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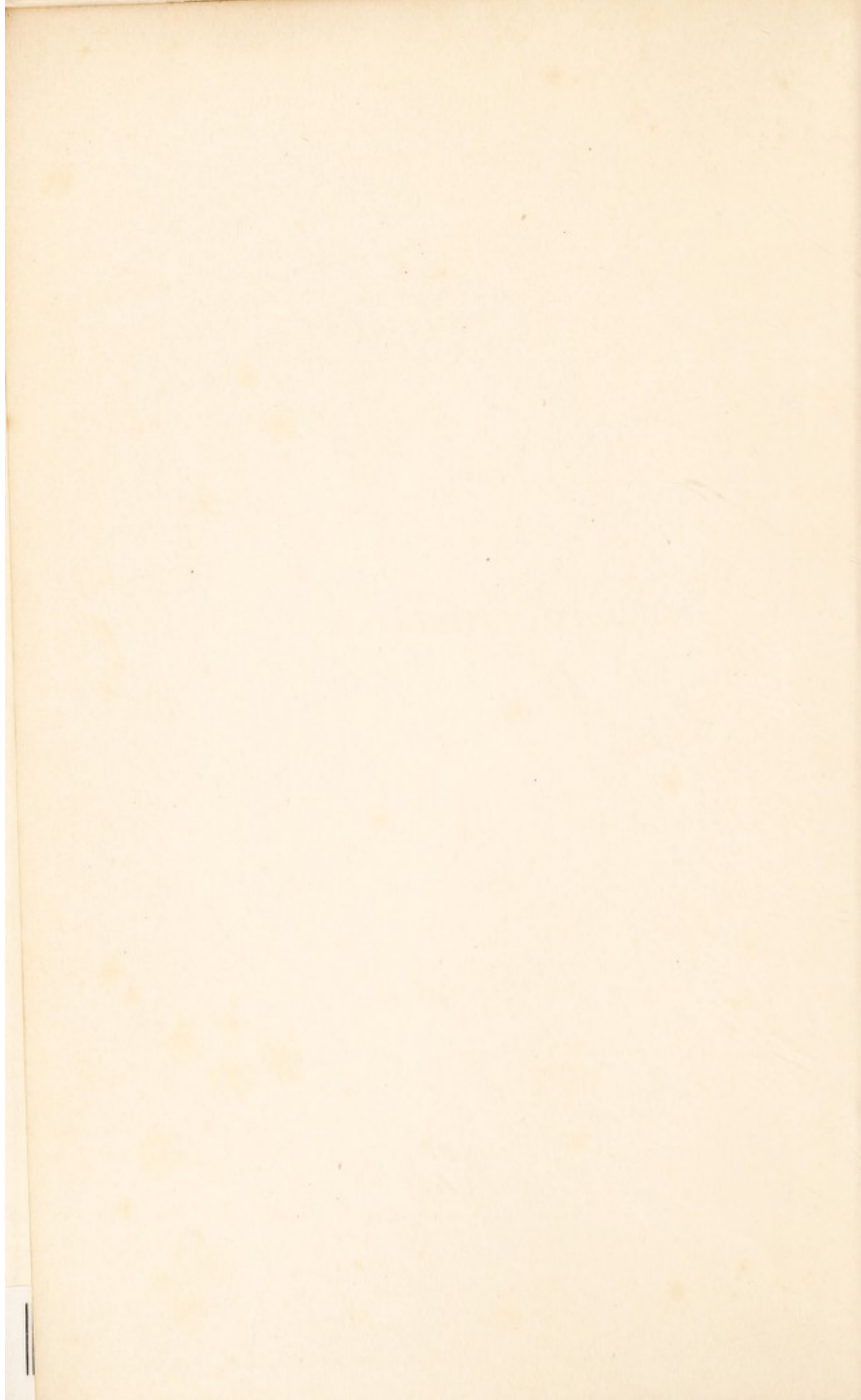
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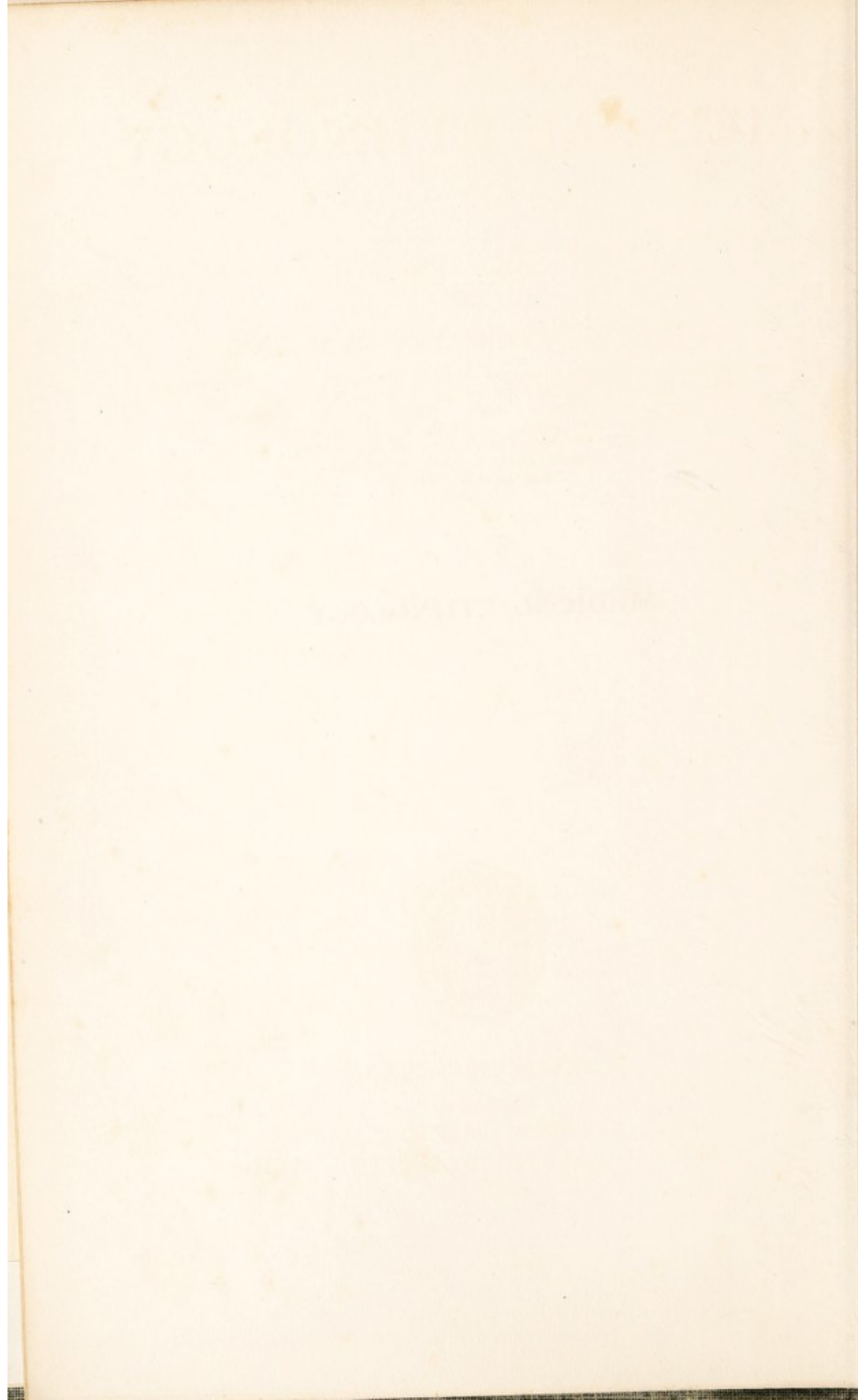






