropical literature—it is even crystallized in proverbs, and in the famous one inculcating charity to all, even to the enemies who destroy us—“the tree doth not withdraw its shade from the woodcutter.” The Bible is full of such references to the need of the shade of one’s own vine and fig tree, and the terrible burden of labor in the heat of the day. They never had a light hunger, which is a northern symptom. We of the north are the only people who worship the light.

Dr. James Weir, Jr., states¹⁵ that “the violet rays are absolutely necessary in the upbuilding of the normal healthy man. Their action must be, I take it, primarily through stimulation of the vasomotor nerves. The first effect is dynamic in character; there is a dilation of the blood vessels with a consequent flow of blood. The second effect is chemical in nature; the increased flow of blood incites the blood-producing organs to manufacture new blood cells. Consequently the plasma of these cells differs chemically from the plasma of the old cells. There is also increased oxidation and oxygenation through the lungs. The third effect is purely physiological. Owing to the increased flow of new blood cells to the tissues, cell growth is excited and new

¹⁵ Scientific American, November 22, 1902.

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tissue is formed. Of course, waste is going on all the time; the violet rays merely act as a tonic in stimulating the organs of the animal economy toward repairment of waste by removing and building up tissue. These beneficial rays are present in diffused daylight, hence the direct rays of the sun are not absolutely necessary in order to produce their good effects on the animal organism. Direct sunlight, is, however, an exceedingly efficacious tonic when used moderately and understandingly; there can be intemperance, however, in the use of every good thing that nature has given us."

The above is very much to the point. We are dealing with an agent which, in concentration (X-ray or violet ray), no animal or vegetable protoplasm can resist. All living things perish when exposed to concentrated light for any length of time, though they may stand a little all the time, or much a short time. Moderation in all things is the best rule. The lack of all stimulation is very dull, but does not destroy life. He is a cheerful sinner, to say the least, who has a bright cheery house and a bright cheery wife, and when he goes home at night has the latter make him bright and cheery by mixing his toddy for him when he needs it. We do not need darkness because light is deadly in excess, but we do need the stimulation of a little light. We do not advise total abstinence for those who need alcohol, for, though it is deadly in excess, they may flourish under the stimulation of a little of it.

Mental Stimulus of Light

The stimulation of strong sunlight has been frequently mentioned by literary men of genius, for, with rare exceptions, they have very sensitive nervous tissue in which the results would be most noticeable. In addition, their greater intelligence enables them to notice and appreciate the relationship of cause and effect. Dexter quotes quite a number of instances in his recent work on "Weather Influences." For instance, Shelley is said to have depended upon the stimulus of light, and some of his best poetry was composed on the roof of his house near Leghorn, entirely un-screened from the pelting rays of the hottest Italian suns. Byron was no less a sun-worshipper, who noticed remarkable changes in feeling on sunny days. Charles Lamb, though very fond of London, even with its darkness, fogs, and smoke, was stimulated into enthusiasm by a short sojourn in the Mediterranean sunlight. Benvenuto Cellini in his imprisonment had a veritable light hunger, yearning for the sun's rays, and even suffering from hallucinations of sight in which he imagined himself in the sunlight. Lady Mary Wortley Montagu speaks of this stimulation, and at one time thought of moving to Africa for permanent residence. The poet Moore sang the praises of sunshine. Rousseau, like Shelley, "loved to expose his bare head to the sun's fiercest rays even in the hottest weather." Goethe speaks of a "sun thirst," and Walt Whitman experienced it, and, like Southey, he wrote while lying in the hot sunshine on

the white sand of the seashore. The history of literary men shows that they frequently perform long and exhausting labors under the influence of stimulants, but are apt to collapse after the work is done. The above illustrations show, therefore, but one of the numerous means taken to stimulate the brain.

Other Results of Light Stimulation

It is not known why ants of certain species occasionally carry the eggs out of the nest into the daylight. Such exposure, if long continued, is always fatal, but it is probable that the very short exposures permitted are really stimulating to the developing ovum and beneficial, but so far as known to the writer they are the only lower animals which deliberately give light baths to their young. Yet I doubt whether any white baby would survive if it were exposed naked to the same amount of light, so we are not safe in following the lesson of the ant, nor on the opposite extreme should we imitate the bee which keeps its young in darkness.

A. E. Thayer¹⁶ has shown that the death rate in houses on the north side of east and west New York streets is higher than on the south side, the increase being mostly in pneumonia, phthisis and nephritis, and he considers it due to the fact that the south-side residents get more light and air, as they live in the rear rooms which are sunnier and warmer in winter. This may be so, yet it is not at all conclusive, because sleeping rooms are also in the front

¹⁶ New York Medical Journal, January 24, 1903.

of the house, and about equally distributed as to light. As before mentioned, also, a very large number of races from the cave-men down to the present have lived safely in dark houses. Then again the glare from the south side of the street is reflected into the opposite houses, so that it is not at all certain that they receive less light than the south side houses.

Professor Claudio Ferni,¹⁷ in concluding his series of experiments on the injurious effects of solar rays, says: "Under the influence of the direct rays of the sun about eighty-three per cent. of persons experimented on fell ill during the two months of trial. In sixty-nine persons, headache was complained of by fifty-two, sleeplessness by fifteen, conjunctival irritation by twenty-five, heat sensation in the face by thirty-five, dryness of the nose in forty-six, thirst in forty, dryness of the lips in fifteen, a slight pharyngitis in forty-four, weakness of the feet in thirty-two, coryza in fifty-two, and fever in twelve. These persons were exposed to the rays of the sun in April and May for a variable number of hours each day, and were given light muscular work. It was found that the April sun produced more physical discomfort than the May sun. No difference was found between the action of the morning rays and that of the afternoon rays. Experiments with colored glass and solutions of alum through which the rays were passed showed that the heat rays, rather than the chemical rays, were responsible for the disturbances observed in persons exposed to solar rays."

¹⁷ *Gazette degli ospedali e delle cliniche.*

This is really the only discordant statement in the mass of testimony now on record as to the harmfulness of excessive light to protoplasm. So out of place is it, that it seems certain that he has been misquoted and the fact is the reverse of what he is alleged to have said, unless he did really heat up his cases and produced mild forms of "heat fever."

CHAPTER VII

ACTINO-THERAPY

Infra-Red Therapy

INFRA-RED therapy (hot applications) has been a standard treatment in some conditions since pre-history, but it was always applied empirically, and often did as much harm as good. In the past century it began to be applied scientifically and mostly for effects on the nerves, or to reduce inflammations by constricting blood vessels and causing absorptions. Only recently have infra-red been applied to destroy invading organisms, and only in a few cases. In gonorrhœal affections it is specific, as the coccus is so easily killed (113° F.). It is but recently also that we have taken up the shorter frequencies therapeutically.

Ultra-Violet Therapy

There is now a great deal of literature on the subject of the chemical activity of the shorter ether waves in curing disease (phototherapy, radiotherapy, X-ray therapy, etc.), and it furnishes much information as to the action of these rays on the living protoplasm of man. It was this data which convinced the writer of the correctness of von Schmaedel's theory that skin pigmentation of man was evolved to protect him from these harmful short waves, and he therefore

inserts much of it even at the risk of being tiresome to the lay reader. But its perusal should leave no doubt that these rays are exceedingly harmful in excess.

The bacteriologists long ago showed that the short waves of sunlight were fatal to most pathogenic organisms, some resisting longer than others. Such exposure soon became a standard method of disinfecting surfaces or thin fabrics easily penetrated by the rays. Typhoid and cholera bacilli die after a few hours' exposure and the glanders bacillus after a few minutes. Hence began the efforts to kill the germs while still in the body, but we did not appreciate the fact that the rays had identical effects on our own protoplasm as on the bacterial protoplasm and some mistakes were made, until we empirically discovered practical methods of applying just enough light to injure the bacilli so that the tissues and anti-toxins could finish the slaughter.

It is not necessary to kill the bacteria outright, for though that is possible and is often done, yet the light may be so strong as to kill too much of the surrounding tissues and there may be too much necrosis for the ordinary processes of removal and repair. Indeed, it has been denied that we can kill the bacteria in the tissues except by a degree of light fatal to the cells, for it is pointed out that the organisms are imbedded deep in red tissues which filter out the most effective frequencies. Practical results seem to show that it is likely that an amount of light fatal, or rather harmful to the bacilli, may be actually

stimulating to the healthy cells; but here we are on uncertain ground and may be confusing the effects of too much light in one case and too little in another. Bang¹ states that the three following fundamental facts are clearly established by investigation: “ (1) That the most highly refractive rays of light, the violet and ultra-violet, produced a specific dermatitis differing in its symptoms from any other form of cutaneous inflammation. (2) These rays have a stimulating effect on the organism, probably due to reflex processes. (3) They are distinctly bactericide in action.”

At any rate, we have cures of certain diseases by a deadly drug (for its action is the same as a chemical) used in moderation, just as in the case of any other deadly drug like arsenic or strychnine or even quinine. Therapeutically the X-ray and ultra-violet are the same.

I began to collect a list of important papers on the therapy of concentrated light, but the list is already too long. The *Journal of the American Medical Association*, January 3, 1903, has some papers on the question, and medical literature is now full of the subject. It is remarkable that all this literature has sprung up since 1894 when Finsen published his first paper, and in 1895 when Roentgen announced the discovery of the X-rays. The anthropological discovery, in 1895, of the reasons for skin pigmentation in the tropics is then contemporaneous with the medical discovery. The files of the *Archives of the*

¹ Berliner klinische Wochenschrift, December 9, 1902.

Roentgen Ray and Allied Phenomena,² give the technical details of the evolution of this new specialty.

Superficial Parasites Destroyed by Light

The tubercle bacillus seems to be very easily killed by an amount of concentrated light which is practically harmless to the animal tissues in the given time it is applied. The cancer germ is another frail invader, easily destroyed.³ The extent of such treatment for our invading enemies seems almost boundless. Finsen cured nearly all his cases of localized superficial bacterial (though chiefly tuberculous) infections of the skin by concentrated actinic rays,⁴ and most of his cancer cases. Dr. H. J. Steward, of Chicago, reported that Finsen claimed ninety-seven per cent. of cures in lupus vulgaris even when the whole face is involved.

Dr. Carl Beck⁵ says that its influence in killing local infections is so great that in the hands of many operators mentioned by him, it cures sycosis, favus, eczema, psoriasis, rosacea, acne vulgaris, prurigo, lupus, nævus vasculosus, some skin carcinomas, and seems to be efficient in sarcomas. Its depilatory power is due to inflammation set up in the hair bulb.

Dr. E. R. Meek reports cures by X-rays of lupus vulgaris, acute and chronic eczema, and removal of

² Publishers: Rebman Company, New York; Rebman, Ltd., London.

³ See photographs in *Journal of the American Medical Association*, January 3, 1903.

⁴ Metzereit, *The National Medical Review*, March, 1901.

⁵ *New York Medical Record*, January 18, 1900.

superfluous hair. In the latter case it seems as though the irritation caused differentiated elements, hair, nails, and glands, to atrophy, while the least differentiated are increased in vitality probably as an effort to repair damage as after any other injury. It seems natural for the irritation of these rays, as well as the irritation from any other source, to produce pigments as a protective opaque armor,—tan, freckles, extreme redness, etc.

The *Medical News* of May 30, 1902, limits the use of ultra-violet light to new growths of limited and superficial extent. There is more or less relief from pain, cessation of bad odor and putrefaction, and there are no burns caused. In inoperable cases it is helpful, and in the operable cases it enhances other methods. Other writers are more optimistic and report cures of even inoperable uterine carcinomas, the rays being applied both through the skin and by vagina, using a shield opaque to the rays for protection of the healthy parts.

Dr. J. N. Scott⁶ finds that the X-ray is not as efficient in sarcoma as in carcinoma, because the sarcomatous secondary growths are deep seated or in distant organs and impossible to reach, but when they are superficial "the rays help in many cases." In other words, it is merely a question of reaching the abnormal cells without destroying the intervening healthy ones.

Leonard⁷ speaks very highly of X-ray for malig-

⁶ American Medicine, November 12, 1904.

⁷ American Medicine, December 3, 1904.

nant diseases of the breast, checking the growth of the cells and destroying them and their metastases.

Rationale of Cures of Malignant Growths

The action of short waves in curing the malignant growths is not understood by any means, as we are not quite certain that the tumors are due to organisms. Bean suggests that the light actually stimulates the cancer cells to return to normal protoplasm, but it is more likely that they are so damaged as to be easily destroyed and removed by the surrounding healthy cells, providing that these also are not injured by the light. Other writers are inclined to believe that a healthy cell is not affected by a degree of light which is harmful to a diseased or abnormal cell.

It is an axiom of physiology that a healthy cell or a healthy vigorous organism will resist harmful chemical or physical agents which will be fatally effective on one that is unhealthy or frail. Thus a puny man would freeze to death in a northern environment which is harmless to a big strong man. Atypical cells in malignant growths are believed to be so abnormal as to be less resistant and less vigorous than surrounding healthy tissues; their growth into healthy tissue and destruction of that tissue, as though they were stronger and more vigorous, is explained on the assumption that they secrete toxins which are harmful to the healthy tissue and destroy the resistance of the healthy cells. In like manner, the solitary wasp injects a poison into the bodies of

its prey which does not kill them but paralyzes them, and they thus serve as fresh food for the wasp larva, as they have lost all physical resistance. If these speculations are correct there is also truth in the theory that concentrated short waves (ultra-violet and X-ray) which are perfectly harmless, or merely stimulating, to the normal cell, are destructive, or even fatal, to the abnormal cells of a malignant growth within the healthy tissue. It is a simple explanation for the well-known phenomenon of the melting away and total disappearance of superficial malignant growths under the application of the short frequencies.

Jicinsky states^a that the molecules of protoplasm in pathological cells are more complex in their atomic arrangement than cells of normal tissue, though he does not say how this knowledge was experimentally obtained. If it is really a fact, it wholly explains why an amount of light harmless to the normal molecule will destroy the abnormal one of more complex and less stable composition. He gives this explanation of cures or improvement of cases of tuberculosis by X-rays. So many pathologists have reported the cell necrosis observed after applications of excessive amounts of short rays that we must accept it as a fact for both normal and diseased cells.

Negative Actinic Therapy

In the case of variola, varicella, rubeola, and scarlatina—all parasitic diseases—it is believed that

^a American Medicine, December 17, 1904.

the parasites of themselves or their toxins are unable to cause much skin irritation, which is the result of external light. Hence we have revived the negative treatment, as it is called, of excluding all actinic rays by the old empirical method of red windows, and hangings, thus producing a red light like the photographic dark-room. The various eruptions may not even mature, pitting may be prevented and the disease shortened and made milder. In erysipelas the red-room treatment is said to be wonderfully efficacious in shortening the disease and abating the symptoms.⁹ Nevertheless the excellent results as to smallpox obtained in Europe are not obtained in America. Jay F. Schamberg, in the Philadelphia Smallpox Hospital, finds no results at all from red light, and explains the European results as due to the mild character of their disease. Similar failures are reported in New England.

Goldmann, of Vienna,¹⁰ has experimented with vaccination in red light with immediate bandaging with red cloth. He finds that the inflammatory conditions are wholly prevented, but that if the bandages are removed after two or three days and the parts exposed to light, the pustules take the usual course. The red-light vaccination gives sharply raised, round, wart-like pustules—there are no constitutional symptoms—and the resulting scar is flat and scarcely perceptible. It is claimed, nevertheless, that the re-

⁹ Herman Krukenburg, Munich, *Medicinishe Wochenschrift*, April, 1902.

¹⁰ *New York Medical Record*, October 29, 1904.

sulting immunity is very short and does not compare with the ten years' protection to be expected from normal vaccination. It is only mentioned here to show that absence of the short rays certainly modifies the process profoundly, but whether or not they are harmful to the virus is yet to be shown.

Finsen, just prior to his death, wrote a reply to the article by Ricketts and Byles¹¹ in which they denied the efficacy of his methods. He stated¹² that in every one of the cases reported as unsuccessful the treatment was begun too late, only one having been treated as early as the fourth day. He states that smallpox renders the skin very sensitive to light, and repeats that if the patient is excluded from the short frequencies early enough the exanthem is lessened and the suppuration prevented, and he protests against the statement as to the inefficacy of the treatment.

Nash¹³ endorses Finsen's statements and reports successful cases in which the red-light treatment was begun very early.

Light Baths for Sluggish Metabolism

The excessive oxidation due to light has been found to be an excellent remedy in the case of those of sluggish chemistry who are benefited by the slower heat rays of hot springs, spas, etc. It is a matter of experience now that a short sojourn in the Philippines is very beneficial, even curative, in many cases of chronic gout and rheumatism. If we let the ac-

¹¹ *Lancet*, July, 1904.

¹² *Lancet*, November 5, 1904.

¹³ *Lancet*, November 26, 1904.

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tion proceed too far these patients are over stimulated and exhausted, just as any one else, but the stimulation of their chemistry by the light rays of the tropics burns up the poisonous waste products which formerly could not be excreted and the patients are apparently cured at first. Dr. E. Linderman¹⁴ shows that light stimulates circulation, metabolism and sweat secretion, and that light baths are valuable in diseases needing stimulation of metabolism.

J. C. Kellogg¹⁵ describes in detail his methods of the use of light, but he combines other agencies—massage, electricity, heat, fomentations, water, etc.—so that it is difficult to say how much effect the light *per se* has. Nevertheless he seems to show that it has a powerful influence on sluggish metabolism, and by its stimulation of our chemistry creates at first a marked sensation of well-being. The manner in which he promotes exudates from joints, cavities and other localities seems to indicate considerable activity by the light itself.

Marceuse¹⁶ states that the effect of this treatment by light is really due to heat. He states that light is a specific in lupus (tuberculosis of the skin), but its real use in other affections is not yet determined, though its psychic influence in functional nervous affections is very great.

Ferdinando Battistini¹⁷ uses the light-bath ac-

¹⁴ Deutsche Medizinal Zeitung, April 25, 1901.

¹⁵ System of Physiologic Therapeutics, Vol. IX.

¹⁶ Zeitschrift für diätetische und physikalische Therapie, Leipzig, April, 1902.

¹⁷ Rivista Critica di Clinica Medica.

according to Kellogg's method, with forty lamps rendered incandescent by a current of 100 to 110 volts. He begins with a temperature of 30° C., progressively increasing up to 50° C., and rarely to 60° C. The duration of the bath is from fifteen to twenty minutes. "In all cases copious sweating occurs promptly. The pulse and respiration are increased in frequency. The effect on the blood varies. In persons whose circulation was normal, or in whom arterio-sclerosis was in the initial stage, the pressure was very slightly increased, or else not affected. In a second group of patients, apparently normal or else suffering from grave arterio-sclerosis, the pressure was high. Arrhythmia was noticed in some cases. The cardiac area was, as a rule, not affected. The sphygmographic curve was usually fuller during the light-bath, and occasionally there were signs of diastolicism." The author concludes that this method of treatment should be used very cautiously on patients with a weak heart, or on those suffering from arterio-sclerosis.

Albert Stone (Indianapolis) uses ultra-violet rays in neurasthenia. He explains that they cause oxidations and increase metabolism, thereby favoring regeneration within the system. He says their action is decomposing and at the same time reconstructing.¹⁸ This result is very remarkable, for we know that these rays in excess may be the cause of neurasthenia, but probably selected cases due to other causes may be

¹⁸ American Medical Association, New Orleans meeting, 1903. Section on Nervous and Mental Diseases.

stimulated to the point of recuperation by a moderate light-bath.

Light-Baths in Anæmias

Light-baths are said to be useful in anæmia and chlorosis, yet here it is dangerous, for we have marked anæmias in the excessive light of the tropics, and the exuberant health and absence of anæmia in dark countries prove that excessive light is not needed at all.

Pseudo-leucæmia has been apparently cured by X-rays. Whether this is due to stimulation of sluggish tissue or to the killing of parasites, or due to some chemical change in abnormal iron or iodine salts in these glands is not known.

It is interesting to note that in high altitudes, where there is more ultra-violet than at lower levels, there is an increase of iron in the blood. Burker found it increased twenty-five per cent. in the Physiological Laboratory at Tübingen, and Gaule and others found increase of red blood cells in men during balloon trips.¹⁹

J. Mount Bleyer²⁰ states that light-baths increase the absorption of iron salts administered, that the hæmoglobin increases much more rapidly this way, and he sees some relation in this to the deoxidations of all iron salts by light, first discovered by Herschel. It is quite likely that we have here a clue to explain why a little light is necessary for man. In animals

¹⁹ Science, December 16, 1904.

²⁰ New York Medical Record, January 31, 1903.

living in the dark it is not necessary, but probably selection has so changed us that these necessary chemical changes do not take place unless a further stimulant is given.

It is quite evident that we will find that all the shorter rays from every source will be more quickly curative in every case which is now benefited by the prolonged treatment with the longer infra-red frequencies as applied in our Hot Springs hospitals.

To such an extent has this new knowledge gone as to the effect of these forces on our tissues that Heinrich Stern ²¹ even states that retained products of metabolism (urea, etc.) are not poisonous to any degree, but that the deleterious results have some relation to the altered electric conductivity of the blood serum.

Light for Tuberculosis

The fact that the tubercle bacillus is very easily killed by short rays, and that these rays in concentration can be made to pass entirely through our bodies, explains, in part at least, the wonderful efficacy of the open air treatment of tuberculosis of the lungs in climates where there are many cloudless days. Nevertheless too much light and other causes of exhaustion may actually defeat the cure. In spite of the excessive light of the Philippines, and the outdoor life, tuberculosis is there frightfully prevalent among both natives and Americans. In the latter it is a very rapid and fatal disease requiring immediate removal home. They seem to have lost all resistance

²¹ New York Medical Record, January 24, 1903.

from the damage done by the climate, so that the bacillus has no check.

There is some evidence that tuberculosis is an expression of nitrogen starvation, for we find it very prevalent among those who have not had enough of this class of food, and the method of cure in modern sanatoria includes a diet of enormous amounts of nitrogenous foods—milk, meats and particularly eggs. The awful prevalence of these diseases in the tropics can thus be explained in part, for both the native and the white visitor neglect this class of food, and run to rice and starchy foods. The light, being excessive, is harmful and exhausting, rather than curative, because the bacillus, though damaged by the light, is not disposed of by the tissues as in the cures at home. In other words, these rapidly fatal tropical cases seem to indicate that the tissues are to be depended on for the destruction of bacteria and if they are too much injured they cannot effect the cure.

Sciaccia²² reports a cure of tuberculous peritonitis in a child of nine by the use of condensed chemical rays from the sun. In tuberculous adenitis, Dr. G. E. Pfahler,²³ finds that X-ray treatment gives the best cosmetic results and less chance of dissemination, but in suppurating cases incision is required followed by an immediate X-ray treatment.

Freund found that the longer waves were better in tuberculosis than the ultra-violet, and practical

²² La Fototeropia, Rome, 1902.

²³ New York Medical Journal, November 19, 1904.

experience in this country seems to bear this out. Dr. J. W. Kline, of Fort Dodge, Ia.,²⁴ is having marked success in treating tuberculosis of the lungs, larynx, etc., with concentrated sun's rays, and in this method the glass stops most of the ultra-violet, if not all. He cannot exclude all the heat rays, so that there is much warmth but not enough to blister. He shows that the light penetrates the body and kills bacteria or inhibits them so that the increased vitality brought about by forced nutrition and other means disposes of them and healing then occurs. He shows that the light is a stimulant, is absorbed by the cells and causes definite chemical changes. In this same journal Dr. Emil H. Grubbi (Chicago, Ill.) shows the tremendous power of X-rays, more fierce apparently on abnormal cells than on normal ones.

Psychic Light Therapy

Sir James Crichton²⁵ says it is generally believed that blue rays have a depressing psychical effect and red rays an exciting one, yet Piffard states that the longer light waves, red to yellow, exert a calming effect in conditions of mental excitement. They are best obtained by passing sun's light through ruby glass. Very many other physicians have reported observations confirmatory of Crichton's statement and it seems an accepted fact. It is well known that red has a tremendous psychical effect on the bull and it is generally acknowledged that red is more or less used for

²⁴ See New York Medical Record, November 1, 1902.

²⁵ Address at Manchester Sanitary Association.

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erotic purposes by the demimonde, though in the absence of suggestion it is not known how much sexual excitement it causes. It is quite likely that red is a general psychical excitant as it is also to the retina. On the other hand, the soothing and depressing effects of violet and blue seem to be in accord with the well-known anæsthetic effect on the peripheral nerves. It is said that on muscular fibers the results are the opposite, short rays increasing vigor and red rays depressing them as it does all other vital phenomena.

It has been said that some manufacturers of photographic plates have been compelled to remove the ruby red color and substitute another color for the "dark room," because prolonged exposure caused psychic irritation in the employees. It has also been popularly supposed that men accused of crime in Russia and confined in cells so as to be immersed in violet or blue light have been so depressed mentally in a few weeks as to offer no resistance to the police investigation, and that if carried too far the depression is permanent, and may even result in profound incurable melancholia.

Light of various colors is now being used in the treatment of the insane—through its stimulating or soothing effects as needed. The details are unknown, but it is said that some remarkable results have been reached at Ward's Island, New York. The diseased nervous system thus shows itself to be very susceptible to these short rays. Dr. Minim, who uses violet rays for anæsthesia, finds that he cannot use

them on hysterical patients by reason of undesirable psychic symptoms, and there are similar reports from other sources.

All the above discrepancies will probably be cleared up in the future if the reporters of psychic effects will recognize the fact that every color from red to violet is at first stimulating, the minimum being in the red and the maximum in the violet; but that prolonged application brings paresis and then paralysis. Manias should be intensified by light until exhaustion occurs, melancholias which are already depressed can only be made more exhausted, for they need rest and nutriment, not stimulation.

Darkness is soothing, just as in the case of babies who are quieted by darkening the rooms, and it is one reason for the tendency to sleep at night. Cleaves has noticed that prolonged periods of unbroken sunshine produced profound and unfavorable results in the predisposed and particularly in the insane. Hence darkness in the treatment of manias is a very rational method.

Light as an Anæsthetic

Dr. Edward A. Tracey²⁶ reports a case of minor surgery in which the only anæsthesia was the ultra-violet rays from a Minim lamp, as described above. The anæsthetic effect of blue rays relieves neuralgia and is thus used by Gabriele Arilnzo.²⁷

²⁶ Boston Medical and Surgical Journal, November 6, 1902, and the Surgical Clinic.

²⁷ New York Medical Record, June 6, 1903.

Dr. Julius Rosenberg, of New York,²⁸ reports cures in many cases and states that light is "a remedy of no mean order," and that blue, violet, and ultra-violet are almost a specific against pain. The ultra-violet rays from an iron-carbon arc of high amperage are a specific in muscular pain, such as lumbago, torticollis and pleurodynia. In acute and chronic neuritis they always relieve pain and generally cure the disease. They are bacteriocidal in skin infections, promptly curing acne and furuncle, for instance. In rheumatic arthritis they are not so efficient, but in acute and chronic pleurisy and bronchitis they are beneficial. In gonorrhœal affections there are encouraging results.

Female Diseases

"A. I. Orloff²⁹ employed electric light of five to sixteen candle power in the treatment of various inflammatory conditions of the uterus and appendages in fifty patients. Preliminary to a detailed account of his observations, he presents the following conclusions: (1) Phototherapy is indicated in a considerable number of inflammatory diseases of the uterus and adnexa, such as metritis, parametritis, perimetritis, salpingitis, oöphoritis, etc., both in their chronic, and, especially, acute forms. (2) The chief and most pronounced action of the light is seen in the amelioration or entire cessation of pain. (3) Under the influence of phototherapy exudates as well as

²⁸ Medical Record, October 22 and April 24, 1904.

²⁹ Roussky Vrach.

accumulations of pus become diminished or disappear entirely. (4) The pains during menstruation (dysmenorrhea), especially those of spasmodic character, become considerably diminished. (5) The pains accompanying posterior flexions of the uterus and nervous affections of the ovaries (neuralgia) are markedly diminished, and after the first application of the treatment it may be possible to restore the uterus to the normal position without pain. (6) Apparently erosions of the cervix also yield to this treatment. (7) The amount of leucorrhœa in the uterine cavity and cervix becomes lessened, especially in affections of gonorrhœal origin. (8) Menstruation as well as uterine hemorrhage contra-indicate the application of light. (9) Pregnancy should also serve as a contra-indication in view of our lack of knowledge as to the action of light on that condition. (10) No opportunity was afforded to employ the treatment in the case of tumors. (11) As untoward effects of the treatment may be mentioned the appearance in some patients, after three or four applications, of general malaise and a feeling of numbness in the extremities, those conditions disappearing in two or three days. (12) The number of treatments required before any improvement in the patient's condition is noticed depends on the character and the stage of the disease. In the author's experience it varied from eight to forty, each treatment consuming ten to twenty minutes, repeated daily or every other day. No other form of treatment was employed." ²⁰

²⁰ Medical Review.

Malaria

Now comes a most speculative paper by Dr. A. F. A. King, of Washington, D. C.,²¹ in which he mentions many facts to prove that it is light and not heat which is necessary for the propagation of malaria, and as Dr. King through inductive reasoning announced twenty years ago that the mosquito was a necessary factor in causing malaria—a theory now proved—it is well to give heed to this new speculation. (1) He shows that external heat does not affect the blood heat and is of no causative value, but that where there is much heat there is much light too. (2) Paroxysms are in the daylight and not at night, though this may be a matter of selection, the organism being adjusted to the habits of the mosquito just as *filaria sanguinis hominis nocturna* always enters the peripheral circulation at night, as that is the very time this particular *culex* mosquito flies. Other kinds of *filaria* have other hours to accommodate their secondary hosts. (3) The more brunette a race is the more immune it is, and therefore the plasmodium has not enough light. But immunity is a racial trait, a result of selection and killing off of unfit non-immunes, and black races living in malarious regions are immune by this reason and not necessarily from their brunetness. Yet recent observation shows that their immunity is only partial, for they harbor the parasite and are apparently uninjured by it until they lose resistance from some other cause. (4) Ma-

²¹ American Journal of Medical Sciences, February, 1902.

laria is increased by clear weather and lessened by cloudy, but this may be due to the fact that the patient is irritated by the light. (5) Keeping in the cool shade and avoiding light is said to reduce paroxysms and prevent them. (6) Remedies like indigo blue and methyl blue, which increase the violet or harmful light, and diminish the beneficial or red light, cure malaria by killing the plasmodium by violet light. But this is yet to be proved. (7) Remedies which are fluorescent (quinine, fraxin, and esculin—the bitter principle of horse-chestnut) cure because their violet rays kill the parasite, and yet there is no proof of this.

He paradoxically advises keeping light from the parasites by dark habitations, dark clothes, and dark medicines, while administering light to kill them. The amount of fluorescence caused by quinine and esculin, and the change in the color of the blood by indigo and methyl blue are too minute to be considered.

It is all better explained if we stick to the law that violet rays are just as harmful to the plasmodium as to any other animal organism, while the red light is comparatively harmless. Violet drugs and fluorescent drugs may be helped by their color or fluorescence, but they kill by poisoning. Much daylight merely injures the man and reduces his resistance, as in tropical tuberculosis. Nevertheless, Dr. Edward Rhoads and William Pepper, in Philadelphia, showed in 1868 that the normal fluorescence of the blood was reduced by malaria, and yet it was cured by increas-

ing the fluorescence by sulphate of cinchona. Cases not cured by quinine are those in which crescents are present in the dark (spleen, liver, bone, and brain), where the fluorescence of quinine can exert no effect.

Dr. Gunni Busck³² goes to the opposite extreme and advocates the treatment of malaria in the sunshine, or in sunbaths or electric-light baths, on the ground that the light enhances the toxic power of quinine on the plasmodium. He quotes numerous experiments in the way of "sensitizing" solutions; that is, by the addition of something, generally a fluorescent substance, which will increase the sensitiveness of the solution to actinic rays. Some organisms, thus, are not poisoned in the dark, but are promptly killed when light is admitted—that is, an amount of light which is harmless under ordinary circumstances.

He thinks that quinine sensitizes the blood in this way, and that it is identically the same as the addition of a sensitizer to photographic plates whereby chemical changes are caused by an amount of light or by lower rates ordinarily ineffective.

If this is so then malaria should be easier to treat in the tropics than at home, and there is no evidence to this end. All the discrepancies can be harmonized by considering the fact that both amœbæ and man can be harmed by too much light and possibly assisted by a little light. I am quite sure that pernicious malaria is much worse in excessive light only when it has injured the man's resistance. The whole question must be held open.

³² American Journal of Medical Sciences, July, 1904.

Light Baths for Obesity

Light baths are said to be quite efficient in reducing obesity by the increased oxidation in the same manner that beef cattle fattened in the dark lose fat on exposure to light. We know that obese people often lose weight after arrival in the tropics and that obesity is very rare among the natives. Yet a word of warning is necessary. Obesity is almost always due to lack of nervous control over metabolism and is merely one sign of a nervous instability which may give other evidence in brothers, sisters, and cousins—particularly is obesity in childhood a nervous condition. Hence the obese are notoriously lacking in resistance, are apt to be short-lived and suffer from other nervous conditions, and light baths may cause in them very dangerous nerve exhaustions, differing in no respect from the neurasthenias of the same class in the tropics.

Leprosy

In the case of leprosy it seems safe to prophesy success from the use of short waves, and much glory awaits him who discovers the proper wave length and how to apply it without too much injury to the surrounding tissues. The similarity of the bacillus to tubercle bacillus would seem to indicate that it is easily destroyed by light, and it seems to be protected from light by the skin pigment, for it is more a disease of the brown races than of the whites. On account of the brunetness of most lepers it would seem that a very short penetrating ray would be best,

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either the shortest X-ray or those from radium. Dr. H. L. Gilchrist, of the army, has already obtained good results in a white man with ordinary X-ray, but the ultimate cure is yet to be reported. In the Philippines it has been taken up, but at the present writing nothing yet has been accomplished with Malays.

Radium Therapy

William Rolling³³ has taken up the study of the therapeutic uses of radio-active bodies in cases benefited by X-ray, but as these bodies give out X-rays much shorter than those ordinarily produced we can expect to find practical applications where the longer rays fail. The subject is discussed in the *Journal of the American Medical Association*, June 6, 1903.

Robert Abbe³⁴ states that radium has a "strong curative power over lupus and superficial epitheliomas, with even destructive effects when too long exposed," results resembling those of the Finsen light and X-ray. The ordinary wart (*verruca vulgaris*) disappears after one to four applications of an hour each. He has obtained favorable results in a case of deep-seated malignant growth, and submits photographs of epitheliomas apparently cured. Dr. H. G. Piffard³⁵ gives literature to date and much data on the subject.

Roentgen rays will also remove warts. Naoumov³⁶ produces the same results by concentrating solar rays

³³ Boston Medical and Surgical Journal, January 23, 1902.

³⁴ New York Medical Record, August 27, 1904.

³⁵ New York Medical Record, June 18, 1904.

³⁶ Semaine Médicale, September 7, 1904.

for a period of thirty seconds, with the convex lens of an ophthalmoscope. He is reported to have found that the blood vessels had become occluded and that the wart had atrophied from this reason.

Dangers of Excess

Recent works on the energy and the therapeutic uses of all the various ether waves, from the slower infra-red to the extremely rapid waves from radium, give all the data to date, particularly Cleaves' work on "Light Energy," to which the specialist can refer. What we desire here is merely to give enough of the results of the therapeutic uses of these rays to show that they all have a powerful influence on protoplasm, and that if they are in excess they destroy protoplasm. The foregoing is sufficient for that purpose and we can pass on to the necessity for man to be protected from these rays if he is to survive. The manner of producing and applying each separate kind of wave is fully described in Cleaves' book. So great has been our faith in the necessity of sunlight that there has been quite a stampede towards the new treatment of light baths for sluggish metabolism, ignoring the danger of excess. This is quite apt to do harm and result in the swing of the pendulum away from what is undoubtedly a most powerful and useful method of treatment. The increased feeling of well-being is a danger, as it will no doubt lead patients to take excessive amounts.

It has even been proposed to "sensitize" the whole body by administering non-poisonous doses of one

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of the numerous fluorescent substances such as quinine, esculin, fluorescin, resorcin, orcin, eosin, fraxin, urapin, rhodamin, petroleum jelly, or salicin. Then the X-ray or radium ray will generate fluorescence deep in the tissues, but as these rays are mostly from the green area of the spectrum it is not at all evident that they will be beneficial in stimulating healthy protoplasm or destroying the unhealthy. The expectation of developing ultra-violet rays in this manner is of course an error.

CHAPTER VIII

BLONDNESS OF ARYANS

Primitive Man was Brunette

THE first men were undoubtedly brunette, though not as brunette as are the present anthropoid apes, and this brunetteness is still occasionally retained as a vestigial character even until some months after birth, for it is the commonest occurrence to find that babies when born have black hair which subsequently becomes flaxen. We can safely deny that the first men were black, for that would imply a tropical and light climate which from other reasons could not possibly have been the place of man's evolution. That process required a cold severe environment which killed off all except the most intelligent in every generation, as a rule, and thus caused an evolution of the large human brain. This is all explained in greater detail in the article by the writer in the *American Journal of Insanity* (June, 1901). Hence the first men inhabited cold, light countries, such as could have existed in Central Europe and Central Asia, and these two places for many other reasons are assigned as the cradles of the two types of men, dolichocephalic and brachicephalic, or European and Asiatic, respectively.

Cave dwellers were probably brunette, for the

best evidence available has led anthropologists to the opinion that the earliest men in Europe were brunette. Hence, living to a large extent or wholly in dark caves did not cause blondness, nor indeed do the Eskimos develop blondness though their habitations are about the same as caves. But the Eskimos and probably the earliest cave dwellers in Central and South Europe in the glacial period, were exposed when out of doors to a summer glare which made brunetteness a necessity. They are in the same condition as modern city dwellers, who are cave dwellers to a large extent (some even inhabiting cellars as elsewhere referred to), and the city dweller is notoriously brunette in localities where the countryman is blond, and is exposed when out of doors to much more glare in the shadeless streets than are the farmers in the surrounding forests and cornfields where there is no glare from the ground. For blondness to develop a *dark* country is needed.

Blondness of Mountaineers

Ripley¹ says: "There is a factor of the environment in mountainous and infertile regions which operates to increase the proportion of blond traits among men." This can only refer to the lessened light in the cold mountain forests, because men do not live above the wood line. Infertility of itself has no effect, because there are no native blonds whatever in the most infertile regions around the Sahara, Gobi, and our own western deserts. Hence

¹ Racial Geography of Europe.

we find many blonds in the mountains of North Spain and North Italy, indeed the only Spanish blonds are in the northern mountains.

As a preventive of glacier burn, mountain climbers use dark face paints, dark veils, and dark glasses to exclude the dangerous actinic rays so much more numerous at mountain tops than in the valleys, which shows the necessity of the natural pigment in the Eskimos who are equally exposed to a snow glare. The mountaineer may be more blond than the people of the surrounding lowlands, but he is not protected if he emerges from his dark forests and canyons and climbs to the top of the mountains beyond the wood-line.

There are blonds in the Albanian Mountains, in the Atlas Mountains of Northern Africa and also among the Amorites of Palestine, and the latter are said to be figured on Egyptian monuments. Ripley mentions that the reports of the numbers of such types are very contradictory, and it is not said whether there is much or any skin pigmentation. My own observation of almost identical Malay types—that is, identical as far as the evidence goes—leaves no doubt that the red Malays are degenerate types, and from the very evident stigmata on the heads and faces figured by Ripley as blond African types, there is no doubt that they are also degenerates and in no sense a type produced by the climate, as believed by Ripley and Sergi. This leaves the Amorites of the mountains to be accounted for and in the absence of exact knowledge of what blond characters they do

possess we cannot decide what they are. But it is quite likely that the blond, blue-eyed Teuton type has never been a native of the Holy Land.

As will be explained later, the law of increase of blondness with mean annual cloudiness is also an explanation of the phenomenon that blondness is greater in the mountains, which are more cloudy and foggy than the surrounding plains. The woods and ravines have far less sunshine, and in the deep valleys there are late sunrise and early sunset.

Early Britons were Brunette

At the time of the earliest men the present home of the blonds—the northwest corner of Europe—was under ice, for it was in the glacial period. As the ice cap receded from the British Isles man promptly followed and these first immigrants are known to have been short, frail, very long-headed brunettes, the type which then occupied all of Europe and which is not much different from the present Mediterranean type of man. The descendants of these “first families” are called the “old black breed” and are found in all parts of the Islands. The Eskimos are equally long-headed and thought to be a modified western extension of these earliest Britishers.

This type of man was gradually modified in England into a very similar long-headed brunette type called the long barrow race from their habit of burying the dead in long barrows. Survivors of these types are still living in every part of Great Britain.

The next arrivals in the Islands were brunette broad heads (the round barrow race) who came all the way from Asia, after the disappearance of that huge inland sea which until about this time had separated Europe from Asia. They were bigger and heavier men and overran almost all of Europe except perhaps Southern Italy and parts of Spain and Scotland. Broad heads did reach Ireland, though Ripley says they did not. They probably overran Denmark, for the Danes are often called a broad-headed people from the remains of the type still in the land. They entered Greece and Rome, as the ancient statuary show. They submerged the natives and have been followed by wave after wave of Asiatics whose descendants now occupy all of Central and Eastern Europe in a wedge-shaped territory with its apex in France and its base at the Ural Mountains, with scattered specimens everywhere else. Their descendants still survive in every part of Great Britain, and are quite numerous along the Scandinavian coast.

Ripley shows that these broad-headed invaders of Europe long antedated the bronze culture usually identified with them. They surely antedated knowledge of any metal in Gaul and Great Britain and possibly also in Spain. Everywhere they burned their dead, possessed rude pottery, and very quickly became possessed of bronze and even iron.

Blondness seems to have been a later evolution in Northwestern Europe, though it may have begun long before the arrival of that first Asiatic flood of

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broad heads. From what we have seen already the blond type required for its evolution a dark, cold, severe climate, such as was furnished by the forests which sprang up in the north after the recession of the ice. Coldness alone was insufficient, for our Eskimos are far from blond, as they need protection from the summer glare of the snow.

England not the Place of Origin of Blonds

In Scandinavia and all around the Baltic, in Northwestern Russia, North Germany, North France, North Belgium, Holland, Denmark, and the British Islands the blond has the proper conditions and has existed for many ages, but the exact place of origin is not known, though believed to have been in Scandinavia.

Unfortunately England does not possess the proper conditions for this blond type and anthropologists are asserting that the better adjusted three earlier brunette types which were conquered or forced to the west are now reasserting themselves and slowly increasing and percolating east again. As a result we find that the blond current still keeps up from the mainland to replace the decadent lines and England is, and will probably remain forever, a field for colonization by blonds from the place of origin somewhere in the Baltic region.

Beddoe states that brunette children are more tenacious of life in England than blond children. This alone in the course of centuries would render England brunette through natural selection, were

it not for the stream of Teutons constantly pouring in. Even the blond royal type dies out every now and then, and the nation sends over to the mainland for new blood to restock the line, as in the case of William, George, and Albert, and they are constantly sending over for this type for wives or husbands for the minor members of the royal family.

Parts of Scotland furnish almost typical cold dark conditions for blonds, who flourish there, with the natural result that the flow is always south, and the Scotch are really colonizing England. The English do not colonize Scotland. Of course, lack of adjustment of blonds to England is so slight that it takes many centuries to cause noticeable results. And indeed there is an opportunity for natural selection to step in and gradually change the type, as it did in the case of the waves which spread to the south.

First Blond Emigrants

From the original home the blond has spread like waves all over Europe, submerging all brunette types wherever he went. His arrival in Great Britain was very early—how early we do not know—but we do know that blond Gaelic-speaking Scandinavians settled in Scotland ages before the historic invasions, and many of the Scotch people at present are indistinguishable from Scandinavians, particularly in the northern islands. In Ireland, and England too, this type has been almost the foundation of the modern race. The Roman occupation of England stopped this current temporarily, but on the

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withdrawal of the Roman garrisons the flow started again, but these immigrants were of the great middle branch of the Aryan race and introduced dialects of the Teutonic branch of the Aryan language.

The earliest language traceable in Great Britain was non-Aryan and it has been considered to be Iberian, probably that of the brunette men of the earliest stone age. The first wave of Aryan speech was the Gaelic, or Celtic, followed later by the Cymric or Welsh—an allied tongue, probably merely a dialect—and the conquerors who brought in these tongues practically forced the earlier inhabitants to use them and forget their own.

The Teutonic waves now forced the Gaelic or Celtic language to the north and west. The first wave included the Jutes, Angles, and Saxons, and was a flood because the flow had been dammed back so long. The next two floods, the Danes and Normans, were no doubt essentially of the same blond stock, or at least the leaders were; but there is no doubt also that these ancient immigrants were mixed with many brunette broad heads, for Denmark and North France had been for a long time occupied by these Asiatic invaders, who had been conquered by the Aryan type, and compelled to learn Teutonic languages just as those in Great Britain and France had learned Celtic, or Gaelic, speech.

Celts or Gaelic were Blonds

Gael means "fair" or "blond," and so does *gallus*, and these earliest blond invaders of France and Eng-

land looked on themselves as "white men," who conquered brunettes. The word "Scot" comes from a word meaning "sail" or "shield," and signifies "ruling race," and no doubt refers to the blond Gaelic-speaking Aryans who settled there in pre-history, conquering the brunettes more or less completely here and there. Similarly the Irish Gaels once called themselves *Fein*, which is said to mean "fair," the word seeming to be Finnish in origin and derived from the Finnish language brought in by the earlier Asiatic invaders. It might be said, in passing, that there are very many words surviving which show that between the earliest Iberian language in Great Britain and the Aryan tongues introduced by the blonds there was an Asiatic language introduced most probably by the brunette broad heads or round barrow race—a language related to the Finno-Hungarian remnants still spoken on the continent.

Fein, *feinn*, or *fian* also meant "champion" or bodyguard of the king—hence the modern fenians or national guards; as we will subsequently see it is logical that "white" and "champion" should go together.

All the Teutonic invaders of Great Britain have been well described by historians—"tall, tawny-haired, fiercely blue-eyed barbarians." Now, the ancient Britons prior to this invasion did have blond types among them, as several Latin writers have mentioned (Huxley), the head types were markedly long, and their speech being Celtic, and there is but one conclusion, that the Aryan Celt who overran every

part of the British Islands and Ireland was a long-headed blond who forced his language on all the earlier arrivals (descendants of long barrow and round barrow races) and almost drowned out every evidence of non-Aryan languages. It is therefore a legitimate conclusion that there is to-day no way of telling a Celt from a Teuton, for they are the same type. Tacitus even said the Caledonians were Germans. Each type invaded the uttermost parts, and it is not at all unlikely that the Celtic invasion did not antedate the Christian era so very many centuries. It has been said that the Celtic invasion of all the west of Europe, though it did drown out non-Aryan languages, except in the Pyrenees, was really a small ruling upper class, which has left but little ethnic impress except in the present population of Great Britain. It would seem, then, that if the climate has not destroyed the Celtic blonds any faster than it is destroying the Teutonic blonds, there is a slight suspicion that England is more Celtic than Ireland—ethnically, not linguistically, of course—a statement which is enough to give the British statesman a cold chill.

The dark types now found where they were forced into the Grampian hills of Scotland, into the mountains of Wales, into Cornwall, and into the hills of Connemara and Kerry in the west of Ireland, and looked upon as Celtic types, are no doubt older, far older, than the earliest Celtic invader, overrun by blond Celt but forced into the mountains by Teutons,—or perhaps it might be safer to say they were not

forced into these places, but were undisturbed in them, and able to prevent a Teutonic invasion.

The prevailing combination of dark hair and gray or hazel eyes common in the western Irish and southern Welsh, differs in no respect from the Alpine type. If there is any truth in Rys' statement that Brython (Welsh-Celtic speech) means "cloth-clad" people, as distinguished from the conquered type who were clad in skins, it indicates a state of culture which we presume the Aryan Celts possessed not many centuries prior to the Roman conquest. Ripley says also that the best opinion holds that the Celtic culture and language represented a small dominant aristocracy, and as we will later see, aristocrasies since prehistory were and are notably blond.

Disappearance of Blonds

Munro states that the brunettes of Great Britain are absorbing the blonds, that the blond type is less resistant, and that there are fewer instances of long life among them than among the brunettes.²

At the 1904 meeting of the British Medical Society a speaker mentioned the fact that the blonds seem to constitute an undue proportion of hospital patients, and that blond children are shorter lived than brunette.

It is reported that, at the last meeting of the British Association for the Advancement of Science, Dr. F. C. Shruballsall read a paper upon the disappearance of the blond type, and proved by elaborate statistics and maps that the blond suffers from rheu-

² "The Races of Great Britain."

matic disorders and diseases of childhood, to a greater extent than the brunette, who has greater resistance to disease in general and enjoys greater average life, though more subject to tuberculosis and nervous diseases. This evidently refers to England.

Havelock Ellis states that there is a progressive diminution of fair people in Europe; De Quatrefages found it a fact in Normandy and Schaafhausen in Germany; Shimmer seemed to think it an Austrian phenomenon.

Havelock Ellis has recently published in the *Monthly Review* the results of his investigations of the complexions of famous people of England, judging the amount of pigment from the eye colors in the National Portrait Gallery. It is curious to note that he discovers the blond type to be the one on which England's fame rests in great part—that is, the best have been the Aryan immigrants. "The small group of (prominent) persons springing from the working classes is among the darkest of the groups." In the royal family "the early tendency was towards fairness, but by later Tudor times there was a tendency towards darkness," but "the light mixed type of eye, usually blue-yellow, has remained persistent." "It is from the fair elements of the population that the aristocracy is chiefly recruited," but in the course of a few generations there is a tendency to brunetteness in these families, probably from the tendency of the blond men to marry brunette women as before explained.

He published the following table, the index of the blondness being obtained by dividing the number of

blonds in each group by the number of brunettes. An index of more than one hundred means that the fair element predominates over the dark in that group; an index of less than one hundred means that the dark element predominates. The list includes persons of both sexes.

Group with Number of Individuals.	Index of Blondness.
Political reformers and agitators (20)	233
Sailors (45)	150
Men of Science (53)	121
Soldiers (42)	113
Artists (74)	111
Poets (56)	107
Royal family (66)	107
Lawyers (56)	107
Created peers and their sons (89)	102
Statesmen (53)	89
Men and women of letters (87)	85
Hereditary aristocracy (149)	82
Divines (57)	58
Men of low birth (12)	50
Explorers (8)	33
Actors and actresses (16)	33

He concludes his investigation with the following statement: "It is clear that a high index of blondness, or an excess of fairness, prevails among the men of restless and ambitious temperament—the sanguine, energetic men, the men who easily dominate their fellows and who get on in life, the men who recruit the aristocracy, and who doubtless largely form the plutocracy. It is significant that the group of low-class men, artisans, peasants—and the men of religion, whose mission in life is to practice and preach resignation to a higher will—are both notably

of dark complexion. While the men of action thus tend to be fair, the men of thought, it seems to me, show some tendency to be dark. So far as I am aware no really fair person has ever risen to the highest dramatic eminence in this country, and so far as I have been able to observe it is equally rare for fairness to be associated with histrionic ability in Europe generally.

“The more reasonable supposition at present seems to be that the relation between pigmentation and mental aptitude is chiefly indirect and due to race. In other words, the fair man tends to be bold, energetic, restless, and domineering, not because he is fair but because he belongs to an aboriginal fair stock of people who possess those qualities; while the dark man tends to be resigned and religious and imitative, yet highly intelligent, not because he is dark, but because he belongs to a dark stock possessing those characteristics.

“While, however, the fair population is the most irreligious and progressive, the dark population is by no means behind in the production of intellect.”

He quotes parallel investigations by Dr. A. M. Hansen in Norway, and similar results are said to have been obtained on the continent. It is certainly curious to note in this the preponderating influence of the blond Aryan, and the submission and resignation of the descendants of the Brunette long-headed autochthons and Brunette broad-headed Asiatic early immigrants, probably the descendants of the long barrow and the round barrow races respectively.

Religions of Blonds

Ellis might have gone a step further and pointed out the fact that the submissiveness to authority so characteristic of the dark races, the Mediterranean type and the Alpine or Asiatic type, is one reason for the evolution of that type of Christianity found in the Roman and Greek Churches. These are repugnant to the "free and contentious" blond Aryan, consequently the Baltic type of man is a Protestant, as we see in Scandinavia, around the Baltic, North Germany, Holland, Scotland, and North Ireland. It has long been known that the districts of Central Europe are Catholic or Protestant according as they are mostly inhabited by one or the other of these types. Hence we see why there is, now, as there always has been, a great defection from the Catholic Church in the north. Philip Sidney says:³ "The stream of secessions from Roman Catholicism in England is prodigious, and, what is more, is steadily increasing from day to day among all classes of the 'faithful.' This is going on at the same time as there is an extraordinary advance by the high church or ritualistic party in the Church of England who are adopting doctrines and practices of the Roman Church to a degree undreamed of by the originators of the Oxford movement many years ago. Yet there is not the slightest hint that this new movement is drawing the English Church into the Roman; far from it, such subjection is not only unmentioned, but recent writers

³ The Hibbert Journal, London and Oxford.

show that the breach between the two is widening so much that it is a menace to the existence of Catholicism in England."

Freeman, in speaking of the resistance of Constantinople to the advance of Mohammedanism, and Gibbon, in speaking of the check which Charles Martel gave to the Moors at Poitiers, are both inclined to speculate on the probability that Mohammedanism might have spread all over Europe, and the Koran been taught at Oxford. They need not have worried, because these southern religions could never have been accepted by the Aryan brain.

The upper classes who are mostly blond were apparently responsible for the Religious Reformation, which had its beginnings in countries like Bohemia, which are strongly Alpine and Catholic now. The brunette medieval Bohemian peasant probably cared as little about the matter as he does to-day.

Ripley's map of divorce in France shows this effect of religion, for such separations are least in the parts of the country inhabited by the Alpine and Mediterranean types submissive to church teachings, while they are most frequent in the Teutonic sections. Racial traits have been given as the cause by Bertillon, but the racial traits are reflected in the religions built up by these people.

Among the Catholic Flemish of the lowlands there is a large percentage of blonds, and this is an exception to the rule. It does not mean that all blonds are Protestants or all brunettes Catholics, but the preponderance is in that direction, as a rule, to which

the blond Flemish are notable exceptions, for there are blonds in all our Catholic Churches and brunettes in the Protestant.

The point of all this to us follows from the fact that the climate of the United States being suitable for the brunette types of Europe, who are the very people for and by whom Catholicism was evolved, these men are flocking here a half-million or more annually, and flourishing in vastly greater numbers than the protesting Aryan or Baltic types. This explains why it is that the Roman Church which in 1790 had but 44,500 communicants in the United States now has over 12,000,000, an increase of about 270 fold, while the Protestants have increased about 15 fold. It needs no special foresight to predict the tremendous growth of the Roman Church in America during the next century, a matter of which the Church itself is fully cognizant. It is not in the least a matter of complexion, though one has only to visit a Catholic church to notice the greater brunetteness of its communicants, but it is merely a result of the fact that our country is better suited to people from Central or Southern Europe than it is to the original settlers. In one respect we are reversing the experience of Greece, where the Aryans were the invaders and conquerors, while here the lower types are now the invaders. But the brunette non-Aryans will survive here as in Greece because they have not violated the biological law of keeping within one's zoological zone.

Blondness in Russia

The blond people of Russia are in the northwest, brunetteness increasing as we travel southeast, and the country in this respect follows the rule found to apply throughout Europe. There is not the slightest doubt that the men who have evolved the Slav dialect of the Aryan language were blonds like the original Celt or Gael to the west. Among the Scythian tribes mentioned by Herodotus, one called the Budini, and identified with Slavs, "were a large nation, and had blue eyes and red hair"; and linguistic affinities of the Slav dialects show that the original Slavs all "dwelt together in a comparatively narrow space." The numerous Slav dialects now spoken are simply the results attained by dark Asiatic peoples who dropped their own tongues and learned Slav, and, as the language has been traced as far west as Utrecht, the original Slavs certainly were a conquering people. The word has been thought to be derived from "slava," glory, also "slova," or "word," indicating they were "the intelligibly speaking" men as compared with the conquered men. Penka, on the other hand, uses the word "slav" to refer to the dark non-Aryan type who were conquered, and thus derives the word from the word "klu," to hear (slî-Slavonic), indicating subjection.

Slav is also said to have originally meant "illustrious or renowned," while its derivative *slave* is the reverse, and given in contempt by western Teutons to the ignoble races in the East. Surely this conflict of

terms means that the original Slav was one thing and the later Slav must be the descendants of conquered Asiatic types.

Primitive Russians were Brunettes

All authorities agree that the modern Russians are a mixture of many types of men, and we find the same state of affairs as in Great Britain. Practically the whole land was occupied by brunette Asiatics who had flowed in during the later stone age, though there may have been here and there on the eastern shores of the Baltic some isolated Aryan types. But very early the blond Aryan Baltic type reasserted itself, flowed east and south conquering as it went, forcing its Aryan speech (Slav) on the conquered Asiatic peasants, who are now denominated Aryan because they talk an Aryan dialect but who are as far from being Aryan as our North American negro. In some places the Aryan forced out the Asiatic almost completely; the Lithuanians, for instance, are nearly pure Aryan in all three branches,—Borussians (from which is derived "Prussians")—Letts, and Samoghitians and Lithuanians proper,—and the Lithuanian language is a close relative of Slavic.

As in England so also in Russia, this broad-headed Asiatic invasion submerged the original inhabitants who were of the type which occupied all of Europe, that is, they were short brunettes with long heads. The analogy is even closer yet, for these primitive Russians were themselves immigrants from

the cradle of this part of the human race—wherever that was—because this part of Russia was probably under water at the time man was evolving from a lower type.

Blonds in Russia are the Latest Invaders

Ripley agrees with Leroy Beaulieu that the white Russian of the northwest, who is ethnically a Teuton, is of all the Russians (Great Russians and Little Russians of the north and south respectively) “certainly the one whose blood is purest.” That is, he is the nearest to the original Slav type and perhaps identically the same. Between the white Russians and the Teutons is the blond long-headed Lithuanian with a language midway between Slav and Teuton, wholly different structurally from the Asiatic Finnic tongue further north. As we approach the Baltic the Russian becomes taller, blonder and more long-headed excepting a curious unexplained extension of long-headedness into Siberia. Indeed the Slav language is nearer to the Teutonic than is the Celtic and the latter race was undoubtedly tall and blond. The inference from this would make the ancient Slav a blond even though there is so little direct evidence. Professor Zograf, the eminent anthropologist of Moscow, has proved that the original Slav was a blond longhead.

The Asiatics in the minor states of Medieval Russia were so overwhelmed by later Asiatic hordes, that they were compelled to call in Rurik, a pure Scandinavian, who solidified a government which has existed

to the present. But this government is, and always has been, an Aryan aristocracy ruling brunette Asiatic people, just as ancient Greek democracies were Aryan aristocracies ruling a brunette Mediterranean people. So clear cut is this Aryan type in Russia that the name Russian-Germans has been given to them. They are found all the way down to the Black Sea where they went colonizing in the time of Catherine.

Finns are often described as having a white freckled skin, greenish eyes, and fiery red hair, hence in Finland we find a state of affairs exactly the opposite of that in Russia generally, for a very large number of the Finns are pure Aryan, blond long heads like Scandinavians. Indeed they are migrated Scandinavians, but they have learned the Finnish language and constitute a rare exception to the general rule that Aryans always force their language on Asiatics and do not give up in favor of a lower one.

The present course of events in Finland is repeating prehistory. The Russianization of that country means the introduction of forms of government suitable for Aryans governing Asiatics and found to be so very successful farther east, but is not proper for Aryans governing Aryans. Hence there is discontent, and the Finns, unable to resist the modern "yellow peril," are doing what their ancestors of prehistory did—moving on to other lands. They are now flocking into the United States and, being Aryans, are said to be making far better citizens than

the Russian peasant does. What is Russia's loss is our gain.

Yet many of the Asiatic peoples have refused to learn Aryan tongues and we find them still speaking the languages they brought with them—the Tchuds (Lapps, Finns, Esthonians, and Livonians) in North-west Russia, the Permians in East Russia, and the Samoyeds in North Russia. Similarly the Huns in Central Europe and the Basques in West Europe have retained their Asiatic languages.

The languages of the Huns, Permians, and Tchuds are, by the way, mere dialects of one branch of the great Ural or Altaic family called the Uzrian or Finno-Hungarian branch. The Samoyed is another branch.

It is interesting to note that all the languages of Altaic family, which extends across Asia to the Pacific, are of close kin to the languages used by the American Indians from Alaska down. The former seem to be in the process of drowning in a sea of Slav, while the latter are positively choked to death by a Teutonic dialect—English. Each process is the same as the drowning of non-Aryan languages in Great Britain by Celtic dialects.

All these non-Aryan languages from the Basque to the American are exceedingly primitive. They have no abstract terms such as "color" and "length," but every such attribute must be added to the thing described. They therefore show low intellectual power, and we can readily understand why the people themselves should all be so readily sub-

merged by Aryans whose higher and more complex brains have evolved higher languages. Ripley proves that the Alpine type was always forced to the mountains and infertile places by Teutons or long heads from the north, who took the best land.

European Russia, then, is not occupied by the most eastern of the European or white races, but the most western of the yellow races. It is not Occidental but essentially Oriental, with Aryan or Scandinavian overlords. Though many of the army officers are blond Aryans and the soldiers are Brunette Turanians, yet this rule has many exceptions, for each type has high and low variations.

The Aryans conquered the Asiatics of European Russia slowly, for it was not until 1581 that Russia as a government extended her dominions into Asia, though it took her but two centuries to reach the Pacific. Her present policy to absorb Manchuria, Mongolia, Corea, and then Japan and China are but steps in the great movement of conquering Aryans who are ruling the lower Asiatics as their older brothers ruled lower races in ancient Greece, Italy, Persia, and India.

The Celto-Slavic or Alpine Race

In popular literature, and occasionally also in scientific literature, the word Celto-slavic is used for a hypothetical Aryan race which extended all around the Scandinavian or Teutonic branch, from Russia to the British Islands through Central Europe. It is always conceived as a Brunette race, and even

now the word Celt rather brings to mind this type and the word Slav always does. As a matter of fact, this type, now called Alpine, is a broad-headed Asiatic intruder, and the real Celt or Gael was the blond long head who inhabited the western part of the primitive Arya and migrated westward, while the Slav was the blond long head who inhabited the eastern part of the primitive Arya in Northwest Europe and migrated eastward. The Latin, Greek, Persian, and Indian branches were blond long heads who once inhabited the southern part of primitive Arya before their famous migrations southward.

Munro states that all parts of the British Islands, England, Wales, Scotland, and Ireland, have the same ethnic elements, and one is no more Celtic than the others. By reason of linguistic remains, Charles De Kay⁴ even goes to the point of asserting that this great Asiatic people appear "to have held Ireland before the Celts." He sees many resemblances in old Gaelic, and even modern Gaelic, to the languages of the Finns, Huns, Turks, Laps, and Uighurs of Asia Minor—all relatives of the ancient Sumerians and Accadians, plains and mountain people respectively, who gave to early Chaldea and Assyria their pre-Semitic civilizations. And yet we have dropped into the habit of considering their present descendants as Celts. The Asiatics are not "a vanished Turanian race," as De Kay suggests, and they were not a maritime race. It is believed that the Asiatic Finns actually reached the islands of the Irish and Scotch coast, and tradition speaks of the

⁴Century, 1889.

wars between them and later Celtic invaders. They certainly never reached Iceland, which has always been Aryan. Icelandic is said to be the most primitive Aryan tongue, and it indicates a very early migration wave, but the type of these prehistoric men is not known because Iceland has received so many Scandinavian types in historic times, and they had close connection with Ireland and the Faroe, Shetland and other northern islands early peopled by Aryan Celts, whose descendants cannot be distinguished from Scandinavians. In other words, it seems almost proved that all the Aryans, including those who spoke Celtic and Slavic tongues, were blonds, and the non-Aryan Britons were brunette.

The earliest Teutonic invaders of Central Europe are believed to have been the Reihengräber or "row-graves," from the peculiar custom of burial in long rows. They were surely early blond long-headed invaders, but as the earliest Teutons were not known to the Romans until 100 B. C. when they suddenly appeared and threatened the outposts, the Reihengräber may have been Celt or Slav. Celtic place names and village types appear quite far east and Slavic names and village types appear far west overlapping, and it is not at all unlikely that the three types were identical.

Place of Origin of the Blonds and Aryans

This evolution of blondness, then, required a cold, dark, northern country—probably a cloudy, rainy, misty, forest country—the exact conditions needed

for the evolution of the brain by natural selection and the exact conditions of the countries where we have placed the origin of the Aryan or Teuton.

What a strange outcome that these three words should become synonyms—Aryan—Teuton—Blond.

The Asiatic type though it had plenty of cold never had sufficient darkness in its more southern, more treeless Asiatic locality, and has always been pigmented. Those which entered Europe have long been called Caucasians and Aryans, though they may be really a more distant relation than the negro is to the Aryan. (Skin color, then, is variable and due to local conditions and the early anthropologists blundered in using it as a basis of classifications of peoples.)

Ripley mentions the extreme poverty of the linguistic evidence upon which are based the many theories of the place of Aryan origin and almost every land from Asia and Africa to Scandinavia has consequently been chosen from the pliability of the evidence. Yet these few words are very significant. *Snow* and *cold* were indispensable, it seems. There was also *heat* and a quick alternation of seasons with no *spring* or *autumn*, *water*, a *river*, no *mountains*, few *trees*, a *wolf* (possibly a lion), a *bear*, no *agriculture*, most of the domesticated animals, *bees*, *grasshoppers*, and a *few birds*. Somewhere in the Baltic surely fits this slender evidence, though it is to be confessed that no mountains and few trees are difficulties.

Penka is the most prominent anthropologist who

has asserted "that the original Aryan got up into Scandinavia, having followed the reindeer from Central Europe after the retreat of the ice sheet." Ripley, from whom this is quoted, is rather inclined to differ with Penka and quotes approvingly the remark of Reinach, that if the Aryans really did this, "they left a fine country, where deer were plenty, to subsist upon shellfish on the foggy coasts of Denmark." This is probably just what the immediate ancestors of the Aryans were compelled to do by pressure from the rear. They were not Aryans but ancestors of Aryans, for though they were in the neolithic stage, there are no traces of any domestic animals with them. They were still probably brunettes, forced into this brumous latitude to evolve blondness, evolve more brain and the Aryan language. It was a rapid process of course in such a severe environment with such great destruction of the small, frail, dark and stupid ones. Ripley says that "quite early, however, even in the stone age, do evidences of domestic animals occur, to the dog being added the ox, horse, swine, and sheep. Pottery in a rude form follows." Finally he mentions the appearance of bronze, and the custom of burning the dead at about the time the Alpine race entered Scandinavia from Denmark, or about the time the men who forced them into Scandinavia would naturally have followed them, and about the time we would suppose the Aryan to have been really an actuality.

The very high degree of skill they possessed in the

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workmanship of their stone tools, in the long period before they learned of the existence of metals, rather indicates a high degree of intelligence, and their remarkable skill in working bronze as soon as it was introduced proves that the rapid evolution of brain had already occurred.

Ripley has proved that "the northwestern corner of Europe, including Scandinavia, Denmark and the Baltic Plains of Germany, throughout the prehistoric period, has been characterized by backwardness of culture as compared with the rest of Europe. It was populated from the south, deriving a large part of such primitive civilization as it possessed from the south and the southeast as well." All other anthropologists apparently agree with this conclusion, for in 1874 there was substantial agreement that the first men of Scandinavia were in the later stone age and that no paleolithic remains exist. No wonder the early Aryan waves to the south were rude but big and brainy. The stay-at-homes never learned of the existence of iron until the second or third century A. D.

That Aryans were blond is no new theory, for numerous anthropologists have advanced it in the interminable discussions as to the origin of the Aryans. All that Ripley will say is as follows: "It is highly probable that the Teutonic race of northern Europe is merely a variety of this primitive long-headed type of the stone age, both its distinctive blondness and its remarkable stature (and we should add brain) having been acquired in the relative isolation of Scandinavia through the modifying influences of en-

vironment and of artificial selection." Considering how little was known of the effects of light when Ripley wrote the above, it is a remarkably accurate deduction in the true direction. Poesche placed the center of dispersion of the blond Aryan further south in the Rokitno swamps about Pinsk and along the Pripet, but this theory has been pretty well discredited.

CHAPTER IX

EVOLUTION OF BLONDNESS

The Law of Cloudiness

By a mere glance at the charts of mean annual cloudiness¹ we can deduce the following law: *The blondness of a European nation is proportional to the cloudiness of its country.* Indeed, if we would reverse the coloring on this map we could almost substitute it for a chart of human complexions in Europe. East of the Baltic—that is, in Eastern Russia—the law does not hold, because of the increased light of the plains. It also beautifully shows why in Great Britain the blond should persist in the north and die out in the south. The charts for mean annual rainfall do not bring out any general law, because the tropics have the greatest precipitation, yet within a limited extent of latitude the blondness increases with the rainfall as a corollary of the above law. We will return to this subject in a later chapter.

This law undoubtedly explains, in part at least, the phenomenon of increase of blondness in mountains as compared with surrounding plains. The mountains are notoriously more cloudy, foggy, and rainy

¹ Bartholomew and Herbertson's Atlas of Meteorology, Vol. III., Chart XVIII.

and have less sunshine than the plains as a rule, excepting of course such plateaux as Thibet. When the sun does shine, there is protection of trees, late sunrise and early sunset in the valleys.

Early Migrations of Blonds

The blond Aryan type must have flowed south and asserted its supremacy very early, for all traditions from prehistory show the aristocracy and royalty to be of this type, even in lands densely brunette. Most of Poland's great men, such as Kosciusko, have been of this type, but the mass of Poles are too inert for Aryan independence.

Louis Kossuth, the Hungarian patriot, was a blue-eyed Aryan of the ruling aristocrats, his father was a lawyer "of noble lineage and patriotic antecedents." His struggle for Hungarian independence was typically Aryan—"equal rights for every class, freedom for religious belief, trial by jury, free public instruction and the annual meeting of the diet." There were too many Asiatics in Hungary for such an Aryan democratic programme to be successful.

Ripley mentions several investigators who have reported the general tendency to the blond, tall, long-headed type among the upper classes of Russia and Poland, so different from the Asiatic type which he calls Alpine.

At the dawn of history the Celts or Gaels had percolated to Ireland, Southern France, and Spain. They were a blond race with blue eyes and yellow hair, as described by Cæsar. In Spain they united

with the Iberians, who were probably a Mediterranean type, and formed the Celt-Iberian race. But scarcely any of their descendants are left in Spain and but few, if any, in Southern France. In the time of Cæsar the northeastern part of France and the lowlands of the Rhine valley were occupied by the Belgæ, who were probably Teutons, and they, likewise, were blonds with blue eyes and yellow hair. These blonds were so numerous in Cæsar's time as to indicate recent arrival. The brunettes of France were so few that they had to learn Aryan speech, either Gallic or Belgic, and their descendants are now called Celts, Gaels, Gauls, etc., but they are brunettes and are really descendants of aboriginal long heads or Asiatic broad-headed invaders. Franks were blond Aryan Teutons who later invaded France, and this type has ever since been flowing into the land only to die out.