MEDICAL ETHNOLOGY





# MEDICAL ETHNOLOGY

BY

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## PREFACE

THIS work was begun as a revision of the first edition of "The Effects of Tropical Light on White Men," but it was necessary to change the title to "Medical Ethnology" because so many other factors besides pigmentation have entered into the discussion of the reasons for the differences between the present races and sub-races of men. Since the publication of the first edition many articles have appeared calling attention to the damage done to migrants by adverse environmental factors for which they have no physical defenses. It is now an accepted axiom that all the laws which govern the evolution of adaptation of lower animals to the environment by slaughter of the least fit and selection of the fittest, apply with equal force to man. It fully explains the high death rates of migrants and their eventual extinction or change of type. The literature of the subject has become so great that it has been necessary to omit much of the evidence which merely substantiated what has already been proved. Otherwise the work would have grown beyond reasonable size.





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# MEDICAL ETHNOLOGY

## CHAPTER I

### MAN'S EVOLUTION

Medical ethnology deals with the different morbidity and mortality rates of the different physical types of people living in the same locality. Demography treats of the changes in a population as a whole, its increases and decreases through births, deaths and migrations. Medical ethnology is then a branch of demography, and explains why certain changes of type take place. These changes have been known for a very long time, indeed ever since ethnography has been a science, but it is only recently that their causes have been discovered and the matter found to be of great therapeutic and hygienic importance.