Rate of Evolution of Blondness

We must go into the question of the rate at which blondness can evolve from brunetteness and the length of time such a process requires. It is a matter of thousands of years, of course, but how many thousands we do not know. We have some data as to the length of time it required to develop nigrescence from the original brunetteness. From the size of the negro brain we know his brunette ancestors must have departed from the northern cradle of the race at least one hundred thousand years ago, and even two hundred thousand years is not an excessive

estimate, some even inclining to a still greater remoteness of the period of men of this type in Europe. The rate of migration had to be exceedingly slow in order to allow of adjustment by survival of the most brunette as they traveled south. There would have been total extinction if there had been a rapid migration. It was a mere oozing along the surface—not a flight. If the children on marriage or mating did not go more than a mile from their birthplace, it would require three thousand generations, or sixty thousand years, to reach the Equator, and we know he reached North Africa long before this time, hence it is quite likely that eighty thousand years is a very moderate estimate of the length of time it required to evolve African nigrescence from the original European brunetteness. Ten thousand years is therefore a reasonable time for the evolution of Aryan blondness from this same brunette type, indeed it may have taken much longer, and it would not be a great blunder to place at 20,000 B. C. the original causes which forced into the bleak north the ancestors of the future Aryans or blonds. The Asiatic broad heads who invaded Europe about 10,000 B. C., whose descendants we call the Alpine type, have evolved, by natural selection, a wonderfully light skin, but not blondness by any means. Though they have had all these millenniums for this selection they have not had the right conditions for the evolution of blondness.

Mixed Types

There are innumerable mixed types which anthropologists are pretty well agreed are hybrid forms, having no relation to environment. Rarely we find light hair and dark eyes, but the commonest type is dark or black hair, with gray, hazel or blue eyes. The latter are very common among the Irish and also the Alpine race of Central Europe.

There is some ontogenetic evidence that the mixed type of man with brown hair and blue eyes is not a crossment, but an evolution from blonder types which have migrated from their dark homeland to lighter countries. Babies retain ancestral characters, even useless simian ones, if they are harmless, and thus epitomize our evolution. Hence the jet black hair often found at birth is a survival of the brunette stage of primeval man; as it is quickly followed by very blond hair, we presume a second ancestral stage of blondness, and finally, as the child grows, its hair turns to one of the brown shades, indicating a later evolution since migration. The opposite types are also found, for babies are often seen with jet black hair which gradually turns brown, omitting the flaxen period as though its ancestors from which it inherits its characters never lived in the blond producing climates.

There is one other form of brunetteness which is quite common. There is a combination of very white skin, like a blond's, and dark or black hair and heavily pigmented iris and retina. It is found in

Ireland, and it is quite common in Central Europe and in American cities. There are no statistics as to the head shapes of this type so that it is difficult to say from what type, eastern or western, it is derived; but from general observation I should conclude that it is derived from both equally. It is doubtless a late evolution in migrated forms, though not a crossment, because in youth these types frequently have either yellow or jet black hair. It is the survival of those who have been pigmented around the head but who have survived because protected by opaque clothing. This type seems well suited to city life though not as well suited as the sallow or swarthy. Originally brunetteness or pigmentation affected the whole body equally, for the evolution took place very early before there were any necessities or civilized requirements as to clothing, and these types survived when they migrated into cold light countries. So that the pigmentation of the body of an Eskimo presents no difficulties whatever for explanation, though it is never exposed to the light.

Age of Aryan Language

“The Aryan language is the most developed language of which we have any knowledge.” “According to the laws governing the life of speech, the people speaking this language must have existed at least ten thousand years.”² All authorities apparently agree that the early Aryans must have been iso-

² Words of A. Schleicher in Hilderbrand's "Jahrbücher für Nationaleconomie."

lated completely from other peoples in order to evolve this, and moreover it required a very high degree of mental ability to do it—indeed required more brains than any other people ever possessed. Their marriage relations show a high mental level, yet they were a rude people too, struggling for existence in a severe environment as shown by their ignorance of agriculture and of the art of working metals, their undeveloped laws and almost communal property. They were a settled, numerous pastoral people in the mountains of Persia, in India, and probably also in Northwestern Europe, though they did not live in towns. All these conditions existed in Europe about the time of that first and earliest flood into Europe from Asia of the brachycephalic people. The Aryan had no words for spring or autumn, merely summer and winter, such as there is in a northern land. The Romans adopted private ownership of lands after their arrival in the south, the tradition being that Romulus distributed land—two acres to every citizen—just as conquerors in England always divided up the land among themselves.

Whether all the Aryan-speaking peoples of Persia and India were really blond Aryans or conquered brunette natives is a matter for discussion in a later chapter.

The great stumbling-block has always been the current idea that civilization has made man's brain grow. The fact is that man built up civilization after he evolved the brain for other reasons. Hence it is difficult for people to understand that the braini-

est race could exist cooped up in Northern Europe while early civilizations were being built up on the Mediterranean by less intelligent races. Education is not brain, but is training the brain, and we frequently find that very ignorant Aryan immigrants to the United States are really very brainy people who do well and whose descendants become great men. So that the brainy Aryans, without letters, and knowing nothing of their origin and of other civilizations, became very great as soon as they migrated south and learned of the things invented by the lower races.

Man did not enter Scandinavia until the neolithic age and this was probably due to the very late disappearance of the ice. As it is generally thought that the original Aryan home was in Scandinavia or its vicinity, and that the primitive Aryan existed about the time of the neolithic age in Europe, it is plausible at least that the blond type of man originated in Scandinavia and has flowed out in all directions, east, south, and west, ever since. It is not a mere coincidence that philologists have stated that the Aryan language required ten thousand years to develop and that anthropologists estimate that the brachycephalic invasion of Europe began about 10,000 B. C., during the latter part of the neolithic age.

Blonds are Maritime Races

Can it be possible that the ancestor of the Aryan was actually driven off the mainland of Europe by that early Asiatic invasion and survived by taking to his boats in the Baltic? That is, all land-lubbers

perished and he survived because he was a boatman, and has been one ever since. The blond type of man is now, and always has been, the best sailor. He takes to water like a duck even after several generations have lived on land. He is the yachtsman of the world, the boat builder, and rules the sea at the present time. For centuries the Mediterranean man has been building fleets for the Baltic man's pleasure to destroy.

Japan is the exact counterpart of the British Isles. Each is populated by several types of men who have come in successive waves from the mainland, each has been a maritime people for untold thousands of years, probably forced out of the mainland and saved from destruction by reason of their seamanship. Each race instinctively takes to the water and makes magnificent sailors. When our ancestors were savage Vikings, plundering and murdering in every port they could reach, the Japanese were doing the same. Each learned to read and write about the same time—sixth or seventh century A. D.—each built up a high civilization, the foundations of which were borrowed from the mainland, though for a while at least the Japanese were in advance of the English. Both have taken to iron warships only recently. Each has been an aristocracy governing lower types with an hereditary executive with limited powers.

But look at the Russian peasant,—not his Aryan conqueror. He is an Asiatic who has been a land-lubber since the beginning, neither he nor his ancestors away back to the anthropoid times ever saw or

heard of the ocean. For centuries the Aryan rulers of these men have dreamed of an ocean seaport, but of what use is it? The Russian cannot become a sailor for that comes by natural selection, not education. On any ocean ship to-day we find men whose ancestors have been seafaring Baltic people as far back as they can find records. So it is easy to predict that a Russian fleet can have no possible chance when pitted against an equal force of British or Japanese ships. This rule will hold for all time. The Russians have had the audacity to ridicule the Japanese as children playing with a navy as a toy, but find to their cost that they themselves are the children when it comes to the seamanship in which the Japanese were expert for many centuries before there ever was a Russian government. Yet so alike are these two races of Asiatics, that several Russians have been arrested in St. Petersburg on suspicion of being Japanese and therefore spies.³

The original Slavs were called "Wends" by their Teutonic neighbors, and the word has been thought to come from the root *voda* (wandu-lithuanian) meaning water—that is, they were people dwelling about the water,⁴ and the opinion is widely held that they originated on the Baltic shore. The blond type of Russian from the Baltic still furnishes many fine sailors, but the brunette or Asiatic type does not.

The Aryans who subjugated Greece proved that they were seafaring people by nature, for they im-

³ Dr. E. J. Dillon, *The Contemporary Review*.

⁴ *Encyclopædia Britannica*.

mediately became "skilful shipbuilders and navigators." Their commerce destroyed Phœnician trade and their factories and colonies were planted from Odessa to Marseilles (Clodd). The assistance given by the Ionians and Carians to Psammetichus (666 B. C.) gave them that foothold which led to the final Hellenization or Aryanization of Egypt and Asia, indeed of the whole civilized world. The Mediterranean became an Aryan lake, as it is to-day, for it is now merely a British royal highway.

The Aryan Persians, too, in spite of some centuries on the land, were still maritime by nature, and the sea fights between them and their Greek cousins were royal battles, the echoes of which are still heard. It is not at all unlikely that the maritime instinct of Aryans has always led them to spread by sea routes and may account for their wonderful journeys east and west. They may have reached the Pacific islands from India and we know they reached America ages before Columbus.

American Indians

The evolution of nigrescence and blondness must then have taken immense periods of time. This is one of the reasons why we think man is a comparatively newcomer in America—not many thousands of years—for he has not had time to develop complete blondness in the dark, cold forest regions, nor complete blackness in the light, hot tropics, though there is considerable difference in color between the "white" Indians of New York and the "black"

ones of the Amazon. On the plains and prairies, blondness is surely a disadvantage just as it was in Asia. Hence brown or copper skins are as normal to western Indians as to Mongolians. Perhaps our western country will be inhabited by brunettes eventually like the southern parts, Teutonic invaders finding their best places in cold, dark forest regions to the east. Brunette Canadians seem to be better fitted to our northwestern countries than blonds from the Eastern States, and are surely percolating through the country at a rapid rate.

Urban Brunetteness

Beddoe states that brunettes are at a distinct advantage in urban life, for cities are almost universally more brunette than the surrounding countries. Can this be due to the fact that there is more light in the cities than in the forest homes of blonds, making brunetteness necessary, or is it due also to the fact that the urban people are not outdoor workers as a rule, but confined to warm houses where blondness is no advantage as to warmth, as they are warm enough already? City life is more like Mediterranean life—warm and light. Perhaps the intense summer heat and light of cities is the real reason for the relative unfitness of blonds and the better fitness of brunettes. The brunette Asiatic Jew flourishes in hot New York City—a half-million strong already.

Any one living in a city can convince himself of the universal law that the cities are more brunette than

the surrounding country. Even in Maryland which is of the latitude of Southern Spain and Italy, blond families still survive in the country to a degree not found in Baltimore or Washington. If one takes a summer walk in the green fields and green woods, notices the amount of reflected light, and then compares it with the light reflected from the houses and streets of the city he can well understand why the blond is better off in the country and survives much longer. Nevertheless there is too much light there also, and my observations show that the country blonds are suffering so much more than the city brunettes that their eventual disappearance is a safe prophecy.

Ammon's law, so named from Dr. Ammon of Carlsruhe who worked it out in great detail, though it had been previously discovered by Lapouge in France, is the statement of the remarkable fact that there is a general tendency of cities of continental Europe to be more long-headed than the surrounding country, showing that the Teutonic type has a penchant for city life. A great deal of discussion has been raised as to the reason, but this brainy intruded type from the north seeks non-productive or governing occupations, leaving the farms to the autochthons. This law has been found in ancient Chaldaea, Greece and Rome and seems to be universal. Indeed the law has been found to be applicable only in those parts of Europe "where the Alpine race forms an appreciable element in the population." It is precisely the same condition as in Greece where the invading Aryans were city people while the dark

natives remained on the farms, and the similar condition in ancient Italy. It is to a certain extent the index of the mental superiority of this Teutonic type which has been such a marked fact since the first Aryans began to flow south. Hence Ammon's law does not apply to the northern parts of Europe where there is such a preponderance of Teutons. On the other hand it does apply in Southern Italy but in a negative way though it is the same law, for here the main type is the long-headed Mediterranean while the intruded type of broad heads of slightly more brain capacity tend to the cities which are more broad-headed than the rural districts. In other words Ammon's law is merely a modern expression of a condition of Aryan supremacy of Europe existing since the earliest Aryan movements from the north.

Yet this is not the whole of the matter, for we have the conflicting fact that cities with a few exceptions show a decidedly greater brunetteness than surrounding rural districts, just as though the Teutons were becoming darker in the city by natural selection when they did not die out from too much damage from the light. Bibliography on this part can be found in Ripley's brilliant work on "The Races of Europe." He shows that the Alpine type having so much more of that Asiatic patience and passivity which keeps them on the soil, are sedentary and never show the Teutonic restlessness and mobility. Hence the type keeps out of the city, while the Teutons and Mediterraneans and Jews flood into it, the latter raising the average brunetteness. This is a better explanation of the in-

creasing brunetteness and long-headedness of the European cities, than the explanation of the evolution of a new brunette Teutonic city type—Lapouge's "foreordained urban type." Such an evolution requires many thousands of years and could not possibly be noticeable in a few generations. The increasing brunetteness is then merely a survival of more brunettes of all head shapes, and the increase of long-headedness is the result of migration into the city and survival of brunette long heads. In other words, more long heads than broad heads flock into the city and more brunettes survive the damage due to the light, so that the result is greater long-headedness and brunetteness but not a new type.

What the conditions are in American cities is not known, though we do know they are markedly brunette. The apparent evolution of a type with dark eyes and hair but white skin is an entirely different matter, and has been probably going on in Europe for a long time, as elsewhere explained, but nothing is known as to what types of man—long or broad heads—are furnishing the material.

Habits Check Evolution of Brunettes

Natural selection sometimes secures the survival, not of those best fitted to resist a cause of death, but of those best able to dodge it and escape. Hence we see habits and instincts appear, by the survival of those who escape or hide from danger. Likewise man's intelligence, or reflex actions, leads him to escape a danger, whereas lower creatures resist it.

Hence the lowest men, who have not had intelligence enough to escape the light and heat, have evolved blackness, by the survival of the darkest in each generation. When habit, or intelligence, has caused men to avoid tropical light, no doubt they have been uninjured and have survived though not black. Thus we see in very light countries the brown or yellow races wear thick opaque headgear, and this is as necessary as the thick woolly mass of hair is to the negro. The Arab clothes himself in white and thoroughly covers his head, and so do Hindus and Malays. Among the curiosities of all tropical countries are the huge hats found necessary for survival. Umbrellas seem to be part of the equipment of natives of tropical countries, if not an actual umbrella then a hat made like one. With all this care to protect himself from the sun's rays there may also be absolute avoidance of them. The Japanese and Filipinos, for instance, avoid work in the heat and light of the day, as elsewhere explained, but will labor far into the night or before daybreak. They instinctively imitate the nocturnal animals.

So we cannot say whether habit has prevented the full evolution of blackness of the Malay, or whether he is a late arrival from a darker country, and has not yet had time to develop blackness by selection. Both are probably correct, for it is likely that he is a newcomer in a climate which has evolved the blackness of the negritto type and that he is not yet adjusted to the climate but will be in time. For the present he is making the evolution a slow one, be-

cause he hides from the danger instead of braving it like the negrito who thus destroyed his blondest types. The better fitness of the dark types is also shown by the very evident fact that old Malays of pure blood are distinctly darker in complexion than the average of all ages. There is no doubt that they live longer by reason of their darkness and this in time would darken the whole race by the law of selection. We foolish Americans, blond and far worse off than Malays, have a contempt for this danger, and brave it. No wonder we break down. To do our work safely in the hours we select we should be as black as negritos.

As a rule every light country has very black old residents adjusted to it, lighter newcomers who are not adjusted and must hide from the light or be otherwise protected; and, again, it has its white men who must be much more careful, but even with all their care these will break down in time.

Tanning

The ability to tan or take on coloring matter as a protective armor against light is surely a matter of selection among all blonds, for it is quite certain that no matter what were the conditions under which blondness arose there were short periods of time when there was much light—as in harvest times in the short hot glacial summers of prehistory—and then those blonds who could tan were far better fitted to the environment than those who could not, and surely these tanned men, being better fitted, survived when

others would not. They were the "fittest" and became "selected." When the short summer was over, the tan disappeared and the whitened blond was again fitted to survive the dark cold winter.

We have usually looked upon tanning as an evidence of good, robust health and send our children out into the sunshine to get tanned. It is really a pathological process caused by the injury done by the light. Free untrammelled exercise in the open air is the beneficial element and it would be more beneficial still if it could be taken in the shade of the clouds. The boys and girls of Scotland, England, and Ireland are notoriously robust and healthy and have been for some thousands of years, and do not get the bronzed, tanned skin we admire so much in our country boys. The complexions are red—the blood seems to be bursting from Scotch, English, and Irish skins—but all this healthiness would disappear if they had the same amount of light as Kansas or Arizona, and it does disappear when they come to America. I know of two little boys who were raised in England and when they came to America in 1901 they had the usual brilliant complexions. Now they are as tanned and colorless as American boys usually are. The bronzed skin of the cachectic white man who has long been in the tropics is likewise a pathological phenomenon. The bronzed seafaring man has been likewise injured by the glare from the water, but to a far less extent as he wears opaque clothes, while the tropical resident has clothing which is practically transparent.

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The *freckled skin* which goes so often with red hair and is so common in youth before the darkening due to age, is apparently a pathological condition, an excess of tanning in spots and a fairly sure index that the person is not in his ethnic home. It is quite common in Ireland and Finland—on the two extremes of the blond area of Europe, and of course it is an American boy's badge of nationality.

The selection of those able to tan has no influence whatever on the evolution of brunetteness. For instance, certain dark Semitic people in Northern Africa are really tanned, for their babies are very white when born and remain so for a long time. This is the best possible proof of recent arrival from the colder north. The ability to tan then results in a survival of those immigrants who are able to stand the increase in light.

There are said to be blond types in Algeria, the descendants of the Tamahu, who have been blond for three thousand years, but I have no data regarding these people as to whether they are mountaineers, or whether they have survived from great care in hiding from the light.

It is to be noted that people who do not tan easily are very apt to redden. This color is just as efficacious in excluding violet rays, for, as before explained, Piffard, Ravogli, Finsen, and many others, in the treatment of tuberculosis of the skin⁵ by condensed light, depend on pressure or adrenalin to

⁵Journal Cutaneous and Genito-urinary Diseases, No. 231, 1901.

empty the cutaneous blood vessels as the red color of the blood destroys the shorter waves.

Positively nothing is known of the reasons for the remarkable pigmentations accompanying pregnancy and certain diseases: chlorosis and other blood diseases, malaria, liver and spleen diseases, Addison's disease, and malignant growths. At present we believe the pathological pigments to be mere excretions of blood-coloring matter which cannot make its way out by the bile and urine in the usual way. They do not seem to have any relation to light or darkness. Professor Simon Flexner, of the University of Paris, has studied these extensively and the reader can consult his works for details. The excrementitious pigments are deposited in the connective tissues but in Addison's disease and some others they are deposited in the cells as melanin.

Rufousness

The evolution of the rufous type of man is an enigma; he is a blond, indeed very blond, yet the redness of his hair renders it about as efficient in excluding the light as the yellow of his neighbors. He does not tan but reddens under the influence of light, and that color is, of course, as good as the brown of the tanned blond. There seems to be a little area in Europe, with Denmark as its center, in which redness arose, though the Danes are prone to resent the accusation that their country has been responsible for all the red-headed men in the world.

The name Russian itself is said to be derived from

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a root meaning red or rufous (Ripley), and it would rather indicate that the Slavs when first called Russian may have had numerous rufous types among them. Indeed, the tendency to rufousness still distinguishes the blondness of Russians from blondness in other places.

There is also a remarkable rufous tendency all around the Mediterranean. It is more noted on the north side than the south and is quite common on the east side, particularly among the Oriental Jews. But in all these cases the redness is in the hair. The eyes are apt to be brown, rarely if ever blue, and the skin is well pigmented. There are blue-eyed Jews, of course, in Europe, but I believe I am safe in saying that they have plenty of skin pigment like the blue-eyed Spaniards and Italians, so that a real blond is very rare among them. Ripley states that this type was chosen in the early centuries for the pictures of Christ.

As the two Semitic words "black" and "hair" are commonly synonymous in the early languages, we can dismiss rufousness as a marked early character, except the very early mention of Esau as a type which may refer to Aryans as before explained.

Rufousness appears so often among the Teutonic types in Scotland, Scandinavia, Finland, Lithuania, and Germany that there seems to be some reason for Topinard's opinion that it is a mere variety of yellow-haired blondness.

Redness is probably an adjustment, through natural selection, of extremely light blonds with flaxen

yellow hair, who have migrated from a very dark country to a lighter one, or who have been subjected to a change in climate which brought in more light, perhaps by clearer skies or the destruction of thick forests. Red is so near the yellow in the spectrum that it is quite conceivable that there should be variations towards the red to permit of this gradual change by the ordinary laws of selection. It is no doubt a mere variation of yellow pigment, because almost all yellow chemicals can become red by a very slight chemical change, often by a mere rearrangement of the atoms in the molecule.

Redness of beard or hair is found here and there all over the world as a result of mixing of races. In America we have the mulatto with blue eyes and red hair, and similar types are found in all dark races where blonds have intruded. Very many Russians are of this type; in Italy and Spain also they are numerous, and the latter are remnants of blond types which have flooded the Mediterranean countries since prehistory. But all of these offer no difficulty for their explanation, and do not concern the question of the evolution of the blond parent stock. Americans are such a mixture of all types, European and Asiatic, that we find quite a large number of these rufous types as reversions (atavisms) in families where the red ancestor was forgotten.

The appearance of rufousness among brunette races in regions which have had no immigration from Europe is of course unexplained. For instance, the red beards among the Mongols and Tartars of the

north—a race, by the way, more or less devoid of beard—are a curiosity of ethnology. Nevertheless there are analogous facts among the lower animals. We have elsewhere shown that many animals become darker when confined in the dark. The black nocturnal animals, carabao, etc., become red-brown on exposure to the sun. Black domestic animals, like the horse, can be kept black only by protecting them from strong sunlight, for they become tanned to a brown-red. I have known women's hair to turn from black to brownish-red on the parts exposed to strong sunlight. It seems that the pigment of the hair is partly destroyed by light or changed into an allotropic form. The phenomenon is so common that it must be beneficial and it can be for no other purpose than to reflect some of the incident heat, for, as previously mentioned, blackness is a disadvantage when exposed to the direct rays of the sun in places where the rays are very fierce. The process, carried to excess, results merely in the yellow and tawny hair so common in all animals of the plains and steppes—lion, coyote, etc. The red of the mammoth's hair thus indicates sun exposure, and those species which lived in wooded countries were probably black.

Rufousness, then, can be nothing more than an evolution from blondness or brunetteness to afford better protection from longer rays, as they are all impervious to the short rays if the latter are not greatly concentrated. This is also suspected from the fact that among Italians of blond beards or reddish

hair the eyes are apt to be very brown, very rarely a light blue.

Rufousness of the hair is often, if not generally, accompanied by a type of nervous system for which we have no descriptive terms. It is a matter of popular comment, though we do not know what it is beyond the general statement that it is a grade or form of instability. As it is rarely found among the "Who's Who in America" or Europe, it seems to be an accompaniment of a type of mind which prevents greatness. Rufus or Barbarossa, as names of kings, refer to beards not hair. Fiery red hair is seen in the ranks, rarely among the leaders. It is not a far cry, then, to see in it a minor grade of abnormality, even if it is a mere variation of blondness.

Senile Blanching

The reason for the senile blanching of the hair of the head and body is wholly unknown. We have not even a suspicion. Metschnikoff has shown it to be due to the removal of the pigment by the phagocytes, but he does not show why the phagocytes should begin this work after so many years of neglect to do it. In other words, he merely shows what the mechanism of blanching is, and not its purpose, which must be an important one because it is found in many of the lower animals and it is likely that it is a mere symptom of senility—a step towards death. White hair is probably just as opaque as black, for it is proved that white feathers are as opaque as black ones. The white hairs reflect more rays than black

and are a better protection from the sun's rays, but they also radiate less, and it is not unlikely that the white-haired animals do retain more body heat than the black, so that the change may be an actual benefit, enabling the senile to conserve energy—a matter of extreme importance and easily brought about by selection.

Hirsuteness

Cleaves quotes Berthold to the effect that nails, hair, and beard grow more rapidly in summer. Finzen states that hairdressers noted the same and that shaving was required more frequently in summer, and in his clinic hair frequently grew on parts exposed to concentrated light. It is a well-known fact that the irritation of the sun's rays will cause increased growth of hair on the legs and arms of white children and to a less degree also in adults. This is not caused by exposure to heat rays, so we have no other conclusion than that it is a reflex action of the stimulation of light rays on blood vessels, and on the minute hair bulbs. Carried to excess it will destroy the bulbs, as in the case of X-rays or radium emanations, and the hair fall out. Similarly we find that in darkly pigmented skins there is no such formation of hair on exposure to the sun's rays, and the inference is clear that the blond, hairless races must have evolved where there was but little light to induce pigmentation or hirsuteness.

The involution of the body hair, and the evolution of the hair of the scalp, are thus very easily explained. There is no doubt that primitive man was well cov-

ered with hair, as was his ancestor the pithecanthropus. But just as soon as a sufficient degree of intelligence was evolved to permit him to utilize some kind of protective covering for the cold winters there was a selection of the least hairy, for they were far better fitted to survive changes of temperature than those well covered with hair who would be too warm in the caves and too cold outside. The latter also, unless they shed the coat every spring, would be out of place in the very hot summers with rapid variations of temperature, when nakedness was an advantage frequently, but not always. Even a little hair would be harmful. There was but little light to exclude and the skin was well pigmented.

In the case of the scalp the conditions were different. We rarely appreciate how transparent the scalp and skull really are. A candle in an empty skull shines through quite plainly. Hence a hairless head would permit strong light to penetrate to the delicate nerve cells which are here directly on the surface and it would be fatal. The greater amount of light there is in a country the thicker and blacker is the head hair. It is perfectly evident why the ancient European's wavy hair should become more and more kinky as man slowly migrated south, for it is thus a better protection from light. There is then no enigma in the apparently useless masses of kinky hair of the negro. The hair is not needed as protection from the heat, or cold, for it is profuse in all countries, but it is a protection from the light.

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Baldness is an advantage in modern life very often, for it is decidedly better in those rapid changes from a very hot house to the cold exterior. Intelligence has enabled man to protect himself in all conditions, consequently we find that baldness is increasing now, just as the hairless bodies became more numerous in glacial times—in both cases by natural selection. Women are retaining the head hair through sexual selection.

Tallness and Blondness

Our Civil War statistics show that the tallest men came from Vermont, New Hampshire, and Kentucky. Dr. Robert Fletcher, of Washington, is inclined to believe it due to calcium salts in food and water, for these districts are limestone regions; but if that is so then other limestone regions, like Kansas and Michigan, should breed tall men. There are other factors besides lime. Anthropologists have proved that stature is dependent mostly on food, for people who live in desolate districts on bad food are stunted but grow tall in a few generations on good food. Children of stunted immigrants in the United States, are apt to be taller than both parents for this reason. Meat eaters the world over are bigger than vegetarians, though here it may be a natural selection of the robust hunters.

But since experiments prove that both plants and adult animals grow more rapidly in the dark than in the light, food and other conditions being equal, it is likely that here we have a factor to explain that general increase in stature as we recede from the

Equator or go into the mountains, the Scotch and Patagonians being the tallest people on earth. It may be one reason for that remarkable increase in stature found in many families in the dark, rainy parts of our Northwest. In some parts of the Pacific coast the young women who are natives are notoriously large, but unfortunately they incline to embonpoint like all other living organisms not restrained by light. It has been proved, by the way, that man excretes more carbonic oxide, more urea, and more chlorides when in the light than when in the darkness, even if he is passive during both periods.

In order to show whether stature of soldiers modified their health in any way, data were collected from 1300 who had been in the tropics two to three years. They were divided into four classes with the following results as to their average height:

Retained Health.	Deteriorated.	Invalided.	Died.
5 ft. 6.8 in.	5 ft. 7.5 in.	5 ft. 7.1 in.	5 ft. 7.4 in.

It was to be expected that there would be a slight advantage to the short men who approximated to the size of the natives, but the figures show that it was not a very great advantage to be of small stature in the Philippines. It is certainly true that the little dark men are more comfortable by far than the big blonds, but the figures show that it is practically impossible to get at the effect of bigness itself. The other factors are more important.

Men are Blonder than Women in Europe

Havelock Ellis⁶ mentions the fact that in quite a number of races the women are distinctly lighter than men, and it seems as though the relatively greater sun exposure of the men is wholly sufficient to account for the phenomenon. But in England there is the opposite tendency of the women to have darker hair and eyes than the men, and the women tend to darken in complexion at the time of puberty. These rules seem to apply throughout Northwestern Europe. It cannot be explained at present. Ripley inclines to the view that it is due to the law that women hold to primitive types much more than men, and Ellis and Beddoe seem to think it may be due to the propagation of the original condition of the blond invaders who were mostly bachelors and who married brunette women of the conquered country—a habit they still keep up.

As a curious side thought, it might be stated that Ellis finds that women possess a greater resistance to disease than men, and he believes it due to their greater pigmentation. It is accompanied by greater longevity and a greater resistance to senility, i. e., they are really younger for their years, than man. As his data refer mostly to England and France where the blonds are out of their zone, the conclusions are of course in accordance with what we know of brunettes in like places.

⁶ "Man and Woman."

Ultra-Violet Nerve Sense

It is an unsolved mystery why there should be no human nerve apparatus to receive impressions from the harmful ultra-violet, while we can perceive the slower rates by sight or temperature sense. If the heat sense was evolved because those having it were guided from harmful to beneficial temperatures, why did we not evolve a pain sense to guide us away from harmful sun's rays—like the ants and lower organisms generally?

The only hint we have is in the supposition that man and his ancestors evolved in dark, rainy, misty, cloudy regions. Such an atmosphere is proved to filter out the ultra-violet, and even to-day though they are very powerful at mountain tops they are mostly destroyed by the atmosphere before they reach the valley. Hence there was no nerve sense evolved as there was no need of it, but evolution later took the direction of throwing out a pigment and this resulted in the survival of the pigmented and the death of the unpigmented when ultra-violet did enter the environment. It was too late to evolve by variation a new nerve sense, and survival could then occur only in one way—that is, by excluding the harm which was not sensibly appreciated. Hence our present ignorance of the injury we receive when out of our proper zone. It is to be noted also that life arose in the oceans where the ultra-violet rays cannot penetrate, and that terrestrial life was impossible without similar protection from this unperceived danger.

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In Professor Cleveland Abbe's introduction to Dexter's work on "Weather Influences," it is clearly stated that the evolution of man from his ancestral types was due to the very slow action of forces which are now in operation. He quotes Professor A. H. Keane,¹ who states that the divisions of mankind, like divisions of all terrestrial fauna, are the outcome of their special environment. "They are what climate, soil, diet, heredity, and time have made them, and that is the reason why, in the case of all later migrations, the first question that arises is one of acclimatization. If the new zone is favorable, that is, differs but little from the old, the variety persists; if not, it either merges and becomes absorbed in the indigenous element, or else simply dies out."

But he becomes inconsistent when he states that "we need no longer suppose, always a somewhat violent assumption, that some fully specialized group, say, originally black, migrating from continent to continent, became white in one region, yellow in another, brown in a third, and so on. Had such a specialized group passed from its proper zone to another, it would probably have died out long before it had time to become acclimatized." What Keane rejects is exactly what occurred. Primitive man was always so specialized as to be adjusted to his environment or he could not have survived, and his spreading was by very slow stages to allow of survival of variations best fitted to the new environ-

¹ Mill's International Geography.

ment. Rapid migrations are fatal. Hence in slow migrations, gradual changes occur, so that the type is always so specialized as to be adjusted, and the groups which moved south darkened by survival of the fittest as the only adjustment to the increase of light, and those which moved to the dark, cold Baltic regions lightened in complexion by the opposite selection. Thus color is purely a matter of selection in a slow migration. The broad-headed Alpine type, also called Celto-Slavic, is now white and it is no doubt descended from very early yellowish or brownish Asiatic invaders. Later Tartar invasions, such as those of the Huns in historic times, were too rapid and have not left a trace, so complete has been their extinction.

CHAPTER X

RESULTS OF INSUFFICIENT PIGMENTATION

Tropical Stimulation

FROM the foregoing chapters we can now understand the physical and nervous effects in man. resulting from an insufficient pigmentation for the amount of light to which he is exposed.

During the first few months of a tropical residence, before the light stimulation has caused exhaustion, there is a marked increase of the feeling of well-being. Mental processes are more active, muscular vigor is marked and there is a universal opinion in all newcomers that the climate is not bad after all. They are apt to overdo the matter and sooner or later become exhausted. There are several curious letters on record from men newly arrived in the Philippines who have written glowing accounts of the climate and have collapsed or died within a few months. Good accounts often come from men who spent their whole time in office at headquarters and who never witnessed the collapse of regiments in the field.

The preliminary stimulation of the tropics is an exceedingly dangerous matter to people who do not understand it, for it gives them a false idea of the tropics, leads them to do more work and expose

themselves unnecessarily, and they advise weak people to come to the tropics who should stay at home. I know of a chaplain who wrote letters in which he said that the climate was good and he went back for a second tour only to die within two or three years. Another officer while under the stimulation wrote his wife to come over and bring the babies as the climate was perfect. Before she could start he was dead. Another officer was so pleased that he cabled to Washington that the climate was perfect. He was carried home collapsed in a few months.

Ripley quotes Beyfuss and Jousset to the effect that a tropical climate is a sexual stimulant and naturally leads to excesses. It is more probable that the sexual excitement so noticeable in the Philippines is confined almost exclusively to the preliminary period of stimulation of the whole organism and that it subsides in the later neurasthenic or exhausted stages.

Tropical Exhaustion

The action of the rays is twofold: first, an increased metabolism, and, second, an actual destruction of the protoplasm or the derangement of its molecule. Dr. W. J. Simpson¹ notes the fact that in the tropics there is an increase of .05° F. body temperature for every degree F. increase in air temperature, and quotes Dr. Crombie that Europeans in Bengal have an average of .41° more temperature than at home, but he does not mention whether this is due to greater oxidation or lessened radiation.

¹ Journal of Tropical Medicine, April 15, 1903.

Nevertheless it must be mostly the former, for he mentioned that the nervous system is at first stimulated and later depressed so as to be easily affected by external impressions. This is the picture of neurasthenia, a condition no doubt exaggerated by feeble digestion and poor food. Simpson also mentions the danger of nervous depression in newcomers. Now if a temperature of 120° F. will destroy our nerve protoplasm promptly, and 110° in a few hours, and 105° in a few days, surely a rise of half a degree if not fatal is so harmful as to render the organism eventually unfit for survival, if not in one generation then in several.

Tropical Apepsia

Digestion becomes more or less feeble in all whites who go to the tropics, particularly in those markedly neurasthenic, and it is an article of faith in India that curry and other stimulating condiments are absolutely necessary to spur the digestion on to do its needed work. Without curry it is said that the average stomach and intestine is unable to dispose of sufficient food to keep up nutrition and that gradual deterioration is sure to result. It is also a well-known fact that when dysentery attacks men over forty years of age it exaggerates this weakness of digestion, and they practically starve to death if not sent at once to a cooler climate. It is the determining cause for much invalidism and is merely an index of the prevalent neurasthenia. One physician informed me that he considered this condition to be

apepsia of nervous origin and quite common in the tropics.