Man has probably always known of the law of adaptation, for he was daily brought into contact with animals which were specially adapted for their mode of life. The results of lack of adaptation were realized by naturalists a long time before *Darwin* proved that offspring tended to vary from parental type and that those best adapted to struggle for existence survived and the rest perished. The number of individuals of a species remains about the same generation to generation, so it is evident that on an average only two offspring survive to replace the parents, no matter how many thousands of eggs may be laid and fertilized. There cannot be more than two survivors as a permanent rule, or the species would overrun the earth, but there may be less than two, in which case the species becomes extinct. The destruction of life is therefore enormous, and in this terrific struggle for existence the survivors must necessarily be those best fitted to survive or best adjusted to the particular environment.



This is such an old story that it seems a waste of time to mention it, but in spite of its universal acceptance there are few who realize its full significance. It is doubtful if even *Darwin* was aware of the extreme minuteness of the differentiation of characters which determined survival, though he spent practically his whole life in proving the origin of species by this process.

Everyone knew that if we trace all the races of man back far enough we reach a common ancestor, but we could not conceive of the idea that these changes of form were accomplished by killing the least adapted. The universal theory was to the effect that the environment modified each individual who transmitted the modification to offspring who were in turn modified still further. For instance, it was seriously suggested that a race moving toward the tropics became black from the accumulations of sunburn in each generation. Such baseless theories still prevent the vast majority of physicians from realizing that change of type is accomplished in only one way,—preservation of individuals which vary in the direction of better adaptation to environment and slaughter of all the rest.

There has always been a reluctance to include man in the scheme of nature. We have almost invariably considered him a species apart from all others, something supernatural and above the laws which govern the spread and change of other species. Even to-day the vast majority of sociologists have not the remotest suspicion that changes in type are going on around them, through the greater morbidity and mortality of the types least fit to live in each particular environment. There is even a wide-spread notion that we can build up an artificial environment by clothing and houses to shelter us from immediate death by cold or heat or light, and that man is independent of his climatic environment. We will show later that this is not true, and that every extreme of climate or other environment requires a specially modified physique for permanent survival, and that migrant types not so built will disappear through greater morbidity and shorter life.

The time required to extinguish a type of man is always



measured in generations, for there is no place on earth, as far as we know, in which an adult from afar cannot survive to old age if he knows how to protect himself from the grosser harms. This has given rise to the false idea that permanent residence is possible, and we have been blinded to the changes which require several generations. The survival of utterly unfit migrants for a few generations has caused many scientists to assert that as far as man is concerned there is no law of adaptation, but there is now a return to reason. For instance, *Professor Wm. Ridgeway*, Professor of Zoology in Cambridge University, has been particularly vehement in calling attention to the necessity of applying to man all the laws known to modify other animals.<sup>1</sup> Anthropology and ethnology are no longer playthings of men having nothing better to do, but are biologic studies of great practical importance. *Karl Pearson* says, "that the Darwinian theory has applications to civilized man and that a heavy death-rate does mean the elimination of weaklings. . . . For a constant environment the higher the infantile death-rate, the more resistant will be the surviving child population."<sup>2</sup> *Professor E. H. Starling*, of London University, has also found that physique is the basis of success.<sup>3</sup>

We now know that by the ordinary laws of selection, every species of plant or animal evolves characters which are of vital importance either in the active struggle for existence or passive resistance to harm. The lion's tusks and claws aid him in killing his prey and his mane protects him in his fights with competitors. Hence every character has a use for some factor in the environment, unless the animal has recently wandered into a new environment lacking that factor. In the latter case, the character will eventually disappear because it is a burden on nutrition to produce it and those least burdened have the advantage. Besides this, a useless organ is in the way and by that very fact tends to disappear by the great-

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<sup>1</sup> *Popular Science Monthly*, 1908.

<sup>2</sup> The Intensity of Natural Selection in Man. Proceedings Royal Society, August 24, 1912, p. 476.

<sup>3</sup> *Science*, September 24, 1909.



er mortality of those so handicapped. In no other ways can we explain the disappearance of the eyes of fishes which have wandered into dark caves. The wisdom teeth of civilized man seem to be disappearing for these reasons, and there is often considerable disease if they are present.

The rule is then universal. We must consider every character as of present survival value, unless we can prove that it was evolved in a prior environment different from the present and that it is now doing no harm. The old rule was to consider every character and even every organ as useless unless we knew the reason for it. The burden of proof has now been shifted.

Heredity is really "organic inertia," that is, the inability of an individual or species to modify itself. Changes come from outside influences, and in the absence of these influences a part will be developed for thousands of generations after its use has disappeared, if it causes no harm.