This exhaustion may be so severe in the tropics that alcohol in moderation is a necessity. I have given the proofs of this assertion in another paper² on the use of alcohol in the tropics, but merely state here that statistics of about twenty-eight hundred soldiers show that the damage done to these vigorous men by the small amount of excessive drinking they indulge in was not as great as the damage done by the climate to the total abstainers. Approximately 11 per cent. of the abstainers died, while about 3 1-2 per cent. of the moderate and less than 2 per cent. of the excessive drinkers died. About 15 per cent. of abstainers were invalided home, about 9 or 10 per cent. of the moderate and about 8 per cent. of the excessive drinkers. About 26 per cent. of abstainers, 24 per cent. of moderate, and 24 per cent. of excessive drinkers, deteriorated in health. About 49 per cent. of abstainers, 64 per cent. of moderate, and 66 per cent. of excessive drinkers, retained their health. There were very few who improved in health in any class, but the percentage among the abstainers was a trifle higher than among the excessive and less than among the moderate drinkers.

It seems proved that, for the older men at least, the exhausted organism cannot nourish itself properly and that a little alcohol is needed to aid digestion and supply extra absorbable, digested, and easily

² New York Medical Record, December 17, 1904.

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burned fuel and thus relieve the natural processes of part of their burden.

The late Willard Parker is said to have taught forty years ago, "Never drink, but if you must drink do it in hot weather; never, never in cold."

Tropical Neurasthenia and Insanity

In the *Philadelphia Medical Journal* of April 2, 1900, I called attention to the universal neurasthenia of white men in the tropics, and subsequent experience shows that I have not overstated the matter. According to the man's complexion and general resistance this exhaustion from increased metabolism and effects of the light may be so slight as to show mere enervation, or nervous weakness, being more marked in older men. In severer cases there may be mental depression, hypochondriasis, and in a few even actual melancholia. The insanities are more numerous than at home, and this is significant considering the shortness of the tour of duty (two years).

The report of the Surgeon-General, United States Army, shows that of the 186 insane soldiers under treatment in 1902, 114 arose in the Philippines, 63 in the United States, 6 in Cuba, and 1 each in China, Alaska, and Hawaii. In 1901, of 166 cases of insanity in our army, 120 came from the Philippines, a rate of 2.02 per thousand, the rate in the United States from 1889-98 being 1.13. But the disease is so mild in those sent home early that in 36 cases the diagnosis was not confirmed on arrival. "It is probable that most of these cases, if not all,

were insane at the time they were transferred to the hospital (San Francisco) but the majority of them came from the Philippine Islands, and the voyage home, together with more cheerful surroundings, resulted in the disappearance of the abnormal condition. Most of these cases are of the types of insanity of which the prognosis is good and most of them were, without doubt, due to nostalgia and the depressing influence of campaigning in the tropics."³ For the year ending June 3, 1901, the insanity rate was 1.38 per 1000 for those at home or in Porto Rico, 1.61 Cuba, 3.60 China, but in the Philippines it was 2.79 for regulars and 3.90 for volunteers.

Dr. A. B. Richardson⁴ reports that 352 soldiers were admitted to the Government Hospital for the Insane for the four years ending June 30, 1902, or 2.26 per 1000. The rate for the District of Columbia being 1 per 1000. He gives the cause as mostly exhausting ones, that is, fever, overheat, and alcoholism; 62 per cent. were acute melancholia, 11 per cent. chronic melancholia, 19.4 acute mania, 11.2 acute dementias and the rest scattering. There is a very high rate of recovery (58.6 per cent.)

Colonel Charles R. Greenleaf in his annual report mentions the mental, nervous, and physical deterioration after a year in the Philippines in war time.

It is quite likely that every one who lives in the tropics over one year is more or less neurasthenic.

³ Report of Surgeon-General, 1902.

⁴ Philadelphia Medical Journal, January 31, 1903.

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It may show itself in the young by a mere inability to study or in the old by loss of memory, and the milder cases all recover after return to the United States, some indeed on the way home. Probably all the young men, and the vigorous men over forty, receive no permanent damage, but there is considerable evidence that in the old and feeble the exhaustion may go to the point where recovery is impossible.

The yellow journals now and then refer to an alleged insanity of white men in Central Africa to account for the great brutalities which are said to occur there, yet there is nothing definite in scientific literature in support of these wild statements.

Our cases are rapidly diminishing as we are removing the causes and the last statistics show but little increase over those of the United States, 1.02 and 1.05 respectively, omitting the large rate of 2.58 among the few troops in Cuba and Porto Rico. We have adopted the plan of sending a case home as soon as the diagnosis is made so that there are no deaths or discharges for these diseases in the Philippines and the chances for recovery are increased at once.

It is practically impossible to find the relative morbidity of the United States and the tropics, for the published statistics of the home troops include so many cases arising in the Philippines. For instance, 12 cases of hepatic abscess were admitted to the sick report in the United States in 1903, and only 13 in the Philippines, yet we know that nearly all, if not all, of the home cases originated in the

tropics. Yet the statistics do show the trend of general increase of illness as we travel south. The 1904 report of the Surgeon-General shows that the sick rate in the United States is 960 per 1000 and the death rate 4 per 1000, but in the Philippines they are 1700 and 12.55 respectively. Hence the admission for nervous affections do not show the real increase in the tropics, being 22.79 in the United States, and 23.72 in the Philippines. Neurasthenia is often not mentioned, but the case is tabulated necessarily under some infection or other condition from which the patient would promptly recover at home.

Tropical Amnesia

The loss of memory from which almost every one suffers in the Philippines, is more marked the older the person and the more neurasthenic he has become. It exists in every grade from mere forgetfulness to complete loss of memory of current events, loss of sense of value, etc. The British have long called this amnesia, "Punjaub or Burmah head," from the number afflicted in those territories. I have personally seen one such severe case who was retired for it. He could remember no current events but had fairly good memory of things which happened prior to the Spanish War. All these cases are merely cerebral symptoms of tropical neurasthenia. Many recover on return to cold climates, though, of course, the exhaustion may be so severe that recuperation is impossible.

Owing to the evolution of such opaque masses of

hair in tropical natives for protection, as described above, we would presume that baldness would be a distinct disadvantage as it is practically impossible to protect one's head all the time. I have no means of knowing whether bald men suffered more from nervous affections than those with much hair, but it is remarkable that the only suicide and the only case of "Punjab head" I have seen were both in bald men.

Tropical Sun-pain

The feeling of well-being of newcomers is in time followed by a curious distress in the sunshine. It varies from a mere trifle of irritability up to actual pain, which bears a close affinity to that "sun-pain" or migraine already mentioned. Some women suffer dreadfully from it and it drives many home. It is the index of the damage being done, the cry of the irritated and damaged nervous system for relief. It is an axiom of physiology that a healthy organism is comfortable, and that discomfort invariably means damage by some cause. Uncomfortable people are unhealthy people, and if we are uncomfortable we know that something is injuring us.

The nervousness brought about in white children in the tropics is sometimes so noticeable and distressing as to necessitate removal to a cooler climate. The little things, particularly the girls, become restless, easily startled, lose stability, and show the usual signs of neurasthenia. I know of one family of girls which had to be taken from Manila for this reason.

Tropical Neuroses

There are a number of very obscure skin diseases among white men in the tropics which are undoubtedly of nervous origin. They appear quite symmetrically on elbows, knees, etc., in persons of depressed health, sometimes crops of papules, as in lichen, and sometimes confluent like urticaria. As far as I can fathom the cases they are mere expressions of loss of control by the vasomotor nerves, or symptoms of a mild neurasthenia, localized perhaps, but not unlike the vasomotor neuroses so common in neurasthenia. Likewise in the cases of pemphigus, which are so annoying and often so incurable in the tropics, it seems as though a nerve depression must be the cause, as cure follows removal to a cold climate.

On account of the great many cases of tuberculosis arising in neurotic families because of their lack of resistance, there is a general tendency to look on the infection as in some way related to nervous disorders. Dr. Thomas J. Mays says that "consumption not only has a strong indirect relation to diseases which affect the nervous system, but is itself a result of a depreciated condition of the nervous system, and hence belongs to the family of disorders called neuroses." This fully explains its awful ravages among Europeans residing in the tropics who have lost nerve stability.

A very capable physician who has practiced much among civilians has informed me that nearly all

who have been in the Philippines more than two years have more or less cardiac feebleness which may show itself in insufficiency, palpitation, œdema, dilatation or even complete failure. I know this to be the case in some officers and soldiers, even those who are very strong to begin with, and stand exposures better than civilians. It is not noticed among young men.

Another physician has reported an almost universal anæmia in old residents, which accounts for the pallor of the women, certain cardiac murmurs, lessened resistance to disease, menstrual irregularities, metrorrhagia and menorrhagia.

The vasomotor disturbances from weakened nervous system are probably also partly responsible for the remarkable menstrual irregularities of American women in the Philippines; a matter which is so common as to be almost the rule.

Add to these conditions the almost universal neurasthenia and we can well see that white men exposed to too much light are suffering from a positive disorganization from the chemical decompositions caused by the light.

Lombard⁵ found that muscular power was markedly lessened in summer by a hot spell of weather. Ocular muscular troubles are quite the rule in the tropics among white men where there is any tendency to abnormality, and presbyopia is apt to be more marked. Grijns⁶ found that the reaction

⁵ *Journal of Physiology*, 1892.

⁶ *Archiv für Anatomie und Physiologie*, 1902.

time of white men in the tropics was much less than at home, though the Malay was normal in that respect. De Manaccine ("Sleep") found that heated rooms reduced our ability to sleep, and this, of course, only accentuates the exhaustion of the tropics due to other causes. Cantlie⁷ mentions the stimulation of newcomers in the tropics and their later exhaustion and anæmia. The *New York Medical Journal*⁸ very correctly likens tropical exhaustion to the sequela so frequently found after influenza, indeed the two conditions are identical. The long interval between X-ray or radium exposures and the appearance of symptoms of the damage, wholly explains the long delay of weeks or months after exposure to tropical light before any nervous symptoms are evident.

Tropical Suicides

Colonel Greenleaf, in one of his reports as Chief Surgeon, stated that the suicides in the Philippines were of the class of cases of mental depression of greater or less degree. The only suicide I personally knew was insane. The cases have diminished because we send home every case as soon as it is evident that there is neurasthenia or cerebral asthenia of increasing severity, for, as a rule, cure is impossible if they remain. It was impossible to do this in the early years, and we no doubt had more cases on that account. The retention of an insane white man or neurasthenic in the tropics is of course not to be thought of.

⁷ "International Text-Book of Surgery." ⁸ February 1, 1902.

In medical and popular literature there is a wealth of data on the neurasthenic conditions coming on in the tropics and it would be a waste of time to mention even the sources. Kipling's stories of India contain very clear pictures of neurasthenia, but he did not know the nature of the condition he described.

Professor E. G. Dexter, University of Illinois,⁹ and Petit¹⁰ proved that suicides were more numerous in summer than in winter.¹¹ Lombroso proved the same of suicide and insanity, and all similar observations tend to the same conclusion in the tropics, as compared with northern climates. In 1903 the suicides among soldiers in the United States were .07 per 1000 but were twice as numerous in the Philippines or .16 per 1000. There was one homicide at home but eight in the Philippines.

The maps of relative proportions of suicide given in Ripley's "Races of Europe" raise a strong suspicion that this evidence of racial decay from nervous causes, increases with the distance the type is from its natural environment, being greatest, for instance, in the sections of France occupied largely by invading Teutons and Mediterraneans, least among the better adjusted Alpine types, yet in Italy it is greatest among the invading Alpine types. In England the Teutonic areas show a maximum. There seems also to be a similar relation to certain crimes which are most numerous among these immigrant peoples. Of

⁹ Popular Science Monthly, April, 1901.

¹⁰ New York Medical Journal, December 22, 1900.

¹¹ See also The New York Medical Record of March 21, 1903.

course, there is not sufficient data to prove such a generalization, but it does appear, superficially at least, that the descendants of the latest invaders, being least adjusted, and therefore, dying out at a greater rate, are the ones who are showing the greatest degeneration.

It is reported that neurasthenia is becoming a serious matter among the officers in the British navy, so many of whom are being disabled by it. The cause is wholly unknown because the conditions to which it is ascribed—long tours of duty in remote stations, with few diversions, homesickness, discontent, uncertainties of detachment, etc.—are no worse than they were a century ago, and are perhaps better. The food is much better than formerly, and the ships are not overcrowded to any greater extent. There is not any more tropical service than formerly, and the problem must remain unsolved unless we can prove that the modern iron boat subjects the men to more reflected and radiated heat and light than the old sailing craft, and has created an adverse environment from which they have no protection. It is apparently a parallel case to the increasing brain diseases of the cities.

Urban Insanity

Insanity is obviously increasing in all the cities of the world, even in the United States, where the rate for the whole country decreased from 183 per 100,000 in 1880, to 170 in 1890; the city rate increased from 231 to 242. Dr. Robert Jones, Super-

intendent of the London County Asylum, reported to the British Medical Association that England's rate has increased from 1 in 536 population in 1859 to 1 in 293 in 1903, London alone providing 70 cases per week. The types have changed from the curable manias of a century ago, to the more incurable forms of melancholia and premature dementia. Jones says that 38.4 per cent. recovered in 1903, whereas a century ago 67 per cent. of the manias recovered.

Similar reports come from the cities of the continent and the whole matter has now been engaging the attention of alienists for many years. Hammond in 1883 wrote of it. Of course in the cities we find all the conditions which can cause nervous exhaustion and brain disease—overcrowding, bad air, underfeeding, alcohol, vicious conduct, etc.; but no one has ever called attention to the fact that the growth of modern cities during the last hundred years has produced an environment for which the blond types of men, and some of the lighter brunettes, are physically unfitted. The deterioration is precisely the same as in the tropics, only of minor degree, and the resulting forms of insanity are the same, melancholias predominating and indicating exhaustion as the cause. The matter deserves attention.

“The gravity of this extraordinary increase of insanity is accentuated by the agitation now carried on by the medical profession in England over the question: What are we going to do to check the rapidly

growing percentage of feeble-minded children born in England? Statistics show that there are now between 50,000 and 60,000 epileptic children being educated in special schools throughout the kingdom, and that more than 2 per cent. (?) of all children born during last decade are imbeciles. Most of these children are brought up in public institutions, where they are cared for until they are sixteen years of age, when they are turned out into the world, though only a small proportion of them are able to take care of themselves. Many of them marry, and, as a rule, these marriages are very prolific, so that the number of feeble-minded children of late years has increased at a frightful rate."¹²

It is reported that Hobart Langdon, whose article, by the way, I cannot find, has investigated the relative numbers of blonds and brunettes among the insane and finds that brunettes predominate—but that is not what we want. Of course they will predominate in brunette localities, as in Asia, Southern Europe, or a European or American city, but what we should know is their relative numbers in comparison to the relative numbers of the brunettes and blonds in the population from which they are drawn; remembering of course that all our cities are more brunette than the surrounding country districts. I am quite of opinion that we will find in all parts of the United States, except those eminently suited for blonds, that the asylums contain more blonds than the proportion of blonds in the contributing territory. The statistics in asylums supplied from

¹² Press dispatch.

the whole country are, of course, worthless for this purpose.

New York State, with only one-sixth more population than London City, has about one hundred insane per week but mostly foreigners, this fact being reported to me by a State examiner. The vast majority of the insane within a wide radius of New York City are foreign born, and hence are brunettes, for there are but few blond immigrants now. Hence the great preponderance of the asylum populations are brunettes. An investigation of the complexions of the native born insane is now being made.

Neurasthenia of Blonds

As far as the writer knows there are no statistics from which we can prove that the blonds of a city suffer from neurasthenia in greater proportions to their numbers than the brunettes. We only know that for many ages the blonds flocked to the brunette cities from surrounding districts only to perish. In New York the statistics would be vitiated by the large number of Jews who as a class are notoriously neurasthenic in Europe, as a result of the nervous strain to which they have been subjected for so many centuries. They are neurasthenic when they arrive here and unduly increase the number of brunettes suffering from nervous diseases. Among the Christians of the cities we gather a general impression, which may subsequently be verified by statistics, that the blonds are, as a class, more nervous and present more cases of nerv-

ous diseases than brunettes. The nervous, excitable, hysterical condition of these blonds, reverses the natural conditions found in Europe, where the brunette Mediterranean man is notoriously more nervous and excitable than the blond northerner.

The brunette Mediterranean type is practically unaltered in America, whereas the blond becomes more excitable. It is this slow, obtuse northern nervous system, in its dark environment, which makes these men so much more reliable as sailors. When disaster overtakes a British vessel, nearly every one keeps his head, and if they sink, they sink in silence. But let disaster overtake a French, Spanish, or Italian ship! Every one becomes hysterical and the ship is a howling bedlam at once, as we saw in the Bourgoigne disaster. Hence ships manned by Mediterraneans cannot escape conditions which Britishers easily override, and the command of the sea naturally falls to those who are fit to conquer it. This digression is made to call attention to the enormous effect upon history and civilization caused by the nervous conditions of the peoples of light countries. The negroes are still worse. In the Eastern type, or the Asiatics, there is an entirely different and phlegmatic nervous system which modifies the matter; nevertheless they become hysterical under excitement, and a Chinese or Malay crew cannot be depended on in disaster. Is it possible that we are doomed to lose that control of the sea, which seems to be coming our way now?

Sun Fevers

Real sunstroke is very rare in the Philippines, 5.50 per 1000 as compared with 5.33 at home and 7.05 in Cuba and Porto Rico, yet there are in the Philippines, and also in India,¹³ curious fevers of unknown origin. They are proved to be not typhoid, nor malaria, nor Malta fever, nor dengue, nor that curious disease resembling typhoid, but associated with Leishman's bodies in the spleen (Kála-Azár), and they are not due to the autointoxication from indigestion. They may last a few hours (ephemeral), a day or two (febriculæ) or several days (simple continued). It is time that we should investigate what relation, if any, there is between these fevers and the disturbances of heat function known to result from too great an exposure to the long or short sun's rays. We are likely to find out that many of them are thermic fevers or light fevers or ultra-violet fevers (to create a new disease) differing in no respect from the fevers due to X-ray exposures, lasting from a few days to three weeks as described by Holzkreht.¹⁴ In other words, these simple fevers of the white men in the tropics are but one of the myriad forms of heat fever or sun fever or light fever described in a prior chapter.

I have been much puzzled in Montana summers to account for similar simple continued fevers, but as

¹³ See discussion in British Medical Association, 1904; New York Medical Record, August 27.

¹⁴ Archiv für Dermatologie.

they occurred mostly in negroes at an army post garrisoned by negro troops we can eliminate the shorter waves as a causative factor. I considered them heat fevers, and they are no doubt of the same class as the negro (see p. 8) who suffered from heat stroke in the ship's galley. But the cases all show that in the tropics we have myriad forms of affections due to lack of protection from ether waves from the sun, both long and short.

Conditions Due to Arctic Light

I have particularly noticed the nervous irritability of soldiers, officers, and women, in our extreme northern army posts in summer, and cannot account for it except by the excessive light stimulation, as it was certainly cool enough. Officers at posts still further north have told me of this effect in the long summer arctic days, and how they found it necessary to close up the house in the early evening—six or seven o'clock, that is, long before sundown—and light the lamps, whose yellow rays brought comfort. Dr. Frederick A. Cook describes¹⁵ the awful mental depression affecting arctic explorers, the suppression of bodily functions, somnolence, melancholia, and the desperation of the sufferers. De Long's diary of the unfortunate "*Jeannette Expedition*" shows that he was practically insane. Much of all this must be due to light stimulation from the snow and to improper food for it is the picture of neurasthenia. We have shown that darkness is not harmful to man,

¹⁵New York Sun, October 5, 1902.

indeed negroes are able to live in the arctics for a while, and one member of a famous arctic expedition was a negro. If he is vigorous enough to stand the cold air in his air passages the lack of light does not bother him.

It is to be noted that these arctic mental depressions occur in the dark season, as though they were caused by the darkness, and no doubt the darkness has a profound psychic effect in the direction of soothing or depressing all functions, but the final result is not exhaustion, for such soothing is preservative of energy as in the hibernation of Eskimos. When the sun finally appears, after the long winter, the psychic exhilaration is tremendous on the men of these exploring parties,—they dance, sing and act as though they were suffering from mild mania and of course exhaustion must follow.

Other Tropical Conditions

There is a remarkable increase of affections of the ear in the Philippines and the cause is unknown, otitis externa and media being quite common. It is of course not connected with the excessive light and probably is due in some way to the increased secretion in the relaxed condition of the whole vasomotor system, and the facility of infections. The admission rate is 12.47 in the Philippines and 6.63 at home.

Crombie¹⁶ shows that the mortality of European children in India as compared with those in England

¹⁶ Gazette Hebdomadaire de Médecine et Chirurgie, January 12, 1902.

is as 41.09 to 18.31 per 1000, the increase being chiefly from intestinal diseases and pneumonia.

Even with all the care given to white children in the tropics they begin to fade away at six or seven and as a consequence are sent home to England at about this age to be raised. Returning to India after maturity, they may marry and beget offspring before much deterioration has occurred. Hence there are many families in England or Scotland known as Indian, who have been in public service for many generations.

It is not known why the children should begin to fade at six or seven, but it is supposed to be due to the fact that up to that time they are carefully housed and protected from the light, but at this time begins the restless age of running about when it is practically impossible to confine them. Hence they are more and more exposed to these harmful rays, and as we have shown that the rays are most harmful to the developing cell we can understand why children, for equal exposures, are more harmed than adults. Since I have had my attention called to the matter I have been amazed at the wonderful ability of dark American brunette babies to flourish in the Philippines and at the feebleness, exhaustion, woeful condition and struggle for life of the brilliant blond babies, as a rule, there being exceptions, of course, depending on inborn vitality.

Reports of the excellence of the Philippine climate often come from sick men and that is one of the curious phenomena of the Islands. I have listened to a

man and his wife en route home violently defend the climate against all aspersions and declare it harmless. Yet these two were in a deplorable condition of anæmia and weakness, and though he had been there but two years, and she but one, both had been more or less ill during that time. I know of a high official who declares that it was nonsense that men could not stand the climate for an indefinite period. "Look at me, how strong I am after more than two years." As a matter of fact he had visited cold climates so much that he really had had but eighteen months in the heat, and during nine of those he was ill enough to consult physicians. These people all seem to announce that Nature did not know her own business when she pigmented the natives of the tropics. William E. Curtis, the correspondent, is the latest to assert that "a white man can perform heavy field labor without any more fatigue than in Iowa or New York," a statement wholly at variance with the views of tropical residents of experience.

Relative Morbidity of Blonds and Brunettes

There is nothing in literature referring to the relative susceptibility of blonds and brunettes to skin diseases in the tropics. The naked coolie works in the sun and has a clear soft skin which is remarkably free of disease, yet when infections do take place they are known to be severe. Physicians have informed me that they were quite certain that blond foreigners suffered more than the brunettes from all skin diseases. I think I have noticed a preponder-

ance of blonds in these infections, but have no statistics. I also gathered a very strong impression that blonde women became anæmic sooner, and to a greater extent, than the brunettes, though it is a rule that the brilliant coloring which some American women bring to the Philippines fades after a year's residence, no matter what her complexion.

It was also a matter of observation that when officers and soldiers enjoyed their service in the Philippines, and remained well or improved in health, it was almost universally found that they were strongly brunette, and that many who broke down were blonds. In order to show the effect of the climate in this direction, I collected statistics from a regiment which had been there about three years and was about to go home. The company commanders divided the men into the following classes: (1) Those who held their usual health in the Philippines. (2) Those who deteriorated. (3) Those who were invalided home. (4) Those who died. The figures following are the result, there being 1114 cases in which complexion was mentioned.

It is exceedingly difficult to determine the amount of pigmentation to classify the cases as to their protective armor, but the following rule was followed. If the man has been reported as having dark-brown eyes, dark-brown or black hair, and dark complexion he is called brunette; if light blue eyes, light brown, flaxen, red, or sandy hair, and ruddy, fair, or light complexion he is called blond. All the mixed types have been put into an intermediate class—that is, they

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may have brown eyes and light hair and complexion, or blue eyes and dark-brown hair, and dark complexion, there being an infinite variety of such mixtures in the mixed types, neither blond nor brunette.

	Number.	Percentages.		
		Brunette.	Mixed.	Blond.
1. Those who did not deteriorate	683	20	54	26
2. Those who deteriorated in health	293	16	49	35
3. Those who were invalided home	95	19	45	36
4. Those who died of disease	43	14	51	35

There were so few who improved in health that it was not possible to erect a special class, but the few did not differ materially from class 1. These figures show the material disadvantage under which the blonds labor from their lack of opaque protection. Of course brunettes can become infected with typhoid, cholera, or dysentery as well as blonds but they resisted in greater numbers. It may be put in this way, also, to emphasize the matter :

	Number.	Percentages.			
		Did not deteriorate.	Deteriorated.	Invalided.	Died.
Brunettes	205	65	23	9	3
Mixed types	583	64	25	7	4
Blonds	306	54	31	10	5

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In two other regiments which gave me the data of 1294 men who had served over two years in the tropics the results are as follows:

	Numbers.			Percentages.		
	Blond.	Mixed.	Brunette.	Blond.	Mixed.	Brunette.
Died	22	32	16	5.25	6.20	4.50
Invalided	47	72	31	11.20	14.00	8.70
Deteriorated . . .	106	130	76	25.25	25.00	21.40
Retained health . .	227	261	211	54.00	50.40	59.20
Improved	18	23	22	4.30	4.40	6.20
	420	518	356	100.00	100.00	100.00

These numbers probably eliminate the personal equations of the company commanders, some of whom gave numerous men as improved while half of them reported none at all. Some gave a large deteriorated list, while others reported most of their men as having retained their health and few as deteriorated. As many of these men died of cholera, which is no respecter of race, the death figures are not as significant as they would otherwise be.

In less than three years forty per cent. of the soldiers in the field die, are invalided home, or are deteriorated in health. The Surgeon-General's report for 1904 shows that in the previous year the losses by death and invaliding were 70.67 per 1000, which is a vast improvement over the above statistics, and shows how much harm resulted from exposure to the climate in war times, and how much illness we can avoid by careful protection.

These tables do not take into consideration the suffering of the blonds from the glare of the light. Whenever I heard much complaint it was usually a blond, and, as a rule, those who wore dark glasses were blonds. People who had little or no objection to the light streaming into the houses were brunettes, those who wanted shade were mostly blonds. Of two sisters we often see the brunette one flourish and the blond one sicken.

A man's opinion of the climate was largely dependent on his own complexion. The officer who seemed to like it and enjoy it the most was as black as a native and had increased his bronze color while out there. When it is considered that all these men are unfit for the climate, and would all deteriorate in time—the difference being merely the increased rapidity of blonds—the difference in the figures given is very significant. Hence we find the reason why there is no third generation of white men native to India or Java, where the English and Dutch have been experimenting on this line for two or three centuries. The stock is too feeble to breed in two generations.

Relative Longevity of Blonds and Brunettes

The relative numbers of blonds and brunettes among people older than sixty years in any one locality should be a fair estimate of their relative resistance to the environment, of course comparing them with the relative numbers of blonds and brunettes in the rest of the population. In the Philippines the old

Malays, for instance, are notably darker than the general population. Nevertheless it is not wholly an evidence of the type which will survive—that depends on the vigor of the children, and the vigor of the young adults at the procreative period. Old men and women of cities frequently have lost all their children and see their line die out. Nevertheless in the long run longevity is a fair test of fitness. There are scarcely any data on record which I have been able to find, but it is a point well worth investigating in America. Ellis publishes a few data on the subject, but not enough on which to base any generalization.

Ripley¹⁷ gives quite a number of instances which prove that in the tropics the death rate of Europeans is proportional to the distance they are from their natural zone. For instance, he quotes Ricoux that the death rate of children is as follows: Maltese, 178; Spaniards, 180; Italians, 194; French, 225.2; and Germans, 273.

In ancient times the same conditions must have resulted from lack of pigment protection when blond races migrated, and we can well see that their death rates must have always become greater than the birth rates, and extinction follow in due course.

Effects of Climate on Conduct

Though there are thousands of articles and books on the subject of the effects of different climates and different weathers on human conduct and physical health, the only statistical study is that of Professor

¹⁷ "Races of Europe."

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E. G. Dexter, University of Illinois. His work ¹⁸ is a synopsis of a mass of data as to the seasonal prevalence of misdemeanors of school children, and crime, insanity, sickness, suicide, drunkenness, etc., among adults, and the effects of the different factors, such as heat, wind, barometric pressure, humidity, and cloudiness. It is of extreme value for our purpose, because it clearly brings out the fact that in New York and Denver, where the mass of the people have too little pigment for the intensity of the light, there is a marked increase of abnormal conduct due to this irritation in the light seasons and on bright days.

It is to be regretted that he did not take up this side of the investigation also—that is, the relative susceptibility of brunettes and blonds. All such investigations have a serious defect in that they do not discriminate between the different types of people. For instance, a very bright day in Pennsylvania may be so comforting to a negro, by satisfying his light hunger, as to give him a feeling of well-being under which he behaves himself, while a very blond man, or albino, would be goaded into an irritated state in which he loses control of his emotions and normal inhibition, and commits abnormal acts. Such a criticism could be levelled at the whole of Dexter's work, but the large number of facts with which he deals shows the trend of results in the majority, whom we know are insufficiently protected from the light.

¹⁸ "Weather Influences." Macmillan.

School Deportment

His charts show that children behave worst on the days when the humidity is least and that there is a general improvement in conduct with increasing air moisture. He is inclined to believe it due to electric conditions which are most marked on dry days and least on wet days, but we are not justified in imputing a harmful effect to this electricity—indeed it might be beneficial. The real reason seems to be as follows: The drier the air, the clearer is the sky from absence of clouds and the greater is the irritation of light, while the cloudiness increases with humidity and lessens this irritation; that is, on the darkest days they are soothed into goodness, on the lightest days they are irritated into actual badness. Indeed, other charts show that on cloudy and rainy days there is a remarkable improvement in deportment. Though the deportment is best on calm days for a similar reason, i. e., less irritation by wind, and grows worse as the wind rises, yet very high velocities actually seem to improve the conduct, probably because high velocities generally mean darkness from storm clouds.

The deportment of New York children is best in winter, deteriorates in the spring, and is worst in June, the lightest month of the year, but improves in July probably because offenses are not noted so near the end of the school year. But in Denver it begins to improve after a maximum of badness in February, and is at its best in May, the end of the school year. The result is to be expected in New York, as the hot

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weather comes on and the children are tired out by a year's work and therefore easily irritated. But the Denver results cannot be thus explained.

Crimes

Assaults are at a minimum in winter and reach their maximum in summer, women being more affected than men, and though another curve shows a general increase with the temperature, there is a decrease with the highest temperature, and a decrease for men in August. That is, the curves show a probability that it is the irritation of excessive light and not heat which is the cause of the increase. This is proved by the increase on dry days and diminution with humidity, with cloudiness, and on rainy days. As the barometer goes up, the number of assaults decreases—a coincidence which cannot be explained. In prisons, the deportment of the criminals varies as above in a general way, showing the irritation of light, for they are exposed to the light in their labor as a rule. Murder in Denver increases in summer, on hot days, on low-pressure days, and is markedly increased by days of low humidity, by wind and on wet and cloudy days, but the latter is difficult to explain unless connected in some way with the wind. The number of cases in this connection is too small for safe deduction.

Insanity and Suicide

The curves showing the number of arrests for insanity in New York bring out the same facts.

Temperature does not seem to have any influence except an increase of arrests due to excessively cold and hot days, but the curves as to monthly prevalence show an almost perfect correspondence with the curve of light, for the arrests are at a minimum in the darkest months, and increase gradually with the light, reaching their maximum in the light months. The curve for men has its maximum in June, the lightest month, and women in May. There is the same increase of arrests for insanity on days of low humidity and decrease with rising humidity, with cloudiness and on rainy days, showing the soothing effects of darkness and the irritation of light, dry days.

Alienists are now fairly well agreed that suicide is an evidence of mental abnormality, if not actual insanity. Fifty per cent. of the cases are known to be profoundly neurasthenic, hence suicides should be more numerous in irritating weather. Not only are they excessive on clear, light days, and deficient on wet and cloudy days, but the monthly curves clearly show the irritating effect of the increase of light, for the minimum number occurs in the dark months, and there is a gradual rise in the spring, culminating in a maximum in the light months, though there is another maximum in August. Dexter quotes Morselli, who found the maximum number of suicides to be in May, eight times, and in June, eighteen times. In Denver the number of suicides in May is nearly double the normal, and though they are increased on both clear and cloudy days they are a minimum on partly cloudy days. Even among the natives of In-

dia this increase of murder and suicide in the spring has been found, but it continues longer in the autumn as though the heat had some effect. But in America the great mass of the suicides are in the pleasant temperatures (45° to 70°), the extremes of heat and cold giving a few cases though they give more than their proportional share.

There is the same curious rise of suicides on days of low pressure, excepting the very lowest, and diminution as the barometer rises, just the reverse of what we would expect, for low barometers are usually accompaniments of stormy dark days and high barometers of clear skies. Perhaps it is the result of the cumulative effect of the succession of high-pressure days with clear skies, culminating in an irritable condition, which needs only the disturbances of a storm to act as the final straw—indeed the figures show that the effect of high winds is an appalling increase. This view is rather strengthened by the fact that, unlike other abnormal acts, suicides increase with the humidity in New York, though the reverse is found in the dry climate of Denver. Nevertheless, the days of lowest barometer, when it is apt to be darkest, have less than their share of suicides.

Sickness and Drunkenness

The curves for sickness of policemen do not show anything from which we can deduce any facts as to light, because there are so many causes for sickness and death in winter unconnected with light, and

it is a well-known axiom in armies in garrison, that summer is more free of infectious disease than winter. But the curves for deaths of the whole city of New York show a great increase just after the lightest months, as though the effects were cumulative. The maximum is in July and it then decreases in spite of the increasing heat of August. This is corroborated by the curve for temperature which seems to have no influence excepting a rise on the hottest days, and we cannot tell when these days occurred.

It is a well-known fact that drunkenness is at a minimum among peoples of tropical and subtropical zones and increases to the north, being at its maximum in Northern Europe, but, paradoxically, the consumption of alcohol per capita increases in a general way from the north to the tropics. Our statistics show much less drunkenness in the Philippines than at home, and though I believe more alcohol per capita is consumed by soldiers in the Philippines than at home there are no data on that point. Dexter's statistics are confirmatory of all this, for he shows that drunkenness is at a minimum in summer and at a maximum in winter, though it is likely that more alcohol is taken in the summer beer than in the winter whisky. There are no explanations of this paradox, unless it is that the heat and light of summer are so exhausting as to permit more alcohol to be taken than in winter. This is quite in accordance with what we have already said of the need of alcohol in the tropics to help us bear up under the exhaustions.

CHAPTER XI

RESULTS OF MIGRATION OF BLOND RACES

Earliest Blond Migrations

Now let us look into the known results of the migration of any type of man into a zoological zone markedly different from the ancestral one which caused the particular pigmentation of that type. These migrations of course have peopled the whole earth when slow enough to have allowed of survival by natural selection of the varieties fitted for the changed environment. So that the history of the world and evidence from prehistory show a ceaseless movement of streams of men here and there, and only when it is a rapid migration into a wholly unfit environment is there total extinction.

The movements which concern us the most are those of that blond type of man whom we have called Aryan, Baltic, Teutonic, Germanic, and Blond. The world got along very well without this type of man for a long time, indeed it is only recently, zoologically speaking, that he appeared on the scene. We have no knowledge of our ancestor races nor our cousin branches until about 2000 B. C., or perhaps a little later, for the Dorian invasions of Greece are placed at 1200 B. C. Prior to this time some combination of forces cooped the race up in a limited

area of Northwestern Europe, where it was cold and dark and where it was subjected to a terrible struggle for existence—so terrible that only the most vigorous and intelligent could survive, and the others all perished in each generation. Surely it could not have taken many thousands of years of such selection to cause the evolution of the large brain which has been an Aryan inheritance ever since, and which enabled him to build up such high civilizations and now to control all the lower races who were so unfortunate as to escape too soon from that northern struggle for existence, which we might call nature's brain factory.

Of course we do not know the nature of all the unsurmountable obstacles which fenced him into his little area. We have shown that man is a very late arrival in Scandinavia—that is, during the neolithic age. We have also shown that during the neolithic all of Central Europe was overrun with a dense mass of broad-headed Asiatics, a prehistoric "yellow peril," which came probably at 10,000 B. C., or perhaps even earlier, and whose descendants are there yet. They constituted a sufficient force to coop up this poor little tribe of Europeans which was to be the Abraham of Aryans. It was a very little tribe, or collection of tribes, which could do nothing except go north into the less desirable land, leaving the warmer countries to the "yellow peril." In addition, as before explained, primitive Aryan philology proves that he evolved his language during at least ten thousand years and in a cold country as far north as even sixty

degrees of latitude, and required a big brain to do it.

Now came the time when he evolved so great a brain that he could overcome more and more of the adversities of his environment and lessen his death-rate. The birth rate remaining the same his numbers increased and he had to spread northwest into Great Britain, east and south, as before explained, overcoming the lower races slowly but surely until he waxed numerous enough to conquer his way to the Mediterranean and into Asia. What a bloody struggle it must have been, if we can judge from the conduct of later historic hordes of Goths who, in the fifth century A. D., "ravaged France with fire and sword," and later took possession of Spain, and of the Eastern Goths who, after passing the Danube, overran Greece and Italy, "every step marked by copious bloodshed." When the Dorians invaded Greece, they found a great pre-Aryan or Mycenæan civilization which they promptly destroyed, and when they reached the walls of Tiryns and Mycenæ they promptly sacked and burned those cities. Then began for Greece "the long dark ages, the medieval epoch, out of which she emerges only in the Homeric Renaissance"—the history of all Aryan conquests in ancient times. The ancient Homeric Greeks and the later Goths behaved the same way in all their sanguinary wanderings.

The recent excavations in Crete have laid bare some wonderful palaces which are doubtless the ones referred to in the Greek legends of the Homeric

period and they show a high pre-Aryan civilization with extensive commerce, all of which the blond northern barbarians destroyed.

Migrations of Brunette Semites

We must remember that while the Aryan was cooped up in the north the Mediterranean countries were in the possession of another less brainy type of European long heads, for the Asiatic did not get over the Pyrenees in any considerable numbers, nor further south than the middle of Italy, as the archaeologists have definitely determined, and it is also strongly believed that he did not get through the Balkans into Greece in any great numbers in these early millenniums. This ancient Mediterranean type was the same as the present Mediterranean type. Its successive waves which came from the north, had brain enough to build up civilization after civilization in Northern Africa, Spain, Italy, Greece, Asia Minor, and Palestine, and even flooded into Egypt where the Asiatic type of man had already built up several civilizations, one on the ruins of another. We will give the name Semitic to this Mediterranean type, including those generally classed as Hamitic, all of which still exist in these countries—but of course our anthropologists will be much scandalized at such a use of this term. Nevertheless there is plenty of evidence that they were all Semites. It is even stated that the Iliad and Odyssey are merely amplifications of old Phœnician sailors' log books and were idealized into an epic by later Aryan con-

querors. The original Semitic language may have been evolved by but one branch of this Semitic stock, just as, perhaps, one tribe evolved the Aryan speech now used by similar tribes.

It is certain that the ancestors of these two types of Europeans, blond Aryan and brunette Semite, were separated by some barrier—say the Asiatic invasion before mentioned—long before the evolution of language, in neolithic times, before high civilization existed anywhere on earth. Hence the two branches evolved separate languages on entirely different systems, using different sounds and now having different root words.

The Semitic languages such as Arabian, are quite primitive in the lack of abstract terms, proving without a doubt that they were evolved by men of less intelligence in the south while higher men in the north were evolving a language with special words for abstract ideas which occur only to men of great intelligence. The Semitic tongues are higher of course than the Turanian, and this explains the invariable law—when Semites migrate into Turanian territories, the former become the ruling class and the latter are the proletariat, but Aryan migrants always became the upper layer no matter where they migrated. It was the result of their brutal evolution of brain.

We must not confuse the word Semitic with the word Hebrew, used for a very small Semitic tribe which became isolated, or pocketed, on the Eastern Mediterranean shore and the interior valleys—a tribe

which was very backward, being barbarous for thousands of years while great Semitic civilizations grew up in Egypt and around the Mediterranean and in Asia Minor. They even knew nothing of writing until the seventh century B. C. Nor should we mistake the word Jew, which now refers solely to that religion evolved about 600 B. C. by Ezra and the other Hebrews in their Babylonish captivity and after they were released by the Aryan Persian conquerors of that Semitic kingdom. The Hebrew Jews were wonderful proselyters and made converts in many other Semitic lands, so that by the time of St. Paul they had synagogues in Egypt, Northern Africa, Spain, Italy, Greece, and Asia Minor—indeed wherever Semites lived. Later they proselyted among the Asiatic broad heads, and to such an extent that the present Jewish people are in most part descendants of Asiatic converts. Semites are mostly Mohammedan and Christian. Dr. Maurice Fishberg¹ and others have proved that the ancient Jews were distinctly African in type, like the peoples now living on the northern and southern Mediterranean shores.

The Semitic conquering and ruling types, in ancient Chaldea, were called "white men" in comparison with the darker Turanian conquered type, and their portraits are European in character. Ripley states that the Hebrews were anciently long-headed western types, as were the ancient Phœnicians and Egyptians.

¹ *Science*, March 20, 1903.

Migrations of Asiatics

For some unknown reason the Asiatic branch of mankind, or, at least, some tribes of it, evolved a big brain sooner than even the Semites, so that they came out of the paleolithic stage very early and flowed south to Southern Asia where they conquered earlier types of Asiatics and built up Akkadian civilizations very early. Perhaps it was at the very time when that first flood was pouring into Europe through Russia. The cradle of this type, somewhere in Central Asia, is probably arid land now through climatic changes.

The early Asiatics, then, had high civilizations in Mesopotamia (Akkadian) and Asia Minor (Hittites) and flowed over into Egypt and there built up other civilizations. They also sent streams into India, where they established early civilizations prior to the arrival of the Semites and the Aryans, and their descendants still occupy India. Other streams went east into China, thence into Corea and Japan, in each place building up new civilizations all based on the original civilizations of Southern Asia.

It is not known what race, whether eastern or western, built up the first civilizations in Egypt. While some are inclined to believe that it arose *in situ* others believe that it must have been the result of conquering invaders, and this view is the most reasonable as it accords with all known facts of civilization resulting from northern brainy types conquering southern and less intelligent ones, and then perishing

from climatic unfitness. But whether these first brainy invaders of Egypt came from Asia or Europe is wholly unknown, though it is probable that they came from Europe if we can judge from ancient skull shapes. Maspero, Flinders Petrie, and others seem to agree that the first race of warriors, priests, and architects of Egypt were of the white race.

Semitic Streams in Asia

The Semite came into Asia from the Mediterranean quite late, and tradition states that he came from North Africa, *via* Egypt, but he also came through Asia Minor. He finally succeeded in conquering all prior types, Hittite and Akkadian, and established Semitic civilizations all the way from Spain and Morocco to Persia and India. Even in Egypt he is still the basic type, for the fellah is a branch of this great Semitic or Mediterranean family and has remained unchanged through all these conquerings by Turanian, Semite, and Aryan.

The Semite of the historians is probably the eastern half of the whole Mediterranean race which we have called Semitic for the express purpose of drawing attention to the ethnic unity of all these peoples. The eastern types began an eastern drift through Asia very early, and probably they first percolated individually into the early Turanian civilizations long before they came in organized masses, just as the Aryans percolated by individuals southward in Europe into Semitic states long before they came in military organizations. The western

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Semites have long been grouped with Aryans, and Alpine Asiatics as Caucasians, to which some add the Aryan-speaking Hindus, while the eastern Semites are often looked upon as Asiatic in origin instead of immigrants from Europe.

Beginning with the earliest Semitic invasions of Mesopotamia some millenniums before Christ, there has been a constant eastward stream of these long-headed, short, dark Mediterraneans through Southern Asia, which reminds one of the constant southward drift in Europe. There have been minor counter currents here and there, such as that of the Turks, both in Europe and Asia. We have no reason to believe that the earliest streams came from any other direction than the Mediterranean basin, and we know that the stream in India has always been from the west to east. The stream still keeps up, probably as strong as ever though we notice it as little as we notice geological changes, but when we see the changes of many centuries it is quite evident. Arab missionaries constantly flow east through India and Java and have reached Mindanao, and they are tincturing all this vast territory with long-headedness just as prior Semites have done for 4000 or 5000 years.

Now the point so interesting for us is the fact that this eastern stream does not take the type out of its light zone, like the southern drift in Europe. Consequently they survive, and we find at the present day, that the Mediterranean type is exceedingly well marked throughout Southern Asia, India, and even

further, though we have no exact data as to how much long-headedness there is further on than India. But the type exists throughout Southern Asia, in a zone similar to its native one, inextricably mixed with broad-headed Asiatics. Ripley says of the Brahmans that there is no doubt of their affiliation with Berbers, Greeks, Italians and Spaniards and we could add Portuguese, Egyptians and scattered types at the eastern end of the Mediterranean and in Persia. The languages of these people have been drowned out by later floods of Aryan or Asiatic tongues, but the alphabets carried by the streams in historic times have survived in scores of forms all the way to Mindanao. Even the Tagalos of Luzon used a modification of these alphabets until it was suffocated by the Roman form brought in by the Spaniards around the world from the opposite direction.

The people not being out of their light zone have persisted, here and there modified or refined by sexual selection perhaps, but the same type, so that it is now possible to select a Hindu, Persian, Oriental Jew, Greek, Italian, Spaniard, and Portuguese, dress them alike and defy an ethnologist to differentiate them. We can then assert that from the Mediterranean to the confines of Farther India, there is a brunette Semitic zone.

Blond Migrations into Greece

But to return to our blond type. He began to flow southward very early because pictures in Egyptian pyramids show "white men of the north, with

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blue eyes,"² and these pictures date probably from 3500 to 4500 B. C. As before stated, he conquered his way into Semitic Greece about 2000 B. C., or later, no one knows exactly when, and became the blond ruling or upper class—the warrior class who furnished soldiers, judges, legislators, writers, poets, and philosophers—and all the evidence is to the effect that they were blonds. Indeed their complexions so distinguished them from other people that they were called xanthochroi, Huxley's term for the blond type of man who has xanthous or yellow hair. The youths practiced gymnastics naked to get tanned, which would not be necessary if they were brunette.

In the Boston Art Museum there is an ancient Greek amphora of the earlier art age—sixth century B. C.—decorated with views of artisans and mechanics, which shows them to be very dark, but the customer being served in a shoemaker's shop is white.

What is called the "Grecian profile" is uncommon in modern Greece, but exists among the Arabs, and as it is seen in the sculptures from Cyprus as a Phoenician trait it is believed to be a Semitic type—that is, the eastern type of the Mediterranean race. Indeed the Grecian profile has been called Iberian or Mediterranean. But the faces of the men as revealed in Greek statuary are typical Germans, and most of them had hair or beards not now found in Greece, but found around the Baltic. They remind us of the pictures of the upper-class Russians to-day.

The word Helen means "white," the Hellenes

² Anderson's "Extinct Civilizations."

were "white men," and Hellas was white man's country and originally referred to Thessaly—a stopping place in their migration. The Trojan war seems to be a tradition of a race war, the white men banding together to revenge the kidnapping of one of their women by the darker race.

The above-mentioned old Greek amphoræ have a remarkable tendency to depict women with white skins, particularly the Amazons, while all the other people are shown as very dark.

Munro ⁸ states that the ancient Greeks were probably Teutons and akin to those who settled on the east coast of the Adriatic, raising the stature of that people. *Albanian* may also be a name given when white men lived in the country. The curly or wavy hair so prominent a feature of Greek statuary is a northern character, not found in modern Greece to such an extent.

Ripley says that we have no reliable data as to the brunetness of the Pelasgians, and of the ancient Greeks; he says, "their admiration for blondness in heroes and deities is well known," and quotes Beddoe that "all of Homer's leaders were blond or chestnut-haired as well as large and tall." Lapouge says that the above facts indicate that the ancient Greeks were tall blonds—a statement which Ripley does not accept because the modern Greeks are short, dark Mediterraneans. The real place of the modern Greeks in the Semitic column is evidenced by the fact that throughout modern Turkey it is difficult or impossible now and then to tell a Greek from a Jew.

⁸ "Races of Great Britain."

Decay and Death of Blond Greeks

Historians are now pretty well agreed that at the period of the greatest literary glory of Greece, 500 B. C., the decadence of the Greeks was already evident, and it is even said that it was complete. It is possible for such neurotics to be possessed of great literary, artistic, or military skill, as at the present day, and the decadence of the Greeks was probably the cause of much of their art. A wonderful confirmation of this view is afforded by a study of ancient Greek statuary which faithfully copies the stigmata of degeneration found in modern degenerates, just as though their best models from the aristocracy were defective. A famous head of Juno has arrested development of the lower jaw of marked degree and is the head of a dying race. It confirms what we know from all sources, that the climate of Greece, practically in the latitude of Maryland, required but seven centuries or thereabouts to destroy its blonds.

For instance, Socrates (born 469 B. C.) was repulsive in person, of a lecherous countenance, an immoral hypocrite and a grotesque mountebank. Antisthenes, a successor, was filthy in his person and indecent in his habits, and Diogenes was lower still in his defiance of all the decencies of life. Could anything be clearer than the degeneration of a people which would produce such degenerates even though they were men of genius.

Greeks in Egypt also died out soon and their wonderful sciences were lost, though there were able

men in Greece and Rome of the Mediterranean type for a long time after the decadence of the Aryan, and there have been such exceptional variations ever since—men who are intellectual giants in a race of mental pygmies. Yet they are apt to be, and generally are, results of unstable or degenerate development, as Lombroso has proved. The Christian Church was Greek for several centuries, and its history—full of murders, lust, and other crimes—is painful reading, but it is what we must expect from the lower races which had fallen heir to the Greek civilization, from Constantinople to Alexandria. The awful history of the early Roman Pontiffs can be read in the same light.

It was these *white men*, then, who built up that wonderful Homeric Greek civilization on the ruins of a Semitic one which they had conquered, even forcing out the native language and forcing their own tongue upon the peasant. They of course adopted the Phœnician or other Semitic alphabet as they had none of their own, being an unlettered and savage race. Nevertheless they were so injured by the climate that they degenerated. Brunette natives were now reasserting themselves, and imitated the effeminate aristocracy. The women dyed their hair to an auburn or reddish color just as they do at the present day. One hundred and fifty years later Philip and Alexander, who were northern men and descendants, no doubt, of later arrivals from Germany, had no difficulty in conquering them all, for they were practically helpless from degeneration and

partial extermination. And though these great men carried Greek arms and civilization all the way to India, and Hellenized Southwestern Asia and Egypt, yet in a little while longer the whole rotten fabric dropped piecemeal into the Roman Empire.

It is quite likely that by the beginning of the Christian era few Homeric Greeks were left, if any, and the Romans described these few effeminate in words of the greatest contempt. But the real Greek—the brunette Semite who was the peasant, the farmer, artisan, fisher, trader, and slave—the low class—survived and his descendants are modern Greeks, still talking the same language forced upon them three or four thousand years ago, but speaking it so badly as to constitute another tongue. We are fond of dilating on the decadence of the Homeric Greek—we should speak of his total disappearance, for he has left no descendants whatever in modern Greece, whose people are not Aryans at all. They were so incapable of self-government that they sent up to Denmark for the Aryan king who is now the ruler.

The decorations of a supposed sarcophagus of Alexander at Constantinople, placed at 300 B. C., show numerous figures with reddish tinge to the hair, but the skin is sallow and the eyes are reddish brown, just as we find at the present day. There are no blue eyes depicted, as though there were no blonds when the paintings were made. A copy can be seen in the Boston Art Museum.

Blond Migrations into Rome

Italy presents the same picture, beginning at a much later date, say 700 or 800 B. C. There was a high Semitic civilization, and then an invasion of big savage blond Aryans who built up Roman civilization on the Semitic foundation and constituted the patrician class, the conquered class or type being the brunette plebeian, and like the Greek plebeian he was the wealth producer of the country. The Roman was so vigorous as to absorb the whole Semitic world, including all that part which had been Hellenized by Alexander and his successors, even turning against the home land and fighting the Northern Germans to prevent them overwhelming the early Aryan arrivals in Italy. Of course the patrician Romans had not the slightest idea that they themselves were related to Germans, as they had no records of their own origin. In this case, too, degeneration was so rapid that in a few centuries there were so few of the type left to control affairs, that the whole Roman Empire crumbled.

Stevens ⁴ says of these degenerated Romans, that the nobles were a parcel of crafty intriguers solely interested in graft, and the plebeians were a "contemptible pack of rascals."

In ancient Rome only citizens could be soldiers and they had to be five feet ten inches tall and well built, but in the third and fourth century the army had to enlist men from the country as the big, tall

⁴ Fortnightly Review.

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men had died out, and the remnant were effeminate, delicate and unfit for military service. In later years the authorities were required to recruit the army from the north of Italy where the people were braver and more vigorous. Then later still, the Goths were enlisted as already explained. These facts from Dr. Richard Stump's article⁵ show conclusively that the big northern type was the ideal soldier in ancient Rome and continued to be the ideal long afterwards, and they also prove that the ancient soldiers who conquered Rome and built up its civilization could not stand the climate and had probably completely disappeared long before the time of Cæsar. This was vastly different from the first centuries, when a Roman citizen was compelled to keep his right arm under his cloak until he had distinguished himself as a warrior.

Italy then became the theater of repeated later invasions of this same brainy stock, but not in sufficient numbers to do more than rule it temporarily. They never established a new civilization. They, too, have all gone and Italians are still the same dark Semitic stock as ever—descendants of the plebeians of ancient times. There are numerous blonds in Northern Italy, even red-haired types, but they are mostly in the mountains as previously explained. The south is almost solidly brunette.

In Italy, then, on account of the many clear days, and the great amount of semi-tropical light, we have conditions for northern blond immigrants vastly dif-

⁵ Allgemeine medicinische Central-Zeitung, 1893.

ferent from the British Islands. The Italians, like the British, are a very mixed people of many types, but there are a great many of the earlier conquered types left because they could assert their numerical supremacy much sooner in a land which killed off the blonds so soon. There is a very general agreement among students of the subject that the earlier people of Italy were non-Aryan, and that the Aryans were comparatively late arrivals, though, of course, there are differences of opinion as to who the Aryans were and whence they came.

Gibbon says that the men who built up Roman civilization were merely elder brethren of the Germans who went down into the peninsula in historic times, and there is a goodly and growing number of students who have concluded that these early Romans are all extinct. From what we know of the appearance of one-sided men of brilliant genius in disappearing degenerate families, we are perfectly safe in asserting that, as in Greece, so in Italy, at the period of the greatest intellectual, artistic, and military glory, the disappearance of the blond German type which built up the civilization was well under way, if not completed. There were several centuries of damage, so that in the first century before Christ the fact that the ruling type had been blond was scarcely a memory.

The death of the ruling and conquering Aryan type in ancient Rome is shown by the statement of Draper⁶ that "in the earlier ages the Roman

⁶ "The Intellectual Development of Europe."

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Dominion was exercised by a few thousand persons; that it passed into the hands of some score families; then it was sustained for a moment by individuals, and at last was seized by one man, who became the master of one hundred and twenty millions." And then he goes on to describe the frightful condition of degradation, depravity, immorality, unnatural crimes, and degeneration existing, as results of the form of government (pp. 252-253). The conditions are almost inconceivable to us, but were no doubt precisely the same as existed in Italy among the ancestors of these people before the invasions of higher types with their Aryan virtues. Bad governments do not destroy these virtues, but cause revolutions, as happened in America. Every people has the government it deserves, and the Roman governments exactly suited the Romans. Draper states that "the ruin of Rome was accomplished before the barbarians touched it," and, paradoxically, at the end strikes the nail on the head as to the cause of the ruin: "Whoever enquires the cause of the fall of the Roman Empire will find his answer in ascertaining what had become of the Romans." The anthropologists have answered, that the "Romans" disappeared long before Cæsar's time, from climatic causes, being blond Aryans unsuited to sunny skies.

Virchow thought that the blond invaders of Italy had completely disappeared, but Ripley thinks there are living remnants of the later hordes, particularly in Lombardy, where there are isolated German-speaking islets of people.

Modern Italians

The low class of Italians of to-day are savages according to Lombroso. They live in conditions which other savages even resent. They are short brunettes of long heads, and many have large negroid projecting faces. Many are not at all unlike the type which we imagine to have been the occupants of Europe in paleolithic times, which oozed into Italy as soon as they could escape from the northern home where they evolved their brain. They were subjected to a selection of the most fitted—that is, the most brunette—until they reached a pigmentation suited to the degree of light to which they were exposed. Hence, in later ages, although they were repeatedly conquered by later blond types who had developed larger brains because they remained longer in the severe conditions which evolved brains, yet the brunettes remained healthy and survived, while the blonds perished. As in Greece, so in Italy, we cannot speak of the decadence of the Roman into the modern low-type Italians, but must regard him as extinct, for the land repeatedly reverted into the possession of the lower types of adjusted brunettes who are descendants of the paleolithic, stupid, more brainless men.

One type of prehistoric Europeans had a long skull but a broad face, and it was a very wide-spread race. The Engis skull of Belgium is of this type and there are remains as far as Northern Africa. It still survives in Northern Africa and in a little area around

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Périgueux in Southern France, — Ripley's Cro-Magnon race. It seems as though there is quite a respectable representation of this race among modern Italians, and it fully accounts for Lombroso's remark and the curious contradictions in Italian history. It may have constituted the first wave into that country.

Italian anthropologists are now quite unanimous that the ancient Ligurians were similar to the present Mediterranean race, and have been overlaid by broad-headed invaders in the north since neolithic times. Etruscan skulls are of both types, and Ripley suggests a broad-headed ruling, conquering type which built up that civilization. The Iberians or first Spaniards and the Pelasgians or first Greeks were apparently of the same stock. All these very ancient races seem, by long selection, to be perfectly adjusted to their respective climates and persist in spite of the repeated blond invasions during the last three thousand years. The invaders invariably constituted the ruling class, built up civilizations and died.

It has been practically impossible heretofore to distinguish between the drift of races and the drift of cultures. We are so wedded to the idea that immigrations of men have carried civilizations with them, that it is almost an axiom of anthropology that when we find evidence of a culture having come in from a certain direction, a migration brought it. This is not necessarily true, and it is quite likely that many mistakes have been made which will be corrected when we recognize the fact that climate kills off a race which has migrated too rapidly into a region

too light for it. Hence we find that though the general drift of men has always been southward in Europe, the general drift of cultures has been northward, excepting civilizations evidently indigenous. Rude, brainy northern types flooded south into higher civilizations, built up still higher ones and they died, but their culture proceeded to drift north at once. This natural law, then, of extinction of unfit types by climate, explains many an archæological puzzle. At the Homeric period of Greece, 1000 B. C., prehistoric civilizations of Europe were high but were later delayed long after the southern forms. Scandinavia, for instance, did not learn of iron until many centuries after it was known in the south.

Blond Immigrants in France

In the year 1858 there were about 400,000 foreigners in France, but in 1898 there were about 1,250,000. Marseilles might be said to be an Italian colony. Gustave le Bon says that it will not be long before one-third of the inhabitants of France are Italians and one-third Germans, but in this he does not consider that this stream into France has been going on for a long time and that the blond types, except in the north, are being killed off by the climate now as they have been for several thousand years. Indeed France is at the apex of three vast streams of men, Mediterranean, Alpine, and Baltic, which ceaselessly flow into it, to disappear in time, for none of them are as physically fitted to the environment as the descendants of the primitive cave

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man. In the course of centuries it invariably repeats the history of Egypt, where intruders die and the Fellah lives. Cæsar found the Gauls to be blond where the land is now strongly brunette, and the Gauls in all probability have scarcely left a trace.

Ripley isolates four races in France, the north is now really Teutonic, more so in fact than Southern Germany. In the south there is the Mediterranean, and between the two, the remnant of the ancient Cro-Magnon and of the Alpine invaders of the stone age.

Blond Immigrants in Spain and Africa

Spain was repeatedly invaded by the Aryans, but never in sufficient numbers to build up an independent civilization; there are but few remnants left, and they are in the northern mountains. They offered the most stubborn resistance to the Romans. They never were conquered by Arab invaders nor converted to Mohammedanism, and, indeed, have been the foundation of Spain's independence as a nation, for they led the efforts to drive out the Moor, and constitute the most vigorous types to-day. They are vastly more liberty-loving than the southern Spaniard.

Indeed the native autochthonous Spaniard, like the native Italian, is not Aryan, but is closely allied to the Semitic type if he is not a part of that race, as I am inclined to believe. He was converted in large numbers to Judaism, and when the Semitic Arab and the Berber brought in Mohammedanism he embraced that too and was much happier and more contented

than he had been under the severities of the Christian Goths. The chances are that they would have permanently remained bigoted Mohammedans had it not been for the northern mountaineers among whom Aryan types undoubtedly existed.

As bearing on complexion it is interesting to note that the Romans called the Berbers *mauri*, or dark men (Gr. *mauros*—dark), and the Spaniards soon corrupted that into *moros* or *moors*, and these became equivalent to Mohammedans. Saracen, the name the Arabs gave themselves, means “men of the Desert.”

We would presume that the further south the blond went the sooner would be his decadence and disappearance. “But some great providence forbade to our race, triumphant in every other quarter, a footing beyond the Mediterranean, or even in Constantinople, which to this day preserves in Europe the faith and manners of Asia. The eastern world seemed barred, by some stern doom, from the only influence which could have regenerated it. Every attempt of the Gothic races to establish themselves beyond the sea—whether in the form of an organized kingdom, as did the Vandals in Africa; of a mere band of brigands, as did the Goths in Asia Minor under Gainas; of a pretorian guard, as did the Varangians of the middle ages, or as religious invaders, as did the Crusaders—ended only in the corruption and disappearance of the colonists. That extraordinary reform in morals, according to Salvian and his contemporaries, that the Vandal conquerors

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worked in Northern Africa, availed them nothing; they lost more than they gave. Climate, bad example, and the luxury of power degraded them in one century into a race of helpless and debauched slaveholders, doomed to utter extermination before the Semi-Gothic armies of Belisarius." Charles Kingsley would not have considered this a strange Providence had he known that they had violated law in going too far out of their zone, and paid the usual penalty.

The deterioration in ancient times must have been the same as in modern times a little further south in Liberia. In a report made to the State Department, Ernest Lyon, United States Minister to Liberia, dwells on the physical and moral degeneracy of foreigners in that country and the methods of some of the missionaries. Mr. Lyon says: "It is astonishing how quickly the foreigner degenerates in Africa. He is himself conscious of the degeneracy, but is apparently powerless to overcome the downward tendency. Climatic conditions influence the mental and moral as well as the physical and social environments. Men and women who come to teach and to lift up have been found among the victims, not merely of heathenism, but of wanton immorality. Many of the missionaries have adopted the barter system in their work among the natives. This places the missionary on the same level with the trader."⁷

The course of events in the evolution of brunetness of Berbers was precisely the same as in the case

⁷ Press reports.

of still earlier types which flooded over into Africa,—the gorilla and chimpanzee which escaped from the north before the brain evolution and hair involution had gone very far—probably before the glacial period culminated, and the negrito and negro which were confined in the north longer, until probably the first interglacial epoch when enough ice melted to permit escape, by which time they had lost their hair and gained several ounces of brain. All these earlier types, likewise, by natural selection developed pigment to protect them from tropical light so that they remain healthy in places which promptly kill off the blonds.

The Historic German Hordes

The historic medieval waves of blond Teutons, in a southern or southwestern direction, need not delay us long. Rome had kept back these wild virile peoples only at the expense of very sanguinary wars, and then when she could keep them back no longer she adopted them into her legions, so that many of these forces were composed mostly of Gothic officers and soldiers. They were high-type men as we would expect, they possessed “comparative purity of morals; sacred respect for women, for family life, for law, equal justice, individual freedom, and, above all, for honesty in word and deed.” Strong in body and brain, willing to learn, earnest and genial—surely a good type to be the new guardians of the decaying Aryan civilization of the Romans, which was in the hands of very degraded men.

But the barriers weakened about the time that this type of men flooded England, and when "the mythical Hengst and Horsa would have landed on the shores of Kent, and an English nation have begun its world-wide life," the Teuton stream simply flooded the whole Roman Empire, as though it had gathered head from being dammed back so long. The Longbeards, who are said to have been the noblest of them all, and who came from the Swedish mountains, gave their name to Lombardy, but we can scarcely find a trace of them, whereas their brothers who flowed east to Russia at the same period have left plenty of strong descendants who are now typical Longbeards. At the present writing these modern Lombards are in Manchuria doing exactly as their ancient cousins did in Italy and Greece and precisely as the Franks in Western Europe.

Taylor says: "The Gothic blood has nearly died out in Spain, the Lombard in Italy, and the Vandal in Northern Africa. Southern Germany was originally Celtic or Ligurian. It was Teutonized in speech by German invaders—but the type of the conquerors has now disappeared, and the prehistoric type has reasserted itself, except among the nobles, who are of the Teutonic type. Plainly the fair northern race has been unable to maintain itself, and has left little more than its Teutonic speech as an evidence of conquest."

A southern flow of men has existed in Europe since prehistory, and as the Mediterranean type is practically the same as it always has been, as far as

we have knowledge, it is clear that this drift is like that of a glacier. The men disappear like the ice, but their thoughts and civilizations remain like the bowlders and gravels of a terminal moraine.

Migration of Individuals

It is now a well-recognized fact that in the Russian Empire the later arrivals—the men of German origin, or the Teutonic Aryans—are creeping into positions requiring ability and reliability. It seems as though the Slavic Aryans who originally percolated into the country and built up an Aryan supremacy, are actually becoming decadent and are not as efficient or reliable in public office as the later arrivals who are of the Teutonic branch of the same stock. Indeed anthropologists are inclined to the view that the original blond Slavs are really decadent, if not already in great part extinct.

For instance, General Stoessel, the defender of Port Arthur, is said to be a Swede, his grandfather having been a Swedish army officer, but his father served in the Russian army. Whether this story is true or not, it illustrates the above condition and it also shows how migrations usually occur. Anthropologists are now quite convinced that as a rule great migrations take place by percolations—that is, it is an individual affair. Very rarely does the movement take the form of military masses, like the historic waves of Teutons in a southern direction, but the men move into the new country one by one and may be lost in the mass of people of another type. It is

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of interest to us here as it shows how the Scandinavian always rose to leadership when he migrated to a country inhabited by people of less brain power. This is noticeable not only in Russia but throughout Europe as far as we have any trace of them.

This law of individual migration of blonds fully explains their appearance in Egypt as shown on the old mural decorations. It also explains another fact which has not been generally noted, that the mural paintings on Etruscan tombs also show very white men in a position of superiority to the dark men of Italy. The migration of blonds into Italy must then have antedated the invasion of the ancient Romans, but they must have come individually, not in military masses.

Blondness of Aristocrats

Now this conquering blond type in Europe of course became the aristocracy—the ruling type or soldier class. Hence history and tradition show that even back in prehistory the nobility and aristocracy were blond even in countries strongly brunette. All folk lore points the same way, for princesses, fairies, and angels are invariably pictured as brilliant blondes, the brunette peasants' way of referring to a higher type. Modern artists still follow this conventional rule and use the blond type for symbolic figures and the supernatural. Almost all the dolls made in Europe are given flaxen hair to the present day, and that strange tendency of actresses and prostitutes to bleach the hair has its origin in the same admiration

for the blond ruling Aryan aristocracy just as in ancient Greece.

Dumont and many others have mentioned the fact that blonds were the rulers of brunettes all the way from the Peloponnesus to Ireland. Irish traditions still refer to a blond race which conquered brunette earlier arrivals. In Scandinavia, too, the brunettes were serfs. This fact, by the way, is not inconsistent with the theory that Scandinavia gave rise to blondness for these serfs undoubtedly were later arrivals. We have shown that light is not as absolutely necessary as we once thought, so that brunettes can survive longer in the home of blonds than blonds can survive in the home of brunettes—even the negro survives many centuries in temperate climates, but a white man does not survive three generations in the tropics. Hence brunettes who have percolated into Scandinavia may possibly survive millenniums, if not permanently.

On account of the same instinct to believe that all exalted persons are blond, we find that, as a general rule, the pictures and images of Christ are markedly blond, although we are quite certain that this type was not found in Israel. Ripley quotes Beddoe as stating that until the second century Christ was always considered to be a brunette. In the next centuries there were differences of opinion as to the Lord's personal appearance, but it was at a time when he had not yet been definitely elevated into the Trinity as God, and when the Arian controversy was still a living issue in the Christian world. As soon as

the doctrine of the Trinity became definitely and surely orthodox the opinion of Christ's appearance settled down into that of a tall blond, with amber hair and beard, blue eyes, clear complexion with a delicate tinge of red, and oval face, as described in the spurious epistle of Lentulus to the Roman senate.⁸ Somewhat later, he was generally believed to have been brunette, but this change of opinion corresponded, I believe, with the invasion of the Teutonic tribes into the Roman Empire. They were Unitarians, as a rule, who would not accept the doctrine of Christ's divinity, and he was therefore looked on as a man who must have been brunette like the Jews in general. But as these Teutons disappeared and the Roman Catholic Church was unrestrainedly in possession of the Mediterranean type of man, the Trinitarian doctrine was re-established and Christ was again exalted into the Godhead as a blond. In some countries, as Mexico, he is always given red hair as an exaggeration of the amber color. It is not paradoxical, therefore, that this church should picture Christ in the form of that type of man which has been the most persistent enemy of the Church, whose teachings, as expressed in the Church dogmas, the mass of blonds cannot accept. It is merely the symptom of that mental attitude of the brunettes of Central and Southern Europe, who from prehistory have been under the control of a blond aristocracy, and who look on all higher persons as blond.

Similarly the Virgin was always considered to be

⁸ Draper's "Intellectual History of Europe," p. 361.

brunette in the early centuries of the Church when she was doubtless looked on merely as a fortunate Jewess.⁹ As her worship became a part of Christianity and she became divine, her complexion was changed, so that her images and pictures in the Roman Catholic churches are now blonde. But Mary Magdalene shows her lowly origin by being pictured as brunette. It is also not astonishing to find such a large number of blonds among the religious pictures of the old masters. Cathedrals, such as St. Mark's at Venice, are simply covered with them, and in modern times in all symbolic pictures, particularly mural paintings, there is a general tendency to use the blond. In the decorations of the famous Boston Library, for instance, there are but few brunettes.

The Devil and all his Imps are almost always pictured as brunettes, in accordance with this law, as they are looked on as a lower order of celestial beings. Similarly the villain of the drama is generally brunette, while the hero and heroine are more apt to be staged as blonds. There is also some relation in this to the word villain itself, which may come from *vilio* (vile) or *villa* (a country house or farm), the original *villeins* being the lowest laborers, slaves, or serfs and they were presumably conquered brunettes. We even use the word "bright" in referring to a face which is intellectual and reflexly one which indicates goodness, but a "dark look" indicates lowered moral tone irrespective of complexion. The thieves crucified with Christ are generally dark.

⁹ Draper, *Ibid.*

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This general tendency to blondness in the higher walks of life is very evident in the United States. One has but to visit public gatherings, such as in theaters, to be convinced. The lower the grade of the theater the greater is the number of brunettes, while in the highest and best the proportion of blonds is markedly greater even in our brunette cities where there is such a large number of high-type brunettes. So that the law is still in existence.

At one end of the Old World we find that "*caste* and *color* are of common derivation in the Sanskrit language," and at the other, the Eddas describe the servile ones as brunettes. "The thrall or churl is invariably a dark type, the opposite of the flax-haired, blue-eyed jarl or earl." Ripley, from whom this is quoted, gives many other instances and asserts it as a proved fact "that the upper classes in France, Germany, Austria and the British Isles are distinctly lighter in hair and eyes than the peasantry." The Teutonic conquerors of prehistory were blond, and tallness and blondness are still insignia of noble descent. There is a great deal in medieval literature on this point collected by Gummere.

The interesting point in all this data as to Central Europe lies in the fact that the conquering blond always seized the fertile, rich countries and drove the vanquished brunettes to the mountains or infertile regions. That is, the blonds by a sad fate remained in the lightest places least fitted for them and thus hastened their own extinction. It is no wonder that they all died out except the leaders who

were not required to expose themselves to the climate like the farmer.

Blond Immigrants into Asia

About the time the Homeric Greeks migrated into Greece other branches of the same blond stock crossed over into Asia Minor, and though the course they took is not known they evidently kept to the highland forests, and this may account for their survival. The first we hear of them is their existence in Media and Persia where they had waxed strong enough to conquer the Asiatic natives, whether Turanian or Semite we do not know, and established kingdoms. Their head men, such as Cyrus and Darius, were believed to be blond, rugged, hunting foresters. Yet how short a time this type lasted after it descended to the lighter and hotter lowlands and conquered Babylonia. In about two centuries it was all subject to the Greeks, and yet the language it forced on the people of Persia lasts until the present though in a greatly modified form, and using a Semitic alphabet based on the one the Aryans found in use there perhaps three thousand years ago.

The type of man called Esau in Genesis was red and hairy. This description was written about 700 B. C., and it is a tradition of some very early tribe which had disappeared, but there is no such type in Southwest Asia now. It must have been an immigrant type and indeed the whole account of Jacob and Esau seems to represent Semitic and Aryan types respectively—the one oily, smooth and tricky, the

other fierce and rude, as we know the Medes and Persians to have been.

It is much more likely that the route of these Asiatic Aryans was by the north and east of the Caspian Sea. We know that blond Slavs existed in the southeastern corner of Europe long before the Christian era, and it is but a step relatively from there to the Oxus River, up which the first Aryans trekked, and rested a long time in Bactria north of the Hindoo-Koosh Mountains; just as the Greek branch seemed to have rested in Thessaly, their original Hellas. The Asiatic branches looked back to Bactria as a holy place; there, about 500-1000 B. C., Zoroaster was born and the Magi of the Medes lived. The Medes, Persians and the Sanskrit-speaking branches all make references to the same Bactria or mother of cities, and their languages are of very near kin. Perhaps there were still great cities in all that part of Turkestan, now desert from climatic changes, the looting of which was the real object of these big blond barbarians, just as it was the object of the Goths and Vandals in the west much later. Bactria was and is in the great trade route from the East to the West, though Bokhara in the same valley is more important now.

This route is the more probable because it is the route of the modern Aryan flow, for the Slavic outposts are now at this same Bactria—now called Balkh—resting there like the first wave, but looking longingly into Persia and India for loot—knocking at the doors kept shut by other Aryans who came in

by the back-door. Perhaps the first Aryans enlisted into their armies at Bactria immense numbers of brunette Turanians, just as the Slavs are now doing at the same place, and just as the Normans and other Teuton invaders of England undoubtedly did also.

Blond Immigrants into India

From the Iranian plateau stream after stream of Aryans flowed through the passes down into India, conquering as they went, and becoming the warrior class, as in Rome and Greece. Indian scholars have repeatedly found records that these conquerors were all white men. They forced their Aryan tongue on the northern population and built up a great civilization. The wonderful resemblance between Indian and Greek philosophies and between Buddhism and Christianity, means identity of origin and not that one is derived from the other. Yet scarcely a remnant of these Aryans is left, so complete has been their extinction by the climate. So great, however, was their influence that we are in the habit of calling the present Indians, Aryans, whereas they are merely the descendants of the Asiatic and Semitic types conquered by the Aryans. No doubt many of them are as bright and intelligent as the Asiatics who now live in Europe and speak Aryan tongues, and both types furnish many great men, but there is no reason for calling them Aryan.

All the Asiatic immigrants called themselves Arya or "nobles" and they certainly became the ruling light-skinned aristocracy—priesthood and soldier

caste, both in Persia and India—while the conquered remained as they were—farmers, shepherds, artisans and laborers; and Anderson ¹⁰ says the latter in Persia were all Turanians who could not then accept an Aryan religion and they actually killed Zoroaster. It was then as now, white men and yellow peril. The present Aryan race in India—the English—constitute the highest caste now and enlist the lower caste Turanians and Semites into the army by which they control matters, and there is not the slightest doubt that the Sanskrit-speaking Aryans did the same. We can well dismiss as almost inconceivable the statements that there are any descendants of the ancient Aryans in such a climate as India, which is solidly Semitic and Turanian. They may talk Aryan dialects now but that does not make them Aryans any more than it turns American Semites into Aryans. If we call the Spaniards and southern Italians Aryans, then the Brahmans of identical type must be so denominated, and we might add also the American negro.

Aryan Migrations Beyond India

Aryans who spoke a dialect of Sanskrit called Pali even flowed over into Ceylon where they created a wonderful state, with huge cities, giant irrigation works and fine roads, the ruins of which excite wonder. One city alone was sixteen miles in diameter and had massive stone houses. Yet not a remnant is left of either conqueror or civilization for they all died out before the Christian era. Other

¹⁰ "Extinct Civilizations."

branches went to Java and duplicated the Ceylon civilization. But the Aryans in Java must have completely disappeared about the same time as the Ceylonese Aryans (500 B. C.), leaving ruins of mighty temples of Hindu architecture which were a complete enigma when first found by the Dutch. Similar ruins have been discovered in Siam and Cambodia in recent years and are probably Aryan remains.

There are said to be ruins of big buildings in Borneo which may have a Ceylonese Aryan origin, but whether the Aryans ever went further is not known, the Sanskrit words in the Malay tongues of the Philippines being probably taken there in the course of trade or by the Malays themselves. Dr. David P. Barrow suggests that the words may have antedated the Malays, though Aryans themselves never reached the Philippines. Dr. Pardo de Tavera thinks they did. Yet the sailor instinct may have led Aryans to the Pacific Islands, whose huge statues may thus be explained, as the present races there are all incapable of such work.

Disappearance of Blond Aryan Immigrants

Thus the restless, energetic, blond Aryan, migrating south, always paid the penalty by death, and has always left his civilization in the hands of the conquered lower-type native, who, being of less intelligence, invariably let it decay. Like every other animal he must stick to his zone, and can migrate east or west, but not north or south. In another article¹¹

¹¹ Philadelphia Medical Journal, April 7, 1900.

I have quoted very many illustrations of this law from various sources, chiefly Taylor's "Origin of the Aryans." We have given sufficient already without quoting further, except to mention that Egypt has been the theater of immigration of intelligent races time and time again, but in each case they died out, and the civilization decayed though the native Fellah survived. Thus there were numerous civilizations separated from each other by dark ages. There will never be another dark age for the present Aryan conquerors rule it from London and are not colonizers. They are making the land more prosperous than ever before; it feeds more people, who are doing greater deeds than in any previous empire.

In the literature dealing with the disappearance of civilizations, or their decadence, there are hosts of causes asserted for that decay. Almost all of the alleged causes are really results of the decay, and there is a wonderful tendency to assert that the resulting moral decadence noted in all dying civilizations is the main cause. Scarcely a work on the subject has clearly and definitely grasped the main reason—namely, that a civilization dies because the people who built it up die out from climatic unfitness. All the ancient subtropical civilizations were built up by men who had migrated south out of their zones, and the men perished chiefly because they possessed too little pigment for the tropical light to which they were subjected. Gustave le Bon in his numerous works wholly misses this point.¹² Lower races never

¹² See "Psychology of Peoples."

have and never will keep up a higher civilization thrust on them—they have not sufficient intelligence. It is a matter of brain. Hence when their conquerors die the civilization decays.

Many more illustrations of the law of extinction following rapid immigration north or south may be found in an article by the writer on the evolution of the brain.¹⁸

As far as we can now determine there are no blonds on earth who cannot be traced to the north-western corner of Europe. In prehistory the same law is found to hold as far as the evidence goes, and there is no doubt that it will be found to be an universal law, nor is there any doubt that the peculiar dark, cold climate necessary for this evolution was a very localized one. Hence blonds are always intruded types wherever we hear of them.

The disappearance of blond invaders of a light country, and the greater density of population in the higher civilizations built up by these higher types, explain a phenomenon in Russia which the anthropologists have repeatedly quarreled over but never explained. Ancient Russia in the stone age, like all the rest of Europe, was peopled by a long-headed race, and the tumuli show that they were tall and possibly somewhat rufous. Modern Russia in these same places—all the way from the Carpathians almost to the Ural—is strongly broad-headed. The paradox is this,—though the Asiatic invasion which submerged or drove out this primi-

¹⁸ *Journal of Insanity*, July, 1901.

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tive type is known to have been very ancient, yet the present condition of broad-headedness is a quite recent affair, for to the ninth to the thirteenth centuries the graves still show a large proportion of long heads. Ripley states that no other explanation is possible than that the broad head is a new-comer, and yet we know he was a very ancient immigrant.

The density of the ancient populations was very low, and even if broad heads had killed off all the long heads they were not numerous. Then came the percolation of blond, brainy long heads from the north, now and then in military masses, building up civilizations permitting of the production of more food and denser masses—the conquered and conquerors—and the gradual disappearance of the blonds but persistence of the broad-headed brunettes in these large numbers. The density remains high because the civilization is still kept up by the blond types ruling from the north, and the relative proportion of broad heads must therefore be steadily increasing and the present high proportion is then a recent phenomenon. The same phenomenon is now occurring in Egypt, where high civilizations with great tillage acreage are producing a greater density of population than ever before; but it is a civilization kept up by people in London and the increase is of the dark people, who therefore outnumber the northern types in a higher percentage than ever before. As before mentioned, the Russian upper classes even yet show a tendency to blondness and

tallness. Instead of being a proof of the change of a long-headed type into a broad-headed one of which there is no biological evidence, it is the strongest kind of proof of the disappearance of a type from climatic unfitness.

The White Man's Burden

We can here refer to another curious fact. The Greeks, Gaels, Celts, some tribes in Ireland, and the Aryan invaders of India, all called themselves "white men," and this great racial distinction only arose with the appearance of blonds or Aryans among people of dark hue. White man's rule and the white man's burden are thus several thousands of years old, and modern history has not evolved anything new. In India, and all over the tropics, the Aryans are now only repeating what they did before, but with this difference—having found that climate prevents colonization outside of our blond zone all efforts to colonize the tropics are being given up forever, and the white man now controls from his blond zone in Northwestern Europe.

It should be remarked in passing that there is absolutely no relation between complexion or skull shape and intelligence. We have wonderfully high types of man of every conceivable complexion and every head form. It is only where we take huge numbers and compare types that we find the average of the blond type of white men to be so much more intelligent than all others as to have been the ruling element in Europe since historic times, and even long before.

In the above article ¹⁴ it is proved that races of men from the Aryan to the negrito owe their relative superiority to the size and weight of the brain, and that the longer a race is civilized the greater are the variations among the individuals of that race. We cannot enter into the reasons for these laws in this place. At present the blond Aryan races are apparently producing higher specimens than ever before in the history of the world and also specimens lower than the average negro. It is reported that Dr. Bean of Johns Hopkins University read a paper at the last meeting of the American Association for the Advancement of Science to the effect that the brains of the higher races also show a higher organization than those of lower races. Dr. Edward A. Spitzka of New York also reported that he found that the brains of great men show a much greater abundance of the fibers which connect the various parts of the brain—a character which was already known to distinguish man's brain from that of lower animals. It is therefore quite evident that the long evolution of brains in the cruel north of Europe has produced a highly efficient organ which has been ruling the world for some thousands of years and will continue to do so forever. North America has reaped the benefit of these types more than any other place to which Aryans have migrated.

The world is just awakening to the fact that it owes a great debt to the ideas emanating from the brains of the blond or Aryan race. The phi-

¹⁴ *Journal of Insanity*, July, 1901.

losophies of Greece and India, many of the religions formerly ascribed to the Semitic races, and nearly the whole of medieval and modern science, are Aryan products. We find the traces of these former streams of men as we find bowlders transported by glaciers of other epochs. There is then no mystery in the fact pointed out by Draper, that the religious doctrines of the Druids recall in many particulars those of the Rig-Veda—they are both derived from the same Scandinavian sources.

Disappearance of Half-Breeds

It is almost a biological axiom that half-breeds between widely-separated races cannot persist. Much of this is due to sterility from unknown causes. For instance, half-breeds between Europeans and Chinese or Japanese are generally sterile, also half-breeds between Japanese and Ainus, and many of the Hindu half-breeds. But the chief reason for extinction is physical unfitness to the climate of either parent. They are actually people without a place on earth suited to their physique. The half-breed is a man without a country. Mulattoes, for instance, are unfit for the tropics because they are too light, and unfit for cold countries because the nostril is so large, hence they are damaged by the climate wherever they go. They are also of poor vitality, resist disease badly and succumb to surgical operations which whites and blacks both survive. They are too light for the West Indies and quickly disappear—being almost gone from Jamaica and San

Domingo. They do not last many generations in our South, though they persist longer in our North, if white enough—that is, the quadroon or octoroon—but extinction in the long run is the rule and survival the exception. Bulletin 8 of the 1900 Census states that where negroes are most numerous mulattoes are least numerous. This is said to be due to less race intermingling as we go south. It is partly if not wholly an effect of climate eliminating mulattoes in the South sooner than in the North.

The percentage of mulattoes in the total negro population is as follows: Savannah, Ga., 18; Richmond, Va., 21; Baltimore, Md., 23; Philadelphia, Pa., 32; Cincinnati, Ohio, 54; Cleveland, Ohio, 59. Likewise the light-colored Spanish mestizos are so unfitted for the Philippines that woeful degeneration is evident in the third generation. Take any half-breed family there and we can see eventual extinction staring it in the face. They have produced a sad crop of degenerates already, and of many families of twelve to twenty children only two or three survive. Then again we must take into consideration sexual selection resulting from hatred between pure bloods and half-breeds. It almost bars out marriage between them, and the mestizo unfitness is thus intensified generation to generation. Chinese mestizos, on the other hand, descended as they are from closely allied branches of the same stock, are more nearly adjusted to the climate. They will no doubt last much longer than the other kinds, but permanence can scarcely be predicted.

The expedition to the Bahamas by the Geographical Society of Baltimore¹⁵ reports that the negroes are the healthiest, the whites less so, and the half-breeds most susceptible to disease. But in Hopetown the whites were woefully degenerate, a condition said to be due to intermarriage.

Dr. Theron, in speaking of the Creole conscripts of Reunion, says that "the nearer the conscript approached the white race in color—and with stronger reason the white Creole—the more cause there was for his exemption from service; the more traces of African blood there were in the conscript, the better were his chances of being declared physically good."¹⁶

A medical officer informed me that mestizo children died of malaria in far greater numbers proportionately than full-blood Malays. This may be due to loss of that immunity possessed by Malays, quite a proportion of whom, both adults and children, have malarial germs in their blood constantly but never show symptoms of the disease unless weakened by some other cause. But it is just as likely to be due to the weakened constitution characteristic of all half-breeds. It is known to anthropologists as an universal phenomenon. Herbert Spencer, in a famous letter to Baron Kaneko, strongly advised the Japanese not to permit marriages with Europeans, and based his advice on this fact of the weak constitutions of the half-breeds. He correctly shows that each type is adjusted to its own environment

¹⁵ *Science*, October 2, 1903.

¹⁶ Burot and Legrand's *Hygiene*.

while the half-breed is physically adapted to neither, indeed is unfitted to any set of conditions it can find anywhere. Hence there is no zoological zone where the half-breed can live and he must die out no matter where he goes. This of course refers to half-breeds between widely separated types, and not the half-breeds between closely related races, and there is very much literature on this topic, as in Taylor's "Origin of the Aryans." We are drifting to the opinion that, in the long run, surviving races are always pure-blooded and not mixtures.

Anthropologists are almost unanimous in opinion that crossing of races is the best means of colonization, a curious mistake in view of the statistics they have collected as to the invariable disappearance of half-breeds between two widely separated races. Ripley gives numerous illustrations of the weakness of hybrids.

Every Climate is Perfect for Its Adjusted Types

It is latitude, modified by forestation and cloudiness, which determines fitness as to pigmentation. To be sure it is slightly modified by elevation, for we have shown that mountains permit a degree of blondness not tolerated in the lowlands of the same section, but it is only a minor difference as we see in the case of the blond Spaniards and Italians. Professor Ward, of Harvard, says,¹⁷ in reference to erroneous impressions we have as to the healthfulness of mountains in the tropics: "They tend to spread false notions regarding the possibility of the

¹⁷ Science, July 17, 1903.

acclimatization of the white race in the Philippines, and of outdoor work of the white men in a tropical climate. Altitude, as in the highlands of Benguet, or of India, gives some relief in the way of lower temperature than at sea level. It means the absence of some tropical diseases which prevail on the lowlands, or a more rapid recovery from disease than at sea level. But all experience shows that altitude does not solve the acclimatization problem. A tropical sun is always a tropical sun. A tropical climate is always a tropical climate. It should be the aim of all Americans who send us accounts of Philippine climates, avoiding generalities based on first impressions, carefully to study the effects of the climate on white men. The experience of English, French, Germans, and others in the tropics furnishes evidence enough of the inaccuracy of much that has been written of the climate of the Philippines."

We are safe in saying that the black man should be within 25 or 30 degrees of the Equator. The browns should be between 30 and 35 degrees. The olive (our Semitic or Mediterranean type) flourishes best at 35 to 45 degrees. The blond arose north of 50 degrees, probably at 55 degrees, and some have even suggested north of 60 degrees in Scandinavia.

We thus see that every climate on earth is a splendid climate for the type of man physically adjusted to it by natural selection, and a bad climate for every other type of man. Men have become adjusted by the process of selection through past millenniums. Nature is a brutal stock breeder and kills off all un-

sued to any climate into which they may have wandered. The destruction is slow if the difference between the old and new climate is small, and more rapid the greater the difference. Climates, by the way, are apt to be blamed for disasters due to our stupidity. We would not dream of blaming the climate of Norway for freezing to death a Norwegian who had not intelligence enough to seek night shelter. We should not blame the Philippines, by the way, for a great deal of the illness of men who have not sense enough to seek day shelter from the light. We can avoid much of the results of unfitness, as we avoid the results of our naked conditions.

Ripley says very neatly, "To tolerate a climate is one thing, to become independent of it is quite a different matter." We can dodge the fatal factors when we find out what they are, but we can no more resist them than we can become immune to bullets.

CHAPTER XII

RESULTS OF MIGRATIONS TO AMERICA

Spaniards in Mexico

Now let us apply these rules to North America and see if there is any evidence of the decay and disappearance of its immigrants who are nearer to the Equator than in their original home. Mexico is much farther south than Spain, and the complexion of the native Mexican of the lowlands is far darker than that of the Spaniard even of the south of Spain, indeed they are as dark as the men of Northern Africa in equivalent latitudes.

The Aztec of Mexico, as well as the other allied races of that country, show very little if any change in four centuries, and it is extremely likely that they, like the Fellahin in Egypt, will show no change for thousands of years in spite of repeated Spanish and Anglo-Saxon conquest, surviving long after their conquerors have died out from unfitness to the climate.

Dr. Ales. Hrdlicka, of the United States National Museum, says this of them, as a result of Ethnographic Surveys in Mexico.¹ The measurements obtained on the natives of Tetelcingo agree with those obtained on the ancient Aztec and Nahuatl skeletons from various parts of the valley of Mexico,

¹ Harper's Magazine, December, 1902.

which leaves no doubt as to the identity of the people, and at the same time shows the interesting fact that but very little, if any, physical change has taken place in the Aztec-Nahuans since the fall of their own kingdom—that is, within almost four hundred years.

Of the present 14,000,000 Mexicans, 10,000,000 are said to be pure-blood native Indians, speaking the languages they used when Cortez arrived, though some assert that as high as fifty per cent. have some mixture of other blood. Customs have also changed but little and, in spite of Christian teachings, they have merely transferred religious ideas to Christian idols. The half-breeds and the quarter-breeds are the leaders just as in Luzon, and the full-blood Spaniard goes home or dies out in a few generations.

Matias Romero² says: "In Mexico the energy of the Spaniard is remarkable. He is forceful of word and phrase, energetic in his movements, immensely vital, tremendously persistent, and wonderfully enduring. After thirty years behind a counter selling groceries he retires a man of fortune, not always large, but sufficient, and is still a man of force and ready for undertakings demanding good brain-power and courage. They come over mere lads from ten to fifteen, toil and moil, feed frugally and sleep hardily, and they become millionaires, bank directors, mill-owners, farmers on a grand scale, hot-country planters, and monopolists—for the Spaniard is born with the 'trust' idea, while his sons are too often dudes and spendthrifts. The thrifty Spaniard

² "Modern Mexico."

toils and saves, and his ambition is to marry a rich girl, frequently the daughter of a Mexican landowner, and so he lays the foundation for permanent wealth. . . . There is one check to the growth of Spanish influence in Mexico, and that is the climate. All Europeans, no matter what their nationality, become physically modified by residence in the New World, and nowhere is the effect of climate more noticeable than in the tropics. The children of the Spanish residents are less energetic than the parents, and the third generation are altogether Creoles."

Here we see clearly the primary stimulation of too much light to even the swarthy Spaniard who is adjusted to a climate like Maryland but who has insufficient defense against the light of Mexico. It is even worse than Romero states for it is common knowledge among anthropologists that these Spanish families perish, so that this element in Mexico is disappearing in spite of constant importations, while the adjusted type of dark Indians is increasing to a very great extent in the higher civilization which has been forced on them and which permits a greater density of population. There are now said to be more pure-blood Indians in Mexico than when the Spaniards first invaded it.

This same deterioration is a feature of this swarthy Mediterranean type in our extreme south, but of course it is much slower as there is not so much difference from the native climate of Spain. But the deterioration is marked nevertheless.

Light Zones in the United States

Between 25 and 30 degrees of latitude we have the Peninsula of Florida and a bit of Southern Texas. It is as far south as Nubia and light enough for black skins. The 1900 Census report shows how the negro is naturally shifting his zone. Though he was introduced into all the seaboard he had already died out partly in the North by 1790, when the center of the negro population was in Dinwiddie County, Virginia, but in 1900 it had moved 476 miles southwest to the northeast corner of Alabama. This is in spite of the tremendous stream constantly flowing north. That is, he is tending towards the latitude of Nubia. The densest areas are now along the banks of the lower Mississippi.

Between 30 and 35 degrees we have our southern tier of States, at the same latitude as lower Egypt where negroes seemingly flourish but will eventually die out, as already explained. Probably the cool winters of Egypt and of our black belt are too cold for the open nostril of the negro and may be responsible for his extinction in Egypt and probable extinction in America. This belt, though suited for brown, red, yellow, and olive men, is wholly unfitted for whites of any complexion and the southern families who do not migrate north every summer become enfeebled. Indeed degeneration and extinction is the rule in this belt, even for the best fitted—those brunette Creoles whose ancestors came from Spain and Southern France.

Between 35 and 40 degrees we have the northern tier of negro States where we know already that the negro does not flourish and was not as profitable in slavery days as further south. In this zone also the blonds cannot flourish except in the mountains, but as it is the zone of Southern Spain, Southern Italy, and Greece, we find that the olive and dark brunettes are perfectly adjusted and flourish. The Mediterranean races even flourish further south and this explains their tendency to flock to our south, and to that part of California south of 40 degrees.

Between 40 and 49 degrees we have all of the northern half of the United States, unfit for blonds except in the mountainous parts, for it is the zone of brunette Central Europe. Practically all of the blonds of Europe are north of 49 degrees, and within an oval curve whose center is somewhere in the south of Norway.

Havelock Ellis quotes Baxter ³ that the blonds in America suffered more from the permanent effects of every form of illness than the brunettes, and also quotes Dr. Alice Ross ⁴ that, "In red-haired women and those brunettes who have red lips, red cheeks, and are inclined to freckle rather than to tan, lacerated perineum and cracked nipples occur most frequently. And those sallow-skinned blondes who tan rather than freckle, and who have a tendency to a deposit of pigment in the areola of the nipple, and about the

³ "Statistics Medical and Anthropological," Washington, 1875.

⁴ Medical and Surgical Reporter, October, 1892.

neck and armpits, are least liable to suffer from these accidents."

Baxter asserts from the statistics of one hundred thousand soldiers in our Civil War, who fought between 30 degrees and 40 degrees of latitude, that brunettes opposed greater resistance to disease and offered more hope of recovery from injuries in the field. This alone in time would eliminate the blonds. Hence we have a clear explanation for that decided increase of brunettes already noticeable in this part of America, excepting of course in the mountains.

In the United States the only region north of 45 degrees is the tier of northern States from Minnesota to Washington, all of them too light for blonds, except the mountains, and suitable for such types as we see in the similar latitudes of the steppes of the south of Russia where blond Germans were colonized by Catherine—yet now unsuccessful after a century of trial.

It is possible that there is no place in America except the northern mountains fit for blonds, and that Americans are to become brunettes by survival of the fittest as we have seen occurred in Italy, Greece, and Spain under identical circumstances.

The Southern Hemisphere

The Southern Hemisphere, except the tip of Patagonia, is north of 45 degrees, and therefore unfit for blonds; even in New Zealand and Australia the native white families are already dying out or kept alive by constant new importations from home.

In New Zealand, in spite of its mountains, supposedly good places for blonds, there is ample evidence of the physical decay of the white people. In Australia there is not so much written of the physical decay as in New Zealand but it is the same. Indeed it is foolish to suppose that a climate which evolved the blackness of the native is not harmful to whites. In both islands there is consternation over the fact that the birth rate is so small that the white population can be kept up only by constant immigration. Such deplorable results after but two generations are to be expected when white men are so far out of their zones. The *New York Medical Record*⁵ mentions that there is rapid decay of Anglo-Saxons in New Zealand, the prevailing conditions being the loss of teeth, cessation of lactation in nineteen-twentieths of mothers, chlorosis, sexual and nervous disorder, and neurasthenia. Colquhoun⁶ mentions the decay of native Australians, their anæmia, nervousness, and exhaustion.

The cessation of lactation so noticeable in New Zealand is becoming a great defect of American women too. It is an evolutionary phenomenon, even in the old country, from the increasing numbers of female babies, who can be raised on modified milk and who inherit the maternal weakness. Formerly all such babies died and the only families surviving were those who had normal milk. It is not known whether our percentage of women who cannot nurse

⁵ February 2, 1901.

⁶ "The Mastery of the Pacific."

their babies is greater than in civilized communities in Europe but it is believed to be much greater.

The mountains of South Africa may be cool enough for blonds for a while, but from the brownness of the native in this light country we are safe in predicting the death of the Boer type in time. The short history of Central and South America, shows survival of only brunettes, and even they are known to be dying out, leaving the land to the adjusted brown or black native Indian types everywhere. All of contemporary history of Central and South America can be explained by the degeneration of the European settlers who rule it, now utterly unfit for republican institutions or high civilization—repeating the history of Egypt where every civilization died in the hands of the native.

We need have no fear of permanent German colonies in South America where they are now flocking for trade purposes. They will all die out and there will not be a third generation of such blonds to cause the United States any future trouble.

Percentage of American Blonds Already Diminished

Japan extends from 30 to 40 degrees in latitude, or the same as from North Nubia to the middle of Spain, Portugal, Italy, and Greece, and the same as from Florida to Pennsylvania. The natives of these three sections have about the same pigmentation, and the blonds are just as unfit for one place as for the other.

Dr. Theodore N. Gill, of the Smithsonian Institution, is reported to have stated that our blond types are becoming less plentiful, but he is not necessarily correct in asserting that it is due to blending with the brunette types which have been flooding the country in the last thirty years. There has not been sufficient time for this to take place though it is a factor no doubt. The real reason is the greater mortality among the blond types who are less adjusted than the brunettes.

Professor Otis Mason also states that the blond type is decreasing in America and correctly gives the reason—"the skin, hair and eyes of the Indian are the colors which nature loves (evolved by selection) in America." He thinks we are all to have dark eyes, hair and complexions in the future, "depending somewhat on the altitude in which we live," and he should also have stated on the latitude.

On the other hand, Professor W. J. McGee (director of Anthropology at the St. Louis Exposition) is reported to have stated that "esthetic development tends to whiten the skin, . . . culture would therefore tend to produce a blond race, while vigor, on the other hand, would help to establish a brunette race." In this he is wholly wrong. Culture does *not* cause blondness, but the blond races have caused the highest cultures in ancient Greece, Rome, and in Northwestern Europe in modern times, not by reason of their blondness but by reason of their brain which enlarged by natural selection in the same environment which evolved the blondness. He has mixed

up another matter—the increased *number* of blonds in modern times due to high civilization. The higher the civilization the denser is a population. Hence the English in one century have been able to feed forty million people by importing food where they formerly could not support one-tenth that number. There is an increase of thirty-six million light types, but not a particle of increase of the blondness of any one family. Indeed the brunettes in England have increased relatively more than the blonds, because the increase in population is confined mostly to the cities, which are markedly more brunette than they were one hundred years ago. If McGee were correct the Philippine pure-blooded Malays should be very light. They had a high civilization and culture forced on them by the Spaniards, who in three centuries have been able to increase the population from one million to seven, but they are not any lighter than they were three centuries ago. Culture thus increases the numbers of a population, whether it be white or dark, but does *not* alter the complexion.

Professor Starr, of the University of Chicago, is the most prominent advocate of the theory of the climatic unfitness of the United States for blonds, but erroneously states that we are drifting by natural selection to the Indian type. We may be drifting in the same direction but as the Indian himself is a comparative newcomer no one knows exactly what his final type would have been. Nevertheless, we may be actually evolving a new dark type just as the

Alpine type has been evolved in the opposite way. These people have brown hair and gray eyes as a rule,—a vast difference from the supposed black hair and brown eyes of prehistory.

Degeneration of Scandinavians in America

The racial decay of Norwegian peasants after some years' residence in our Northwest may be due, in part at least, to the excessive light of these countries against which they have no defense. Janson⁷ believes it to be due to the change in environment. According to *American Medicine*,⁸ his "observations are based mainly on a study of the peasant and his offspring from certain mountainous parts of Norway." He speaks of the diet, physical characteristics and freedom from disease, and contrasts them with the conditions present in those people as found in the United States. In the same generation there is loss of buoyancy and elasticity of gait, the hair becomes dry and alopecia results, digestive disturbances and constipation become common, and, following the latter, many disorders, especially in the female, entirely unknown in their native land. Nervous disorders are frequent. In the second generation are found decaying teeth and an alarming frequency of the so-called scrofulous diathesis. Particularly important is the prevalence of rheumatism and tuberculosis in its various manifestations, this being the disease on which most stress is laid in con-

⁷ *Northwestern Medicine*, January, 1903.

⁸ March 14, 1903.

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nection with these victims of change of environment. It seems to make up for the time lost by the past immunity of the race, and the mortality is high. In Rockford, Ill., and other localities in that section, the Scandinavians who exist there in hordes, seem to → be positively melting away of tuberculosis, just as they disappeared in Spain and Italy, which have about the latitude of Chicago.

With this nervous irritability men of great talent and genius are developed, in business, finance, professions or politics, but the physique is poor and brilliant careers end soon with the diseases of degeneration—tuberculosis, cancer, premature fibrosis.

What applies to the Norwegians applies equally to other Europeans who have lived among simple and secluded environments. Whether adjustment is possible in such a great change of environment is problematical. It seems that extinction is inevitable in time, and that the hordes of immigrants are not to be assimilated but sloughed off, except those who are physically fitted for the climate. The reduction in the birth rate of other classes of immigrants is a natural phenomenon found in all countries with advancing civilization; and we can dismiss it from our present discussion.

When it comes to a matter of dollars and cents the insurance companies generally know what they are about. They are the best experts on the effects of climate, and they have data carefully collected for a century. Some of them will not permit an Aryan policy holder to reside within 30 degrees of the

Equator, others will permit it but levy an enormous increase of premium. They know of the destruction of health and life in the tropics and the money loss to themselves. Some have even gone out of business in the southern part of the United States.

Tuberculosis in America

From the known increase of tuberculosis among white men in the tropics and among blond Scandinavians in America, and from the well-known fact that the disease has a neurotic basis of some sort as elsewhere explained, there is some ground for the generally received opinion that blonds in America are much more susceptible to infection than brunettes. The general idea of a tuberculous candidate is a washed-out blond, and if statistics should bear out the preconceived impression, they will furnish still further proof of the nervous damage due to the light. The prevalence of the disease among ill-fed Malays and American negroes at the opposite end of the pigment scale seems to be due to an equal nervous depression from other unhygienic causes, but it would not be at all improbable that defect of stimulation in the negro is a factor as in the similar prevalence of the disease in prisons.

Nervous Diseases of Americans

There is now a great deal of thought being expended on the marked increase of nervous diseases in America—the main disorder being neurasthenia. Every now and then we learn of some great man col-

lapsing of nervous breakdown before forty-five under loads which Europeans seem to bear safely until sixty or sixty-five. Suicides, which are nearly always due to mental or nervous disease, are increasing in the United States as follows: 1899, 5340; 1900, 6755; 1901, 7245; 1902, 8291; 1903, 8597,⁹ and a similar increase of other neurasthenic conditions is frequently reported.

Dr. H. M. Hurd, of Johns Hopkins, is inclined to believe that it is due to the new life led by our immigrants, which is exhausting as they are not adjusted to the new strains of the strenuous life. Dr. C. E. Atwood¹⁰ also places the blame on the worries and strains of our over strenuous life, with its irregularities and its deficiencies or excesses of eating, drinking, sleeping and working. He and others also show that overwork alone is not capable of causing neurasthenia since rest and sleep will permit recuperation. Nevertheless it is shown that a nerve cell exhausted by five hours' artificial stimulation does not recover from its changes under twenty-four hours' recuperation, so that Atwood's causes are probably correct. But he wholly omits unsuitable climatic conditions as causes of exhaustion, particularly excessive light.

Dr. A. McLane Hamilton, of New York, describes in an essay ("The Neurotic Conditions of Presenility") the reason for American breakdowns—that is, the quicker deterioration than among Euro-

⁹ Chicago Tribune.

¹⁰ New York Medical Journal, June 13, 1903.

peans. He says it is due to over use of the nervous system in the push of American life, and therefore it wears out soon, but he does not touch on the cause which stimulates the nervous system to over exertion.

Our athletes are more nervous than Europeans, as we would suppose, and excel in all sports requiring quickness, holding all speed records under one-half mile. But for endurance and sports requiring a solid nervous system they are nearly always beaten by Britishers who have never been out of their normal dark environment in our ancestral home. We have always laughed at the stolidity and nerve slowness of the Britisher as something abnormal, but it is normal and our quickness and brightness are the result of instability and a species of neurasthenia due to the more southern climate to which we are unsuited physically.

It is an axiom of American ophthalmic practice, that slight errors of refraction which are wholly ignored in Europe, require careful correction in America because of the nervous condition of the people, who are injuriously affected by tiny errors which are harmless to a normal person. The same thing is being found in American school children, an appalling number of whom require glasses for the relief of irregularities which our ancestors ignored¹¹

At the 1904 meeting of the American Pediatric Association¹² attention was called to the neurasthenia

¹¹ Claiborne, *Journal American Medical Association*, December 10, 1904.

¹² *Boston Medical and Surgical Journal*, November 10, 1904.

so often found in American infants and children from causes which should not produce such profound results if the children were normal. One speaker mentioned the deplorable condition of the "present day native American girl of middle class," declaring her to be "a bundle of nerves incased in a fragile frame," unable to stand much schooling, one in twenty giving up school on account of ill health. He thought she "was the artificial product of advanced civilization." If this is so, the same conditions should be found in Europe where there is the same advanced civilization. But they are not found in Europe, though they are found in New Zealand and Australia in the same latitude as in America. So we must blame the light climate and not the civilization.

It is found that eighty per cent. of the cases of neurasthenia in the Vanderbilt Clinic, and sixty-six per cent. of the insane of New York, are foreign born or of foreign parentage. Even outside of New York City fifty per cent. of the insane are of foreign born parents and thirty per cent. are foreign born themselves, and most of the above cases of neurasthenia are Russian Jews. We are justified in concluding that many, if not the majority, of these are defective before they come to America, like the insane Russian Doukhobors with their peculiar delusions. That is, we are inclined to exaggerate the importance of causative factors of insanity if we do not recognize the defective nature of the immigrants who come here because they are defectives and failures at home. A slight cause, harmful to them, is harmless to the

healthy. The only point we are to recognize, as far as complexion is concerned, is the fact that lack of adjustment to the light is a cause for damage, and the damage decreases with the closeness of the adjustment so as to be practically *nil* in the very dark brunettes in our Northwest who so closely resemble in complexion the native Indian.

Blonds in the South

When we take into consideration the blonds who have in the last two centuries migrated from Europe, north of 50 or 55 degrees of latitude to 30 or 35 degrees in our South, we can well understand why there should be such poor physiques among the men of the South, just as occurred among the conquering Aryan Roman soldiers in a similar migration. The writer was examiner of volunteers in one of our Southern States in 1898 and was astonished at the wretched condition of the candidates for enlistment and experienced great difficulty in filling the regiments, and it could only be done by accepting many men who would have been peremptorily rejected in time of peace.

An officer who was Medical Inspector at Santiago in 1898 and 1899 informed me that he investigated a regiment of immunes at that place which had been raised in our Gulf States, and who presumably should have been able to stand the climate, but they were dreadfully sick, except two companies, and he failed to find the slightest thing in the surroundings of these two well companies different from the surroundings

of sick ones. Their greater resistance was due to the fact that they were stronger Northern men enlisted in Chicago and sent South to fill up the regiment. They were far better for tropical service than the alleged acclimatized immunes from the South.

Even the Japanese have found it impossible to colonize so far south as Formosa, and find it difficult as far north as Yesso, but they flourish in America in latitudes similar to Japan.

The physical deterioration of the poorer classes of our Southern lowlands, who cannot migrate North in the summer, is a very sad and a very prominent fact. Even in as high a latitude as Maryland it is common in every district to find degenerate, decaying or disappearing families, who have lived a sober, upright, temperate, outdoor life in a country environment which we are taught to believe is the normal. If it were normal these families should not be so prone to decay in four or five generations. There is something different from the homeland in Northwestern Europe which causes this decay, because the ancestral families in Europe in identical methods of living do not decay. I have been painfully impressed with the conditions in Maryland and Louisiana, so different from the better health and vigor in the old families of New York and New England. In the South there is quite an amount of the milder grades of degeneration with all its physical and psychical stigmata.

The worst districts in Ireland are the Connemara

Mountains, now said to be threatened with famine and where the poorest and worst specimens of Irishmen are found, but a gentleman who has visited them, and also lived in our Southern States, informed me that in the wretched condition of these Irish there is nothing half as bad as the conditions of the degenerated whites he found in our Southern country districts.

Local Areas of Mental Ability

We have previously mentioned that Havelock Ellis had shown that the blond type had built up British greatness. John Munro, the English anthropologist, also finds that British men of talent belong mainly to the blond type, but there is a strong infusion of the two brunette types—Alpine and Mediterranean. He believes that the extreme blond type of man does not develop so many men of intellect. Lombroso shows that the other extreme, the darkest Mediterranean type in Sardinia and Calabria, produces few men of genius.

In France there seems to be a great increase of intellectuality in the sections where the blonder or Teutonic types live, though there is also a minor increase in the southeastern corner which is markedly Mediterranean in type.

Applying this rule to America we would expect that the sections most fit for blonds would produce more men of talent than the places best fitted for brunettes. This is admirably shown¹⁸ by Gustave

¹⁸ *Century Magazine*, November, 1904.

Michaud. The number of men of talent per one hundred thousand births is greatest in the extreme northeastern corner of the United States, and diminishes towards the south and west, increasing again on the Pacific Coast and being at a minimum in the central elevated plains and plateaux, where brunettes flourish best in the extreme light. Michaud, of course, gives other reasons for the results of his statistics, but he ignores the fact that the climate of New England, though not perfect by any means, is better fitted for the survival of the intellectual race than most of our country.

Yet even in New England, one of the best places for blonds in the United States, there has recently arisen a discussion of the degeneration of the old families as though they were dying out in a manner not found in the more northern home in Europe. In a recent issue of a medical journal a Connecticut physician records attending three obstetric cases in twenty-four hours in which twins were born, and as twinning is notoriously an evidence of nervous instability, there must be many abnormal families in that neighborhood. As it is an exceedingly important matter, it would be well to investigate what types of families—blond or brunette—are showing the most rapid disappearance, if they are really disappearing.

The degeneration of blonds along our whole northern border, particularly in the West, is in marked contrast to the healthy conditions of the brunette French Canadians, whose color approaches that of the "white Indians" native to the northeast. These

French are now flowing south and are already in practical possession of the whole tier of Northern counties, and are slowly percolating south. In New England they are crowding out other types. The blond French have not done so well; whether many have perished is not known, but it is notorious that around the towns of Northern New York there are colonies of low-class French—the slums—full of lazy, worthless, neurasthenic ne'er-do-wells. I have noticed that they are markedly blond and in sharp contrast to the brunette respectable class.

Nervous Conditions in the West

The light of our western and southwestern country is probably the cause of that wonderful exhilaration we experience in the West. "I wouldn't live in Colorado if they gave me the State," says one Washington woman. "There ought to be a sign up on the eastern boundary, 'Abandon all hope of complexion, ye who enter here.' Complexion! Why, there isn't one in the State. You can't put on skin food fast enough to keep from being dried to the bone. The dazzle of light makes you squint till your face looks like a railway map for wrinkles. The climate braces you up till, in your laziest moments, you work like a steam engine. It stimulates you till your nerves are stretched to the highest tension. You walk on air, you talk fast, you fairly bubble with energy, and you think Colorado is the most magnificent climate on earth, till some day a friend comes out from a dull little town in New

England, and after she looks at you she says: 'My dear, how you are aging.' People don't rust out in Colorado, but they wear out, and the complexion is the first thing that goes. They do things in a year in Colorado that would take ten to do in the East, and they show it in their faces. No Colorado for me, thank you. I don't want to grow up and old with the country. I want to stay where things stand still and keep my complexion and my hair and my nerves." Can we not see in this the reason why the white women of Arizona and New Mexico almost invariably break down before they should? They are not pigmented like the native and have a veritable struggle for existence. There is also an impression among those who have studied the matter that neurasthenia results from residence in the Rocky Mountains, and physicians are sending their nervous patients to lower altitudes.

Professor E. G. Dexter, in his work on "Weather Influences," mentions the neurotic condition observed in the residents of Colorado, with the consequent loss of emotional stability, showing itself in the social, political, and economical history of the State. It is a pathological condition though he thinks it a mere increase of nervous tension felt by all except the strongest and most phlegmatic. "It shows itself frequently in mild insomnia or an occasional irritability of disposition, though not in melancholia. . . . The effect on the mental worker is also recognizable. Work is, for the most part, turned off under higher pressure, with the necessary consequence that it gen-

erally cannot be so long maintained without a resulting condition of partial collapse ensuing, which demands a brief sojourn at a lower altitude for its relief. Ministers, teachers, lawyers, and professional men generally feel this especially, and recognize the necessity of longer vacations than were needed by them when working at lower altitudes. The school year is shortened in accordance with this requirement, and even then the mental collapse of both pupil and teacher is usually greater than that felt by them at the conclusion of the longer school year in a more humid climate."

This of course is a good picture of neurasthenia, such as we find results from excessive light all the world over, and though Dexter is much inclined to the view that it is all due to the atmospheric electricity, which is so excessive in these dry climates, yet there is not the slightest proof that these small amounts of electricity have such profound results. He gives the real reason in another remark (p. 139). "The quieting effect of cloudy days for the Denver climate is much more decided (than in New York) and is somewhat surprising to one who has experienced it." Now when we consider that Denver has forty-two per cent. of clear days as compared with New York's twenty-seven per cent., and has only half as many cloudy days, and further consider the excessive amount of the actinic rays which are present in Denver, but which are filtered out by the atmosphere and never reach lower levels, we can well understand that the Denverite is constantly bombarded

by short waves which injure his nervous system; and that to be able to stand the bombardment he should have a complexion as opaque as that evolved by the people in the identical climate of Thibet, and by our Indian who is native to the Rockies. The neurasthenic condition of Denverites is shown by the irritability caused by the winds which they claim are worse than those of New York, though the figures show New York to be twice as windy, and Dexter's statistics show that the winds have a much greater effect in Denver in increasing the number of murders and suicides, and of the misdemeanors of school children. Though mountaineers are more blond than the people in the surrounding plains, yet such blondness, as before explained, fits them for residence in the dark forests and valleys where they live, and unfits them for such light as they encounter in Colorado and similar elevated plateaux.

Europeans take life easily, but Americans under the constant prodding of the more southern climate than that to which they are adjusted, are stimulated from the cradle to the grave, burn the candle at both ends and are less prolific of strong offspring than Europeans. This alone will make room for immigrants for all time, for Northwestern Europe is the real breeding place of the men who have built up Aryan civilizations, though many have migrated and their descendants survived for a while.

There is a curious tendency of Americans to go back to Great Britain for permanent residence when they can, and they do so by reason of that increased

feeling of comfort and well-being in these darker regions of the north. Yet there is another curious fact which seems also paradoxical. People who go from the United States to the British Islands experience a greater vigor. They soon think nothing of walking ten or twelve miles a day, like the native, something they cannot do at home because of the lassitude which follows the stimulus. We can do a sprint, but do not like continued exertion, and this is the condition of undue stimulation.

It is perfectly evident now why New Mexico and Arizona have been so long unfit for statehood, the people being mostly of lower races adjusted to the climate but now ruled by Aryan types from the north, constantly dying out, and constantly renewed, as in Egypt. There are some that assert that these two territories by these climatic conditions will never be fit for statehood, and if it is conferred on them there will be a government grow up similar to the Latin republics further south in which neither life nor property will be safe.

Present Brunette Flow to America

We can now also understand why there is such a flood of brunettes from Europe and Asia. They are continuing the westward movement which was begun about ten or twelve thousand years ago, which was interrupted until recently when the way became open by cheap transportation. But they never go out of their zone. Armenians, Slavs, Greeks, Huns, Serbians, and Bulgarians flock to America to live in the

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same latitude as at home. No wonder they flourish, whereas the blond Aryans are too far south in Boston or New York and tend to deteriorate. There are cities and other localities in Poland and Central Europe which are more than half Jewish, and these men are filling up New York, which is almost perfectly suited to them.

Negroes in America

{ Too little light, on the other hand, is probably one cause for the increase of degeneration (dementia, imbecility, idiocy, crime, pauperism, and infections) among the negroes. But it is slow in action for our negro was here some centuries before his troubles began and these are mostly due to the privations and unhygienic living from his unfitness for the struggle for existence in freedom. He was well when a slave because cared for like a horse or ox.

As we have more literature on the negro than on any other topic it will be wise to enlarge a little on this point. It is a noteworthy thing that the negro soldiers who went to the Philippines found themselves so much more comfortable than at home that large numbers of them preferred to stay where their black pigmented armor was an advantage. It was curious also to see the intense blackness of these negroes, the blacker the more comfortable they were, so that the majority of the colored teamsters, colored servants, saloon keepers, and loafers were jet black. The mulattoes did not seem to like it as well and fewer stayed over.

We have mentioned open nostrils as offering no protection in the way of warming the air entering the lungs. This, with the loss of heat from a black skin, and their unsanitary crowding for warmth, is responsible for the awful increased mortality from consumption in twenty years.¹⁴ It is said that nearly all pardons of negro criminals are due to consumption, though this is also an affliction of white criminals. Their death rate from this and other causes has increased from 24 per 1000 in Charleston, S. C., in 1822 to about 45 per 1000, some say 50 per 1000, in some cities, and it is now more than double the white rate, whereas in slavery it was less than the white rate. *

Insurance companies refuse them as the risk is too great. "Dirt, disease, and the devil" are given as the cause, but this is merely the result of putting savages in a civilized environment—they are savages still—only they talk English and many can read and write. Civilized negroes can only arise in millenniums, in the same way we arose, by the brutal method of killing off the stupid of each generation. Their annual birth rate is now slightly more than that of whites, 26 to 22 per 1000, and they must decrease relatively.] They should have numbered 26,000,000 now instead of 9,000,000, their increase in the ten years ending in 1900 is said to have been 12.24 per cent., the white increase being 23.91 per cent. Their median age (average of all living) is 19.4, while that of whites is 23.4.

¹⁴ Philadelphia Medical Journal, August 25, 1899.

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Wm. Hannibal Thomas, himself a negro, writes that the negro is still a savage, unfit for civilization—that is, unfit to carry it on.¹⁵ Dr. Curry, late Minister to Spain, and P. B. Barringer, Chairman of the Board of Trustees, University of Virginia, are both said to have declared that the higher education of the negro is impossible as they have not the brain. Dr. Searle Harris¹⁶ shows the continual decadence of our negroes, and Dr. A. B. Richardson, Washington, D. C., Superintendent of the Government Hospital for the Insane, stated that the superintendents of Southern asylums are unanimous in stating that negro insanity has increased since the war and is constantly increasing.

The extinction of blonds in Northern Spain and Northern Italy was a very slow process as they persist now after many centuries, though permanence is not conceivable, as that climate evolved a brunette type. Hence we can readily see that in the northern half of the United States, north of 40 degrees, in the hill country, blonds will also survive very many centuries, but permanence at lower levels is as inconceivable as in the case of the hordes which have melted away in both Spain and Italy in historic times. Our plains must always be brunette like the plains of Siberia.

As both negroes and blonds have survived many generations already in the United States the decay is so gradual, and extinction is so far off, that we need not worry over the matter in the least. It will do

¹⁵ "The American Negroes." Macmillan.

¹⁶ American Medicine, September 7, 1901.

no harm if the present blonds do die out in a few centuries, for they will be replaced by others. The stream from Europe will be continuous just as it is continuous from the Continent into England, which has never suffered in the least from its slight lack of adjustment for blonds. Indeed we may learn how to avoid the dangers, and be just as fitted to resist the light, though blond, as we are able to resist the cold, though hairless. The negro, on the other hand, in spite of a present numerical increase must deteriorate and disappear, as he always has in Egypt, for there is no stream of immigrants from Africa to replace the families becoming extinct.

Blonds in the Extreme Northwest

There is one part of the United States which has almost the same dark, cold conditions of our original Aryan home near the Baltic. I refer to the northwestern corner, on the Pacific and in the mountains, and to southwestern Alaska. There are cool to cold winters, short cool summers, plenty of rain, and "God's sunshine" appears on an average of one day each week, some places having but fifty days per year. According to the present theory the people here should be very badly off, yet they are absurdly healthy, and as for the children, they almost burst with rugged health. They should thank God that they are protected from His sunshine. There is a remarkable similarity of this climate to that of Ireland, where blonds have flourished for many thousands of years.

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The people are so extremely comfortable in these fogs and rains that it is quite common to hear expressions of great admiration for the climate. They do not know why it is but there is no doubt that it is due to the relief from the painful glare of the sun found in other parts of the United States. Indeed old residents in these dark, rainy cities often remark that they are not so comfortable on the bright, sunny days as on the others. People who have made extended visits on business not infrequently go back for permanent residence, in the same manner and for the same reason that they return to the British Isles, rather than stay in the United States.

It is a curious commentary on our ignorance of climatology, that the people of Tacoma, Seattle, and all this region, attribute their exuberant health, small sick rate, and small death rate, to all sorts of causes except the right one—protection from sunshine. They claim that the only drawbacks to the magnificent climate are the rains and numerous cloudy days. If they could have all the sunshine they wanted they would be as badly off as Eastern cities. It is a notorious belief in Seattle that people are more sickly in the short sunshiny season than in the rainy season, and they are also more uncomfortable—even suffering. Now they should know the reason.

As an exception to the rule for the rest of the United States, there is an actual increased number of blonds in the cold, dark northwestern part. The cities of Seattle, Tacoma, and Portland are fairly bristling with brilliant blonds, with complexions

which the Eastern people envy. It is a country almost as well suited for blonds as the original home in Europe. Unfortunately it is not cold enough, and whether they will ultimately survive is not known, but from their present condition of robust health they probably will survive longer than the blonds of New England.

Weather Charts

The Weather Bureau chart of average cloudiness is not a correct estimate of the light because there may be many clouds yet strong sunshine. Yet the total amount of cloudiness is of some use for it shows, in a general way, the shelter given from the sun. This chart is for 1898 and shows the least cloudiness in the central and southwestern parts of the United States, more along the coast, but the greatest amounts are in the extreme Northeast and Northwest, just where we know there are the best climates for the blonds.

There are no data by means of which we can form the slightest idea of the relationship between mortality (or morbidity) and the amount of sunshine. The percentage of sunshine does not give the actinic power. For instance, a place may have most of its sunshine in the winter when the rays are feeble and another place have the same percentage of possible sunshine, but most of the sunny days in the summer, and therefore much stronger actinically. Then again fifty per cent. of possible sunshine in the north at any season would not give nearly the same actinic effect

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as an equal percentage of sunshine in the same season further south. All the statistics thus far published have very little utility.

What is needed is a table showing the relative amount of actinic power in the various localities. This could be accomplished by any photographic registering apparatus exposed to the direct rays from sunrise to sunset, the amount of change of color in the moving ribbon would then give the amount of sunshine every hour, calculated from any given standard. We would then find out that such a place as Seattle would have far less sun's rays than New Orleans. At present Seattle is recorded as having sunshine (in 1902) forty-four per cent. of its possible, while New Orleans has fifty-three per cent. of the possible, each place having the sun above the horizon six months in the year but clouded over more hours in Seattle than in New Orleans. Even this record would not be perfect, because nature guards against the greatest damage at any one period. Thus the Eskimo has six months' sunshine, and in the summer the rays are not so strong as further south, so that the machine would record less than in Maine, but he has to be protected from the awful glare from the snow, so that brunetteness is necessary even though the danger does not last long.

Maps of atmospheric humidity correspond fairly well with maps of cloudiness, and show in a general way the relative darkness by the law that dry places are cloudless and light. Yet such maps are worthless for our purpose unless we compare places of

equal latitude like the humid northwestern corner of Europe with its blonds, and the dry steppes of Siberia with its brunettes. But if we would compare humid Ireland with an equally humid tropical climate, we do not get equal amounts of light by any means. So these maps must be interpreted like the maps of cloudiness.

Less Mortality in Cloudy Regions

Then there are no records of the amount of sickness in any given place—the Census Bureau has no data, nor any other bureau. The mortality statistics of the census are very meager and confined mostly to our northeastern section. The mortality statistics of the Public Health and Marine Hospital service unfortunately are not given for the same places as the sunshine statistics of the Weather Bureau. It would be far better if they could give statistics for the same places.

Nevertheless the mortality statistics so far collected do show the greatest mortality in the southeastern part of the United States, averaging about 20 per 1000, including large and small cities, but no rural districts. The mortality gradually diminishes as we go north, averaging about 18 to 19 in the Middle States, 16 to 17 in New England, 14 to 15 south of the lakes, 12 to 13 in the eastern plains, 9 and 10 in the western plains, and are nearly the lowest in the northwestern corner—Oregon and Washington.

Thus, generally speaking, the death rate decreases from Florida to the Island of Vancouver. It is not

strange then to see the healthiest record in the rainiest places with the least sunshine. Seattle had only 8.12 deaths per 1000 with 44 per cent. of sunshine.

The chart of annual sunshine for the United States in Bartholomew's Atlas of Meteorology also gives us this deduction: Omitting the southwest portion where the mass of the people are adjusted to the light, the general trend of the statistics shows that *the death rate of a place is proportional to its sunshine and inversely proportional to its latitude—other factors being eliminated.*

There are so many elements which vary the mortality of a city that it is practically impossible to say how much is due to the presence or lack of sunshine, but the only thing we are certain about is this, that sunshine is not necessary in order that a place may be healthy for blonds, and that Tacoma, Seattle, and Portland have as low rates or lower than any city of their size in the United States, or perhaps of the whole world, in spite of many cloudy days. This is rather emphasized by the other remarkable fact, that in the elevated arid regions where there is a very great amount of sunshine, Nevada, Wyoming, Colorado, Idaho, California Valley cities, and Oklahoma, there are much greater mortality rates than in the Northwest or further East. The rates in Arizona and New Mexico are very low, probably due to the complexion of the natives so many of whom are brunette Mexicans, and the further fact that there are no large cities to increase the average rates.

All these statistics of mortality in relation to pig-

mentation will have to be taken up by the Census Bureau. If there is anything in it at all the people have a right to know, so as to protect themselves by proper habitations, clothing, etc. For instance, there should be city ordinances compelling each householder to keep shade trees before each house to lessen the glare from pavements and walls, if we could prove by the census that this would save health and life. Anthropology has been too long neglected in the United States, and we have no better means of finding out what is the best place to live in for each type of man than census statistics of the pigmentation of the people and the relative mortality of blonds and brunettes in each county and city.

In the Adirondacks the number of clear days is small, the number of cloudy days is excessive, and the number of partly cloudy days is below the general average. In spite of this reduction of light this region is remarkably healthy and suited for blonds. Attention has recently been called to similar conditions in the Green Mountains of Vermont, which, in spite of cloudiness, cold and long winters, is one of the healthiest places in the United States, and these two areas have been the birthplace of some of our best Americans, nevertheless they are not as suited for blonds as our extreme northwest corner.

Need of Shade Trees

There is another point which is now cleared up. In a prior chapter we stated the evidence that short waves are much more harmful to a developing organ-

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ism than to the adult. Hence men who are raised on the farm and migrate to the city are able to resist the extra light except for the more or less neurasthenia produced thereby, but their children are markedly affected. They are feebler, more nervous, and shorter lived than their cousins on the farm which was the paternal home. We all know too many illustrations.

The present orthodox view held by the vast majority of physicians is best expressed by Dr. George M. Sternberg in an article on Hygiene in *Youth's Companion* for March, 1903. "Sunshine is one of our best disinfecting agents. Disease germs retain their vitality a long time in dark and damp places, but, as a rule, are quickly killed by the germicidal and drying effects of direct exposure to the sun's rays. . . . God's sunshine is essential to the life and well-being of all living things, except the very lowest such as fungi and earthworms. . . . It is better to cut down the beautiful old trees which have, perhaps, sheltered the home for many years, and are associated with it in the affections of the present and absent members of the family, than to allow the inmates of the farmhouse to grow pale and feeble for want of God's sunshine." I am quite sure that the pendulum will swing to the opposite when we recognize the similarity if not identity of all protoplasm; and if light will injure or destroy that of the bacterium, an equal amount will injure or destroy that of human cells. For the blonds living in treeless parts of our country it is particularly necessary to plant more and more

trees to imitate the ancestral conditions which caused the evolution of blondness, so that they can avoid those deteriorations which we have shown are occurring among our immigrants.

City life being suited only for those dark, swarthy people who have been city dwellers since the days of Chaldea, it is public policy to make it better suited to the lighter brunettes who must live there, and it is also possible to shield the unsuited blonds more than we do. Wide streets and plenty of shade trees are the two necessary conditions, with here and there a park full of large trees, for we must have more shade. Even the Oriental cities have awnings completely over every street. European cities are waking up to the necessity and are widening the streets, planting trees, and here and there buying up a block of houses for a park. All these are necessary. If they would dare to close the parks of London there would be riots and perhaps worse. But look at us—the richest nation and yet niggardly. Philadelphia's greatest crime to itself was the location of its municipal building on its Central City Park, and the people of Washington have lost two necessary parks for the Carnegie Library and Pension Building. It is a great blow to the city dwellers, particularly the blonds in them, to obliterate their parks and destroy their shade trees. Every park established in the city means some family preserved; every tree planted is probably a baby's life saved. Instead of such deadly expensive economy as closing a park it would be cheaper—and save lives—to buy up blocks of houses

here and there to make new parks for the poor babies which never see a tree. This is the plan now being executed in all progressive cities and it is money well spent.

Present Evolution

The *Army and Navy Journal*, April 8, 1899, calls attention to an article in the *Independent*, by Alfred Wallace, who shows the well-known fact that white men can be healthy in the tropics by avoiding causes of disease. But when he goes a step further and states that men can colonize there permanently and continue the race he is stating that for which there is no proof in fact or theory, and against which all theory and facts are pointed.¹⁷

Dr. George B. Groff¹⁸ published an article on "The Conquest of the Tropics," claiming that white men, native to the north, can live and breed in the tropics. His article of six pages contains more erroneous statements than any article of its kind in existence—such mistakes as: "The climate in Cuba and Porto Rico—and the same is claimed for the Philippines—is equal to any in the States south of the Carolinas." He forgets that Panama and the Philippines are in the same latitude and have identical climates.

Nothing could be clearer than that residence in any climate is made safe by skin pigmentation in accordance with the amount of sunlight, and this proves the impossibility of colonizing out of our

¹⁷ *New York Medical Journal*, April 15, 1899.

¹⁸ *Popular Science Monthly*, September, 1900.

proper zone. Brown and black people who now live in light tropical countries will always live there. We cannot exterminate them. Mr. Michael A. Lane has written a book¹⁹ the sole purpose of which is to prove false the theory that "through the force of progress itself these (lower) races must be totally eliminated from the earth." On the contrary they are indestructible but will be used forever by white men, to their mutual benefit, not as slaves, or serfs, or domestic animals, but as junior partners with little voice in the management of the firm.

Man is undergoing a very effective selection now as always, and there is a constant change to fit him to gradual changes in environment or eliminate the type wholly unfit. There is an opinion, here and there, in scientific literature, that owing to his intelligence, man is able to escape the law of selection, and it no doubt arises in the minds of those who think that, as we are able to escape immediate death when we go to the tropics, we can safely defy nature. The facts presented above are sufficient to prove that, as an animal, man is just as much under the laws of evolution now as he ever has been, and can never hope to escape natural law.

What has deceived us so greatly about the climate of the United States, is the low temperature as compared with equal latitudes in Europe. Southern Pennsylvania, for instance, is much colder than Southern Spain, which has the same latitude. Hence when blonds migrated to Pennsylvania they did not feel

¹⁹ "The Level of Social Motion."

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that they were so much out of their zone as those who migrated to Spain, but the light is about the same in each case and the deterioration of blonds is the same. It is not an Aryan climate and is fit only for Spaniards, Japanese, and Indians of swarthy skin and pigmented eyes and hair. Likewise the cool winters of Florida hide from us the fact that as far as light is concerned it is the same as Nubia; but as we have nerves for heat sensation and none for light, in its effect on the body, we think that Florida is about of the same climate as France.

Future Results of Evolution

Should the blond types from Northern Europe die out in America, as they did in Italy, our republic and our civilization would of course degenerate into the condition of the Roman state and civilization when it fell into the hands of the lower types. These lower Mediterranean races are flocking to the United States, and will survive of course, but it is quite likely that the Northern types will survive in sufficient numbers to prevent the destruction of our republic, though of course a perfect democracy is out of the question now and forever. The general trend of thought in America is to restrict the franchise to those who can use it properly no matter what their origin or complexion, and this probably will be the salvation of our government in the future, when our higher types begin to die out. But the form of government will necessarily change and become much more of an aristocratic democracy, if we can use such a combina-

tion of terms. That is, we have never permitted lower types—American Indians and Chinese—to take a share of the sovereignty purchased with the blood of Aryans, and, except for a brief period after the Civil War, we have behaved exactly as our older brethren did when they conquered Greece and established aristocratic democracies. But since there are so many high grade variations among the brunette races, and an increasing number of blonds of low intelligence, the whole trend of events is to make the American commonwealth a democracy not limited by race, but limited to an aristocracy of intelligence. It is interesting, thus, to see how far-reaching will be the effects of excessive light upon unprotected skins.

For instance, take the matter of tuberculosis. Until a few centuries ago population was so sparse that infection could be avoided, and many susceptible people lived to old age. The crowding of modern cities, beginning but sixty or eighty years ago, makes it practically impossible to escape the bacilli so lavishly expectorated in the streets. Hence the susceptible are sure to be infected and succumb. It is estimated from present mortality rates that ten millions of the people now living in the United States are doomed to die of tuberculosis. This is a tremendous selection by destruction of the unfit, and it will not take many centuries of such destruction to evolve a surviving fittest race to whom tuberculosis will be a trivial infection. Indeed this evolution has already gone to a great extent among the Jews who have been under the selection longer, and even among

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other races there is already a partial immunity, for there is quite a large percentage of those who have died of other things, in whom we find, on post-mortem, the healed lesions of an old infection. Some pathologists state that nearly every one shows a healed infection, though others deny this. The Jews, on the other hand, by the bacteriocidal power of their blood, destroy the bacilli they breathe, which therefore do not survive a lodgment in the lungs.

Likewise in the matter of complexion there is a tremendous selection now going on, weeding out the blonds who have wandered far from their zones. Particularly are the blond families of the cities dying out, so that cities have always been known to be more brunette than surrounding districts, in spite of a constant stream of blonds into the cities. They are not being changed into brunettes, or darkened, but are being killed off. The population is becoming brunette by the usual natural process of survival of the fittest. If the city reader will only stop and think, he will at once recall blond city families of his acquaintance which are perishing through infantile mortality, and though the surviving adults appear to be healthy he will notice that as a rule they are markedly more neurotic than brunettes. It is quite evident why cities have always been called "consumers of population." It is natural selection, which is just as powerfully weeding out those of us who are unfit for this environment as it weeded out the stupid and unfit when brains were increasing and anthropoid races were being changed to manlike

races, and just as it weeded out the brunettes in that unknown area in the Baltic region where the blonds were the fittest for survival for so many thousands of years.

Possible Protection and Survival

The only thing we can hope for is to delay this destruction of the blonds now going on, because it is too much to expect us to stop it entirely. By carefully avoiding the causes we can no doubt reduce the mortality so that the disappearance will be as gradual as it was in Central France. We have survived in cold countries for many ages by means of the artificial protection of clothing. In time, therefore, we may be able, by artificial protection from light, to survive permanently in light countries where the natives have evolved brunetness, but if we do not protect ourselves we will surely perish as the blonds perished in Greece and Rome and Africa. Hence the practical rules for white men in the tropics apply in a modified way to blonds in the United States, for they are as far from their normal northern home as were the blond Homeric Greeks. So this enquiry really touches every American of the blond stocks.

We have given proof that blonds have survived among the aristocracy of Central Europe since pre-history. Perhaps lines have died out here and there, and healthy newcomers from the north have married into decadent families to keep them alive, but the main fact is undoubted that these blonds have survived for many years though they are slightly out of

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their zones. The reason is self-evident—they have been able to care for themselves in a manner impossible among the peasantry. If the blond aristocrats had been compelled to till the soil and expose themselves to the climate it is not at all unlikely that they would have perished.

Therein lies our hope in America. If we can find out the factors of the climate that are destroying us, we may be able, by avoiding them, to survive many generations, like the well-protected nobility of Europe. But if we expose ourselves to the adverse climatic conditions our lines will die out in the same way as the blond soldiers with whom the ancestors of the blond aristocrats conquered their way to southern lordly positions. Likewise, much greater departures from our zones, such as white migrations to the tropics, could be made harmlessly, if we knew all the fatal factors and could avoid them.

Urban Migratory Types

In American cities a great class of people are becoming adjusted to the environment like migratory birds, which fly north as soon as the light and heat are too great. So these blond people flock out of our cities every spring to return in the fall. Statistics show that there is a constantly increasing percentage of our people who have summer rural homes and winter urban homes where they make the money to live on. There is also a constantly increasing percentage of people who can in other ways escape from the city in summer time. Therefore the blond types

of our cities are bound to survive a much greater number of generations than if they remained all the year round in an environment fit only for brunettes. Perhaps this new migratory life may enable them to survive permanently as in the case of birds. Modern rapid transit is thus actually tending to preserve the blond city types, which in former ages were killed off.

Relative Vitality of Blonds and Brunettes

It is quite evident that there is absolutely no truth in the assertions so frequently found in current literature ²⁰ that there is some indication that brunettes are possessed of a superior vitality as compared with blonds. The pigmentation is solely to exclude a danger and those possessing it must of necessity have more strength and vitality than blonds in that locality, but in a darker place where the pigment is not needed the blonds are just as strong and vital as proved by the low mortality and superior strength of Scandinavians, Finns and Danes in their native lands respectively. It is regrettable that we have no statistics of the relative vitality of peoples of various complexions in America.

From the biological law that every climate on earth is an excellent climate for the types physically adjusted to it and a bad climate for all others, we can safely predict that American morbidity and mortality rates will be found to increase in any one type the further it is found from its ancestral climate. In

²⁰ See Ripley's "Races of Europe."

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any one locality, the rates will be least among those best adjusted to the environment.

From the known facts of the disappearance of blonds who have migrated into countries which are too light for them, it has been erroneously concluded that they are disappearing from all parts of the earth. They cannot disappear from the dark, cold countries to which they are adjusted, and they must persist as long as the conditions which evolved blondness. Only when changes of climate render the present dark countries much lighter, could the blonds disappear from them, and by that time other countries, now light ones, will become dark and thus become the new homes and breeding places of blonds. The type will probably be permanent. There is no cause for alarm.

We can state the proposition of blondness in a rather figurative way as follows: The northwestern corner of Europe in glacial times was covered by great masses of ice which flowed out as glaciers to be melted by the long rays of the sun,—westward into the Atlantic Ocean, southward into Europe, and eastward into Russia; when the ice disappeared after the glacial period, man flowed into the same area and became blond and brainy and began to flow out just like the glaciers to be melted away by the short rays of the sun, westward over the Atlantic, southward into Europe and eastward into Russia. This never-ceasing current of men doomed to extinction, constantly keeps the rest of the world tintured with blondness, and will continue as long as the present physical conditions continue, and just as the ice cur-

rents continued as long as glacial physical conditions continued.

The Permanent Semitic Invasion of America

We must return for a moment to that great Semitic stream from the Mediterranean to India, overflowing to the East Indies. There is a well-founded suspicion that it also flowed through Turkestan, Thibet and into China, tincturing all that part of the world with long-headed types. Nestorian Christian missionaries, who were Semitic types, reached China over fifteen centuries ago, after they were driven out of the early Church as heretics. Buddhist priests percolated through Japan about fourteen centuries ago though perhaps not in sufficient numbers to account for the remarkable long-headedness seen now and then in Japan. Still I have seen many Japanese priests who, if appropriately clothed, would pass for Mediterranean Friars. There was a great trade route over which all these types went back and forth to the Chinese Empire. We cannot doubt that this stream has existed for several thousand years and has left survivors in the present populations, for the climate is suited to them.

The Semites, throughout this whole belt, have been able to evolve and sustain the same grade of civilization. From the Pillars of Hercules to Farther India, therefore, we find civilizations of equal grade both before and after the Aryan conquests, but they cannot support Aryan civilizations. There is no Mediterranean nation which can do without

ideas from the north, without which they would all sink to what the British found in India.

The important point, as far as climatic zones are concerned, is the fact that nearly all the territory of the United States lies within the Semitic belt. The Semitic flow has been completely reversed and is now westward across the Atlantic, and it began when we declared that all men were equal and when we opened the flood gates to our present sorrow. It does not require inspiration to prophesy that this type will outlive the blond Aryans eventually, that the aristocratic democracy now being evolved will fall into its tender mercies, as in Greece, Rome and India—providing of course the blond immigration is not re-established.

No great disasters need be anticipated, for the course of history only shows that American destinies and civilization will be upheld from the northwestern corner of Europe, just as that corner is upholding the civilization of the rest of the Semitic belt. Americans will be just as contented and happy as now and we need not worry about posterity—not in the least. Egyptians appear to be happier than they ever were when they were independent of northern control. But that is all a long, long way ahead. Perhaps by that time there will be an "International Nation" to keep us in order. In the same manner we should police the poor nations south of us, struggling with a government unfit for them, and no one allowed to help them—indeed killed by the Monroe Doctrine. How we have abandoned them to their unhappy fate!

CHAPTER XIII

PRACTICAL RULES FOR WHITE MEN IN THE TROPICS

Acclimatization is Impossible

IN all works on tropical hygiene we find among the practical rules references here and there to acclimatization, advising newcomers to be very guarded until they become acclimated. These errors follow from the old idea that as man was found in every part of the earth which could supply him food, and as he had travelled into every land and sea, it was possible to become acclimated. The data already presented show that, in regard to pigmentation, acclimatization is impossible if one goes far from his zone, and, when we apply the same reasoning to every other character which has been developed for one particular zone, we can understand the reason for the anthropological and biological law that every living thing must remain in its zone to survive permanently, and that if it is taken out of its zone it must be surrounded by artificial conditions which approximate its natural environment, or must hide from the dangers against which it has no natural defense. We have clear explanations of the ethnic law that "intrusive conquest or colonization has left little or no trace," and there is no difficulty in

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understanding the facts presented by Dumont,¹ de Lapouge,² Leclerc, Isaac Taylor, Wm. Ripley, and others who have shown that acclimatization has heretofore been impossible—but have not given the reasons. Fuller details are given in my own article in the *Philadelphia Medical Journal* of April 7, 1900, with numerous quoted examples of the disappearance of migrant races, which will supplement the long list we have given as to the blond races which alone are considered in this inquiry.

Throughout Manson's "Tropical Diseases" there are numerous facts showing that the longer a white man resides in the tropics the more he is subject to certain diseases, though he thinks there is an acquired immunity to typhoid and heatstroke, the latter being due to greater knowledge and care. Firket, Cruikshank and many others have shown that prolonged residence does not increase immunity to certain affections but actually increases our susceptibility (malaria and dysentery). To give even a synopsis of similar papers would be tiresome repetition.

We have given enough to prove that, being physically unprovided with natural defenses, and being unable to become acclimatized, the practical rules to avoid disease and destruction of health are merely methods of hiding from the known dangers or warding them off.

The past experience of white troops in the tropics has been a very dreadful one from the awful mor-

¹ "Dépopulation et Civilisation."

² "La Vie et la Mort des Nations."

tality. But in the last fifty years sanitarians have gradually discovered the causes, one by one, and formulated rules for avoidance of them. Most of the past mortality was due to infections by the water and food, and modern methods of sanitation have so reduced mortality and morbidity as to render service in India but little more dangerous to life than it is at home. Nevertheless there is more or less destruction of health even when we do manage to dodge the infections.

With regard to statements now and then made in medical literature that a tropical climate *per se* is harmless to white men, who can live there for an indefinite period and enjoy good health, we can only say that such writers are wholly mistaken and will change their views after they learn a little more of biology and the facts in the case.

Since the neurasthenic states are due to excessive metabolism caused by light it is possible to formulate rules for the avoidance of this loss of vitality. We may thus escape some of the ill results of physical unfitness, though we cannot hope ever to be able to colonize there.

Opaque Clothing

Day clothing should be opaque and for this purpose color is immaterial if it does not transmit the shorter light waves and the ultra-violet. The outer clothing should be of a color to reflect as much heat as possible also. It has been said that the long, dark rays (infra-red) are absorbed equally by all colors

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and this is probably correct, but taking the whole spectrum into account the Aldershot experiments show that heat is absorbed in the following order—black, pink, yellow, gray, and white. Hence the outer day clothing should be white, gray, or yellow—that is, if the wearer is to be exposed to the direct rays of the sun, like a white-robed, dark-skinned Arab. But white clothing freely transmits the light waves, and is not only dangerous to the nervous system of white men, but this transmitted light has been blamed for much of the skin disease of the blonds. The underclothing therefore should be opaque, and black is the best color, though yellow will do. This combination of black underclothing and white outer garments for the day imitates certain animals which have white hair and black skin. It reflects most of the heat and light and allows few actinic rays to penetrate, and experience proves the combination to be very comfortable. A black negro dressed in white is about as happy and as contented a being as we have in the Philippines.

We must remember that in the temperate zones we wear opaque clothing and exclude very much of the light, but the constant tendency of tropical residents is to wear clothes which do not give the proper amount of protection even for the amount of light we have at 45 to 50 degrees of north latitude.

For evenings, opacity and reflection of heat are immaterial. Since all colors absorb the dark rays equally it is solely a question of radiation of body heat, and for this purpose black is the best, as in

the case of black nocturnal tropical animals. Experience is also to this effect and it explains that wonderful tendency to wear black clothes which we see in so many hot countries. They are actually cooler than white garments of equal weight.

For office workers and others not exposed to the direct sun's rays, and who therefore do not need white, experience also shows that black or dark blue is the cooler color. Even the Manila policemen found the blue clothes much more comfortable than the white or yellow when they could seek the shade. In the sun of course the blue became quite warm, even intolerable. Unfortunately we do not know whether the blue and black clothes exclude the shortest ultra-violet rays, the most harmful ones, but we believe that, though a few get through, most of them are stopped. Hence, even with the best of protection, one should avoid as much as possible the direct rays between 8 A. M. and 4 P. M.

Our soldiers when hiking took to the thick blue flannel shirt like a duck to water. It proved its excellence and the universal verdict was that it was the most comfortable. It excluded light rays by "stepping them down" to heat rays, but did not transmit heat like a thin garment would, indeed it kept the sun's heat from the skin. On cool nights it was a protection and on hot nights it was cooler than a light color. So it is not at all likely that a khaki flannel shirt will be better, except perhaps at midday, and even this is not certain.

Von Schmaedel and other writers have repeatedly

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called attention to the necessity for opaque clothing for day use in the tropics, and these rules therefore contain nothing new, but the advice has been neglected too long, and it must now be acted on.

Opaque Headgear

The hat must be of wide brim and thick enough to exclude all the rays, for those penetrating the skull are the most dangerous—even a few minutes' exposure bareheaded to tropic rays has been known to be fatal in India. It has even been proposed to make assurance doubly sure and line the helmet with tinfoil which is certainly opaque to all sun's rays. It is surprising how transparent the scalp and skull are to light rays, and we can rest assured that in the tropics, or when concentrated, the shorter ultra-violet pass right through them.

The evolution of the head hair has been explained, and we find it profuse and black in all light countries and even kinky in the negroid races. I doubt the wisdom therefore of cutting the hair very short and removing nature's protection. I have seen scalp diseases promptly follow shingling the hair, and no doubt due to the light. Bald men, by the way, run greater risk in the tropics, and therefore must be doubly careful.

Our campaign hat is the survival of the fittest for campaigns and is being taken up in Europe for temperate climates. But it is too heavy and hot. It is a blunder to compel soldiers to wear it in the tropics except in the field. The only proper headgear for

garrison is the big opaque helmet of white or khaki color—bigger, thicker, and better than the old helmet recently abolished. The most dangerous thing to wear in the sun is our white or khaki cap. It is almost as bad as none, and should be forbidden in the daytime or at least between 8 A. M. and 4 P. M., except for those who are not exposed to direct rays.

American women have taken up a fashion of doing without hat or sunshade and are seen in the streets daily without such protection. It is a dangerous practice and must account for much of their neurasthenia. It is particularly dreadful to permit children to go bareheaded in the sun, with little clothing, and it is surprising that they do not break down in larger numbers.

It is not a soldierly act for a British officer to take to cover in battle, but it became soldierly in the Boer war all the same. Likewise it is not a soldierly act to carry an umbrella in our army at home, but in the tropics many things are necessary which are not necessary elsewhere. Hence an umbrella should be carried by every one not on duty with troops. It should be on the same plane of toleration as the blue cape at home, and I am sure it would prevent much sickness.

Darkened Houses Needed

The Spaniards who lived in the Philippines did not appreciate the dangers of light because they were brunettes and they made but little provision in their homes to escape the dangers. Blond Teutons in

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India, on the other hand, see the necessity for this protection and build great covered porches around their houses for this express purpose. As far as I have learned Americans are falling into Spanish ways and making no provision to protect themselves from the fatal rays of light. American houses must have big verandas whose roofs come well down. It is safe to say that there is not a residence house in the Philippine Islands fit for a blond man to live in. I challenge contradiction of this violent statement.

The roof of a porch or veranda must come down so low that a person seated in the room cannot see the sky; that is, the lower edge must be about four feet above the floor line, or appropriate screens be built to that level.

I have particularly noticed the neurasthenic headaches, malaise, and neuralgias of blonde women exposed to the glare of the shell windows. They are immersed in a stimulating and exhausting "light bath" such as is now part of the equipment of every modern hospital. In three cases I obtained complete relief from the distress by directing the construction of opaque awnings of bamboo or nipa. Canvas will not do and corrugated iron is too hot, for it is as unsafe as sitting under a cook stove. Our depot quartermaster had to hang tarpaulins to shield the clerks from these dark rays radiated down from an iron roof, so that a ceiling, as a shield, is necessary under the iron and at sufficient distance to allow a strong circulation of air to carry off as much of the heat as possible.

I have heard but one person say that sunlight should beat on our tropical houses, and she limited it to a little on one side to dry out the house. She knew of one man who suffered from rheumatism in a damp house in Luzon and she believed it due to the dense shade cast by trees. That is not necessarily correct, for dampness is not necessarily due to shade and I have seen well-lighted houses damp and have seen rheumatism in houses which were not damp.

It is simply astounding that we did not find out exactly what kind of houses had been found best in those parts of India and Java having climates similar to that of the Philippines, and then imitated them or improved on them. The matter has been pretty well threshed out in the past two centuries, and the wooden barracks I personally inspected in Singapore, though built in the simplest and cheapest way, were cooler, darker, and better than any we are putting up in Luzon. Americans are a queer lot! The civilians are worse than the military for the private houses put up in Manila, though suitable as summer cottages in the Adirondacks, are hot, glaring and atrociously bad in the tropics. No wonder the occupants break down and go home in greater numbers than the Dutch or British who live in dark houses.

At one place I have in mind I have no hesitation in asserting that on account of the destruction of health sure to occur to the future occupants it will be cheaper for the owner to burn down the expensive buildings recently erected, extreme as this assertion appears.

The glare from white houses is very harmful. I have seen marked suffering in army posts, before we abandoned the dangerous practice of painting everything white, and resorted to the colors found in nature to which our eyes are adjusted—the greens, dark yellows, and browns. It is matter of common knowledge that in a city the glare from white houses is a great nuisance to the neighbors, and has been known to cause serious eye diseases. Hence no white houses should be permitted in cities; the red color from the brick is bad enough, but the best colors are those above mentioned. In the tropics these rules are doubly important for the glare from the whitened walls is dreadful.

In addition white lead is known to absorb the infra-red rays as well as lampblack, and consequently it is a "warm" paint in the sunshine and will cause a tropical house to heat up.

The mania for building houses and schools so that an injurious amount of light should stream in is really a recent affair. Our grandparents knew better. We can all remember the extreme care with which they shut up the houses and the dread they had of the summer light. The modern woman is taught to expose herself to the light and she is going into sanitariums at a rate to horrify our ancestors. The way we expose our poor little babies to excessive amounts of sunlight is a great mistake. No wonder they cry so much out of doors. An inspection of the schoolrooms which are modern "light baths" fully explains the headaches and nerve storms which

the children have after a few hours' exposure. These rooms are probably more harmful than dark ones. In a former chapter I have given many illustrations of peoples who have been healthy for many ages in spite of the fact that they have very dark houses. We should therefore not be afraid of such houses, and in the tropics they are a positive necessity. Manilaites should remember how comfortable they become on cloudy, rainy days, and how uncomfortable in the dry season with its pitiless sunshine.

The old Spanish hospitals which we are still occupying in Manila are dreadfully hot, and the glare in the rooms is intensely painful. I am quite of opinion that the work of our hospitals, though extremely good, would be better if proper buildings could be erected. Much suffering of the patients would be avoided. The acutest suffering in my experience was due to the glare when I was an unhappy patient in hospital.

Even our home hospitals are entirely too light and in the colder parts of the country we cannot keep them warm by reason of the many openings.

On account of the cloudiness and excellent health conditions, the hills around Seattle would be splendid places for hospitals for the soldiers invalided from the Philippines, the locality also being the natural terminus of the shortest ocean trade routes from the Orient and Alaska and being the home-port of the great steamship companies destined to carry our supplies in the future.

Shade trees are not merely ornaments, but are

urgent necessities in the tropics. I have seen them foolishly destroyed by young and ignorant Americans, whereas more and more should be planted. It will be money well spent and the sooner the matter is taken up the better. Any officer or soldier discovered destroying a shade tree should be severely dealt with.

Another practical point is in reference to the use of canvas in tropical places. It is an axiom of military life that a camp must be dry, for disaster almost invariably follows pitching the tents in wet, marshy, or heavily wooded grounds. Hence, in the temperate zones, we invariably shun the woods and camp in the open uplands. This is a rule which is wholly inapplicable in the tropics and we have caused much unnecessary suffering and illness by compelling soldiers to camp in the heat and glare where they could have secured the shade so much appreciated alike by nature and animals. Under no circumstances should soldiers be put under canvas in the tropics except where houses are unavailable, and even in such circumstances it is cheaper to build shelters than to ruin the health of the men by keeping them under canvas.

“It must be remembered that soldiers cannot be camped in the open air, in the colonies, as in France.”³

The Romans had a series of axioms for their soldiers in the field and they were experts in the art of preventing illness. Among them we find these

³Burot and Legrand, “The Hygiene of the Soldier in the Tropics.”

three: "In the land of the enemy beware of the country, the water, and the time of the day." "Avoid countries full of miasms, also swamps which are sources of diseases, and deserts and mountains without trees." "In the warmest time of the year, the soldier must not be without protected shelter. A man must protect himself from the rays of the sun, and begin the day's march very early."⁴ What a different story 1898 would tell, if we had known as much as the Romans of twenty-three or twenty-four centuries ago about the effects of light. We actually advised exposure to the sun, camping in the sun and avoiding the shade of trees.

Midday Siesta

In spite of the brunetness of Spaniards and Malays it is surprising how careful they are to escape the midday sun. The siesta is an opportunity to hide like the white ant. Indeed every one seems to disappear from noon until 3 P. M., natives tightly closing their houses to exclude the light, no matter how hot it is inside. Indeed it has often been said that natives protect themselves from the sun's rays more carefully than Americans. The mestizo is more careful still. Hence office hours should continue from 7 until 11.30 A. M., after which every one should be free to go home and hide from the light. It is nonsense to expect more than four and one-half hours of good brain work daily from white

⁴Dr. Richard Stump, *Allgemeine medicinische Central-Zeitung*.

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men in the tropics. To attempt it merely means wasted energies, poor work, or none at all in the late afternoon. Besides an increased number must break down from neurasthenia, for the exhaustion of such forced work cannot be repaired over night. The greatest blunder is found in those military posts where the officers and men are driven from morning until night. At one post where it was tried, and the schedule of duties was precisely the same as at home, every officer was sick within three months. Instead of this we should confine soldiers and officers to quarters and barracks from noon until 4 P. M., or say from 11.30 until 3.30.

During campaigning days commands were often marched from 11 A. M. to 4 P. M., the very time they should not have been marching, and as some of the commands had from fifty to seventy-five per cent. sick it shows the necessity of new regulations on the subject to prevent injuring the army. We constantly fret over the issuing of so many regulations, yet it is our own bad behavior which makes them necessary. The dense ignorance of tropical necessities I have found among all Americans in the Philippines is phenomenal.

Studies and Examinations

The great majority of the studies in the schools for officers and men should be abolished in the tropics and only a few things taken up in the cooler months. India has a much better climate than the Philippines, for it has a winter, and this is the time for all

drills, schools, sports, and manœuvres. In the hot weather nothing whatever is done, and every one who can possibly escape to the hills does so. We, who have hot weather for twelve months, keep up the grind during most of the year.

No examinations should be held in the tropics on account of the universal loss of memory. It is unfair to the candidate, who may fail, whereas he might succeed at home. This would necessitate a change in the law permitting promotions subject to examinations, as in the Navy.

Tour of Duty

There is no space here to take up other questions such as heat, humidity, rain, cloudy days, storms, etc., but it may be well to say that the light of the Philippines is only one feature which makes that climate so bad for white men. There is a continuous heat with no winter. Just across the China Sea is Hong-Kong, practically in the same latitude as Havana, but with three good cool winter months and several temperate months as in India. These interruptions permit recuperation from the damage due to the excessive heat and light of summers. The harm done by five years in India is a trifle to that done by two years in the Philippines, which time is the extreme limit of safety for those who are compelled to stand the sun's rays—a rule I formulated several years ago and see no reason for changing. Easy-going English business men stand it for many years, but they are too easy-going to suit our hustling

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American, who must rush around to the limit for two years and go home wrecked. Then, again, the English make it a point to give their army officers from two to four months' vacation a year for recuperation. We get a month a year and must stand the consequences. Our northern habits unfit us for tropical life and we must change our habits or break down.

We must remember that the most of India extends as far north as our two southern tiers of States, and as it is much higher in altitude its climate is colder and better than the mountains of Tennessee and Kentucky, so that blonds can live there as long as they do in the Kentucky Mountains. Only the southern peninsula of India extends as far south as Central America. The Philippines, on the other hand, are wholly within the latitude of Panama and Central America, which have been the white man's burial ground for four centuries.

In the hills of even southern India there are English flora and fauna—wild honeysuckle, blue dog violets, wild strawberries, larks, hares, and blackbirds. At the rate of 250 feet elevation, the equivalent to one degree of latitude, the climate must correspond to Northern France or the South of England. But though this permits white men to live longer and in more comfort than in the low Indian plains, where "a white child may not live, and a white woman may only dwell at the cost of health and strength," yet it does not permit survival, as at home, because the light of these hill stations is still too great for a

white man. If it were not too great the natives would be white.

The majority of the hill stations having a climate the same or better than Chickamauga Park, a five years' tour of duty is not any more harmful in such stations than five years at Chickamauga. But when an officer says that a soldier can remain five years in Southern India or the Philippines as safely as in the hill stations he is as mistaken as the one who will state that five years in Panama is as wholesome as five years in the Kentucky Mountains. The tour of duty in the hot stations, such as Aden, is twelve months, because it has been found cheaper. It will be cheaper for us to replace the officials in the Philippines (civil and military) very often than to lose the service of good men and pay the increased pensions sure to come for long tours. At present these longer tours are unfortunately necessary, like any other war measure.

The naval station of Cavite is built on a sand bar extending out into Manila Bay, hot, cramped, practically no shade—a veritable hades. During the twelve months preceding the writing of this paragraph eight naval officers have been sent home disabled by neurasthenia contracted at that station. The tour of duty at that dreadful place is two years, but the extreme limit of safety is twelve months or less. By so making it we will save more officers for duty, a matter of extreme importance in the present shortage of officers.

The French tour of duty in their best colonies is

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three years; in less desirable places it is two years, and is only twenty months in the worst parts of Africa having climates similar to the Philippines. In the latter places an officer can get permission to stay longer in extraordinary cases, and only on the certificate of the Chief Surgeon. But for further service, or prolonging the tour in the three year places, the Minister of the Colonies must give permission. Our plan is the opposite—no one is allowed to go home before time without a medical certificate.

Colonel Charles R. Greenleaf, in his report as Chief Surgeon, mentions the loss of energy in one year—that is, for those who are exposed to the climate and not those who hide from it; how Americans lose energy, strength, ambition and do duty at a great effort, and do only those things which cannot be neglected, and how they notice trivial complaints to which they give no thought at home.

The Inspector-General of the Philippines, in his last annual report, said: "Few men in their third year of continuous service are in their normal condition of physical or mental vigor. This statement will be confirmed almost unanimously by medical officers who have served in the Philippines.

"It is further believed that a third year of continuous service will result in so great an increase in the number of officers invalided home, or who return to the States broken in health, requiring months of leave and rest for recuperation, that no economy to the government will result. If one could break

the period by a trip to the States for a few months, or could spend the hot seasons in the mountains, it might be different.

“Out of consideration for the almost unanimous wishes of officers affected, and in consideration of what is firmly believed to be for the best interests of the government, it is recommended that the duration of service in the Philippines for all officers be made two years.”

We often hear that soldiers do not stand the tropics as well as English business men, many of whom have been there many years in health. But such a business man does not have a drill in the hot tropical sun several hours every day. If compelled to leave his office and run around briskly in the sun, with a heavy hat on and carrying heavy weights in his hands, he would break down too. He dodges the dangers which we must thrust on our soldiers.

In addition the stolid Englishman is not already in a mild grade of neurasthenia such as affects so many Americans even before they go to the tropics.

Soldiers' Fatigue Work

The question of the amount of fatigue work to be exacted of white soldiers in the tropics is a burning one with us, but the English have settled it long ago. They require none, but hire coolies, as it is cheaper than to injure the soldier. Our fatigue system, so harmless at home, is deadly in the tropics. All post work should be done by natives, as it is a false economy to make the soldier do it. If any

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heavy outdoor fatigue work is exacted of soldiers it should be done before 8 A. M., and after 4 P. M. Usually the morning fatigue call sounds about the proper time for recall, and the afternoon recall about the time to begin outdoor labor.

The English are said to inscribe these words on their wharves in India: "Beware of the Sun," and Drs. Burot and Legrand call attention to the necessity of veritable armies of coolies to carry the soldiers' equipments, even stating that "each soldier ought to have a coolie." In many places, indeed, every cavalryman does have a coolie to do the heavy stable work. They say that no white man can carry a soldier's necessary equipment on a tropical march, and show that where it was tried, as in Madagascar, there were sad results. They also, by the way, state that an umbrella is a necessity for all officers and agents obliged to superintend work in the hot hours of the day.

Again: "It will no longer be possible to see sailors coaling their ships at the hour when the convicts are taking their siesta, as once came to pass in Guiana. There are fatigue duties which must be done by the soldier, but he ought to be exempt from certain kinds of work; in any case, soldiers ought not to be transformed into coolies." They assert that if only one coolie is supplied for every ten soldiers his expenses are actually saved in medicines and time otherwise lost in hospital.

In 1763, twelve thousand soldiers in Guiana attempted to cultivate the land—soon they were re-

duced to two thousand. They give many other instances of needless destruction of health and life in other tropical countries. It was formerly thought that all this harm came from the soil in the way of malaria—we know better now that it has been discovered that the mosquito is the agent. It was mostly due to exposure to the sun which reduced resistance to all infections. Even the Filipino is liable to this breakdown. I know of one instance where fifty per cent. of a company of native scouts developed malaria after every "hike" in a mosquito-free country. They were all infected beforehand but possessed that immunity so common in tropical natives and showed no symptoms, but collapsed from the malaria as soon as greatly fatigued. Likewise white men, if exposed to the sun excessively, will collapse or die from a malarial infection which may be comparatively mild in a temperate climate.

Of all work in the tropics, road-making is probably the worst, and to set white soldiers to this labor when it can be avoided is of course nothing but murder. Unfortunately military necessity compelled it once or twice for short periods, no matter what the cost, and from what I have learned of subsequent sickness and a fair presumption of the pensions we will pay, I have no hesitation in saying that these necessary military undertakings are the most expensive bits of road-making in our history. Men who do not know the deadly nature of laboring in the tropics are quite apt to recommend that our soldiers be compelled to do it, and yet these same men will

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complain bitterly of the loss of health of troops in two years.

It is said that other nations have been compelled to send criminals home as it was discovered that the mortality among them was dreadfully high. We too should send home all prisoners having sentences greater than twelve months. It is impossible to give them hard labor for longer periods in the tropics without running the risk of injuring them. Our military prison is a temporary necessity, but will have to be discontinued.

The experience of all tropical experts is unanimous on this point—no white man should dare to do manual labor in the tropical sun, and had better leave all labor to natives, as they do in Java.

Warm Baths

Then we do ourselves harm with the cold baths we take. They are stimulating to a nervous system that we do not want stimulated any further. The Englishman accustomed to his cold bath has long ago found out that he is in far better health in India if he confines himself to the more soothing tepid or warmer baths.

Social Duties

Social duties are the main causes of the breakdown of women. Dr. W. J. Simpson⁵ mentions the exceptionally bad health of British women in India and blames the darkened rooms in which they live—

⁵ Journal of Tropical Medicine, April 15, 1900.

a very curious statement from one who thinks that light might be the harmful agent. The real reason is found in the excessive exposure to the light in social functions that should be done at night or better omitted altogether, for our women break down much sooner than the English women. Women should not dare to venture out of doors between 9 A. M. and 4 P. M., and should have cool, darkened houses with plenty of breeze, and with large verandas for shade. Every one should be in bed by 10 P. M., and up at daybreak. Then the necessary siesta in the afternoon will be appreciated.

Dr. Thomas C. Hodson⁶ voices the common error when he says: "When the sun's heat is fierce most European dwellings have means of darkening their rooms by shutters and it is not uncommon to find this exclusion of the sun's rays carried to an extreme and prejudicial extent." The American women in the Philippines are exposed to more light than their British cousins in India, yet their health fails in greater degree.

Recruits

Finally, in selecting recruits for tropical service exclusively, it would be best to limit them to brunettes, and preferably those of short stature, like the Mediterranean type of man, but this is not possible. Although a vigorous blond is far better than a frail brunette, the rule should be—in cases of doubt as to a man's fitness—if he is a blond, reject him.

⁶ *Journal of Tropical Medicine*, March 16, 1903.

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Blonds who contemplate a long residence in the tropics in civil employ, or in business, should hesitate unless very vigorous; dark brunettes need not worry over it but may run the risk if it pays well enough. For such work as the Panama Canal it would be best to limit the employees as far as possible to brunettes.

As mentioned elsewhere, life insurance companies, as a rule, do not permit a policy holder to live within thirty degrees of the equator, for they have found out that such residence shortens the man's life. It is merely a question of facts and business with them. But they might safely make exceptions in the case of very brunette policy holders, while holding to the rule in case of blonds.

According to Corre, "the major part of the European elements of the colonial army should be recruited among the dark-complexioned; a fair man now and then presents a fine appearance of physical vigor, but to support the fatigues of the service his system needs a too heavy ration of meat. It is to be observed, moreover, that the English in India are more often attacked by hepatitis in all degrees than the Spaniards in Cuba and the Antilles. Abscess of the liver is twice as common among the French of the north as those of the south. Thévenot has observed that yellow fever attacks men of the north in the proportion of five to one of the south." This does not disprove the former statement, that our Southern men being already damaged by a light climate did not stand tropical service as well as the less damaged men of the North.

“In tropical countries the Europeans can live only in a weakened condition. Lind says: ‘The man may be likened to vegetables transplanted in foreign soil, where they can be preserved and acclimated (?) only by extraordinary care.’”⁷

Good Nourishment

Drs. Burot and Legrand⁸ call attention to the universal rule to increase the ration in campaigns, and then mention that in the tropics “the soldier is always in campaign; if not against the enemy, at least against the climate,” and by reason of these losses, which are greater than in Europe, he needs more nitrogen than at home, and, moreover, on account of the languid digestive powers the food must be more digestible than at home.

Dr. James Cantlie,⁹ in an article on tropical hygiene, showed that it is not the heat alone which is harmful but also the light. He mentions the preliminary stimulations of newcomers, and the subsequent neurasthenia, suspended digestion, and exhaustion which may need alcohol. He also shows the need of fresh meat to counteract the exhaustions, for he thinks the lack of “nitrogen” is a prime factor in tropical exhaustions.

This brings up the question of food, and it is well to say that physicians are now almost unanimous in declaring that the old doctrine that we should eat very lightly of animal food in the tropics is a very

⁷ Burot and Legrand—“Hygiene.” ⁸ *Ibid.*

⁹ *Journal of Tropical Medicine*, April 15, 1903.

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pernicious one. The natives are now known to be suffering from nitrogen starvation and we should not imitate them in this respect any more than we should imitate their filthy habits. The white man, by reason of his exhaustions, possibly needs more meat than he does at home for an equal amount of physical labor. There is considerable evidence that both beri-beri and tuberculosis attack by preference those in a condition of nitrogen starvation, and this accounts for the awful prevalence of the latter and its rapidity among both natives and whites.

Musculature

Musculature increases as we go to cooler climates, as seen in the fine muscles of the Japanese as compared with those of the Malays who are so like the Japanese in other physical characters. Hence a fine musculature in a white man is both pernicious and useless if he goes to that climate, for it is a parasite absorbing nutriment, and it requires care, grooming and time to keep it in health, and to do all this the owner must expose himself unnecessarily to the light. A German physician (Walfert) has stated that the man before going to the tropics should submit to a regular training to develop his muscles, and more vicious advice could scarcely be given. Training causes physiological cardiac hypertrophy, and as more than one physician has discovered cardiac feebleness in all white men of any length of residence in the tropics, with œdema of legs and other evidence of defective circulation, it follows that the hypertrophied heart

is liable to subside into a dilated one. I have seen two such cases, and think I know of a third fatal case. So a poor musculature is not a contra-indication to tropical service but may even be considered an advantage if the man has enough for the little physical work to be demanded of him, and a very slight amount of exercise is all that is needed to keep such muscles from dwindling below the needed size. I am much opposed to any calisthenics and outdoor sports which are indulged in for the sole purpose of increasing the musculature. Athletic contests should be abolished in the tropics.

In an address in England, printed recently in *Climate*, Dr. Charles F. Harford says: "The liability which there is in tropical regions to disorders of the digestive system renders it imperative that the person going abroad should be free from bowel disorder, liver trouble, constipation, diarrhea, or indigestion in any form, seeing that not only are bowel complaints exceedingly common, but malarial fever itself affects chiefly the organs of digestion. The teeth also should be in good order, and there should be no faddiness as to food. Freedom from any form of nervous derangement is the next point of importance, and any tendency to headache, insomnia, hysteria, insanity, depression, or fits should be carefully inquired into. Slight valvular disease of the heart with full compensation need not exclude, while chronic bronchitis in a slight form is likely to be better in a hot climate. . . . It has usually been taken for granted that men will stand the changes

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of climate better than women, but experience does not prove this to be the case. It is also a strange fact, which may be only a coincidence, that I have known more men returning from a tropical climate with a breakdown of the nervous system than women."

Proper Age

He might have added that only young men should go there. My own statistics show that the best age is from twenty to thirty or thirty-five, before that time the system is too immature and more die; after thirty-five there is physical decay and greater sickness. No man over fifty-five should dare to go there except for a short visit and even numerous old visitors have died before they could get away. It would be better to keep all army officers over fifty at home, or even those over forty-five, but that is not practicable. Civil service candidates should be limited to those under thirty.

Invaliding and Pensions

Every government employee sent to the Philippines for prolonged tour of duty has his life shortened thereby, for it is nonsense to teach that the damage can be wholly repaired. If the American people have no regard for the lives of their servants they should be made to pay for the damage done in serving there; yet in damaging the servants we get less work out of them from that time forward, have an increased expense also from more pensions and greater retired lists and are doing the most expensive thing

we could do. The most successful corporations find it cheaper to take the greatest care of their servants, work them as many years as possible and pension them in old age. They secure the best brains obtainable and pay the market price, and as a consequence are more cheaply managed than government business, as a rule.

Therefore it is decidedly to our interest for Congress to provide a retired list or pension for civil officials who have been rendered unfit for labor by service in the tropics. In the meantime all white employees in the Philippines showing signs of breakdown should be transferred to home stations at once, even if they have to enter some other government department at home.

Our army statistics do not show at present a much greater mortality in the Philippines than at home, and the reason is very simple. We have found that the best way to keep the mortality down is to send home the sick men to the United States, to get well if not too far gone. So there is invalided home a constant stream of sick, many of whom would die if kept in the tropics. Any man who conceals that fact, and advises white men to go to the Philippines on the strength of the statistics, is committing a grave mistake. Professor Ripley says¹⁰ "to urge the immigration of women, children, or of any save those in the most robust health, to the tropics, may not be murder in the first degree, but it should be classed, to put it mildly, an incitement of it."

¹⁰ Popular Science Monthly, May, 1896.

Future Investigations

It is to be regretted that a strenuous life and overwork in executive matters should have prevented us of the army from doing advance work, for little has come out of the Philippines. Colonel Greenleaf, as Chief Surgeon, succeeded in getting some good work done by the young men, but it had to be dropped later. Hundreds of physicians have come back loaded with valuable knowledge, but have gone into civil practice and buried it. This experience was public property, and before leaving for home each one should have reported fully in writing any discovery he had made in hygienic matters, and what management he had found best in tropical affections. These reports could have been collected into a standard text-book for newcomers, who are now compelled to flounder about, dependent on works which are notoriously behind the times and unsuited to the Philippines. Particularly in the hygiene of the tropics do we find the greatest ignorance among physicians.

In conversation with laymen I have been much impressed with the fact that scarcely anything is known of tropical hygiene, and in the case of the houses, for instance, they have not the slightest suspicion that there are any defects in any of the buildings erected, and yet there were physicians who might have been able to enlighten the builders. Everywhere we find houses designed with the closet adjoining the kitchen or dining room, so that flies can

carry fæces to the food; halls built for circulation of air are carefully shut off by partitions; porches and verandas are so narrow and their roofs so high as to offer no protection from heat or glare. The tropical sun beats down on walls, windows, and unceiled galvanized iron roofings, rendering the places uninhabitable, and the houses are built on the ground instead of being raised eight or ten feet, as experience demands.

If this monograph can stimulate the young men to work in the direction of investigating tropical hygiene, which is a matter of such national importance, and one of which laymen are profoundly ignorant, it will have served its purpose. It is to be hoped also that we shall hear no more of those remarkable assertions, that climate has so little effect on men out of their zones, that white men can remain in the tropics indefinitely and be healthy—assertions which practically accuse nature of not knowing her own business when she pigmented the natives of the tropics.

Though we can never expect to reduce our sick rate in the Philippines to what it is normally in the United States, it is quite evident that a universal recognition of the fact that we are there out of our zones will cause an extension of the present excellent system of sending home all the sick who are not likely to make prompt recoveries in the tropics. It is not, therefore, too much to expect that the death rate in the Philippines will be reduced to that of the United States or even less. Deaths at home would

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be tabulated with the home troops, even though they were due to tropical infections, and we should soon have a smaller death rate in the Philippines. This desirable end is already near at hand.

The death rates per 1000 in Singapore ¹¹ are as follows: Europeans, 25.75; Eurasians, 26.29; Indians, 42.16; Malays, 46.89; Chinese, 54.25; other races, 38.15. This shows that the Chinese are not so well off as we generally supposed—they are too far from their zone, but the low rate of Europeans is due to greater care and the shipping of invalids home for recuperation. If they remained their rates would be very high. Our death rates in the Philippines therefore should be less than that of any other race, yellow, brown or black.

What we desire now, is a full and complete discussion of everything connected with the climate, without the slightest exaggeration of any facts or suspicions of minimizing them. Then we will be in a position to discover the unknown factors of the climate which have heretofore injured our soldiers, and we will be able to protect them by practical rules of hygiene. It is not too much to hope that, though we can never expect all men to serve two or three years in the tropics continuously without damage, yet there are so many who go through unscathed—even many blonds—that we can hope to make our future record so good that insurance companies will be induced to remove some of the heavy burdens which ordinary business prudence has com-

¹¹ Journal of Tropical Medicine, December 1, 1904.

pelled them to lay upon their policy holders in the tropics. But they will not act if they suspect us of concealing scientific facts.

It is also to be hoped that this investigation will take us a step nearer to the solution of that problem which is now confronting the American people as well as European nations—*The Conquest of the Tropics*, to give to its peoples that security of life and property, and that civilization and prosperity, which they cannot attain by their own unaided efforts, in an unsuitable form of government forced upon them by the Monroe Doctrine for our own welfare.



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