There is a growing suspicion that the useless is always so harmful, that the disappearance of characters which have lost their use through change of environment is an exceedingly rapid process, and that the types with useless characters always have an appreciably higher morbidity and a shortened and inefficient life. These are exceedingly important matters in ethnic medicine and explain many vital phenomena in all parts of the world, particularly America, Australia and South Africa, where people are living in large numbers in climates greatly different from those to which their ancestors were adjusted by residence counted in hundreds of thousands of years. That is, the "disharmonies" so ably described by *Metchnikoff* are not as numerous as he thought, except in recent migrants. The disharmonies brought about by the change from an anthropoid to human form are still less numerous, as they have largely disappeared from the elimination of men the most handicapped.

Physiologists have been very backward in explaining the reasons for the enormous differences now existing in types which have long resided in their respective habitats. Text-books have scarcely a word on the subject, although ethnolo-



gists have recorded a wealth of observations, measurements and accurate statistics, which demand scientific explanation. As there are no precedents for guidance, the students of this new science must build it up from the foundation-stones of general biology.

Ethnologists now recognize two distinct branches of the human species, which seem to have been independently evolved from two separate species of the anthropoids. One, mostly long-headed, is found in the Indian ocean and its surrounding shores—Africa, southern Asia and Australasia;—the other, mostly broad-headed, is in the Pacific ocean and its surrounding shores—eastern Asia and America. Both types have percolated all over Europe, and have sent streams in other directions also, so that there is a puzzling mixture where travel has been possible. But wherever a type migrates, it develops new characters to fit it to survive in its new environment. Thus, the two types may live intermingled for thousands of years at a certain place and because they have evolved the same complexion, they were formerly considered homogeneous. Only recently have they been recognized by harmless differences which have persisted by organic inertia. There is now a perfect gradation of long-headed types from the blond Baltic race down through the Mediterranean to the southern African and around the Indian ocean to Australasia. There is also a gradation from the broad-headed Alpine type in western Europe all through central Europe and northern Asia, across to America and down to Patagonia.

It is immaterial to medical ethnology where and when these two branches arose. Almost every place on earth has been chosen by anthropologists who are competent to form any opinion at all and evidently most of them are mistaken. In recent years there seems to be a growing tendency to place the cradle of each type in the far north, where the difficulty of making a living in the increasing cold of the pliocene period caused a destruction of the stupid and a survival in each generation of only those who were the most intelligent. Others have suggested that this evolution of brain was exceedingly rapid, and that before the climate had changed from



tropical to glacial, there existed a creature which was sufficiently intelligent to be called human, though it still retained many simian physical characters, which, by the way, organic inertia still blindly produces in the infants if they do no harm. The tropics and sub-tropics are being given up as possible cradles of the race. The anthropoids persist there because they have no external factors to cause the rigid selection of brain which developed man in the north. It seems likely that these animals are really escapes from the north in the beginning of human evolution, and that they have changed more or less to fit them to their present very limited environments. The types which changed into man disappeared in the process, and they have left no fossils in Europe except long prior to the human epoch.

The persistence of head shape seems to indicate that it has no survival value, though there must have been a powerful factor at work to cause the evolution of long heads in the west and broad heads in the east. The only reasonable suggestion so far made is to the effect that it was merely correlated to the rest of the body, the broad-headed race being originally short and stocky and the long-headed tall and slender. The former are supposed to have been plains dwellers and the latter forest types. Some zoologists still consider the eastern anthropoids broad-headed—gibbons and ourang-outan—and the western long-headed—chimpanzee and gorilla. It is difficult to decide in such irregular shaped skulls, and not a few observers deny any such generalization.

*Professor Boas*, of Columbia University, New York, has found<sup>4</sup> that there is a marked change in head shape as a result of one or two generations' residence in America, both extremes of long and broad heads tending to become less marked in the children. His conclusions have been violently assailed by other anthropologists, so the matter must be held *sub judice*. For the present we cannot be so dogmatic in the old opinion that head shape is wholly immaterial in the struggle for existence, though we are correct in asserting that if it

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<sup>4</sup> Immigration Commissioners' Report, 1911.



has any effect at all, it is too small to be of practical value in medical ethnology.

*Dr. Adolph Bloch*<sup>5</sup> has collected a wealth of evidence showing that the percentage of broad heads has persistently increased in nearly every part of Europe ever since this type came from Asia in the bronze age. He considers this proof that the head shape has changed, but the facts merely mean that in these places since the bronze age the broad-headed men have had other characters which made them fitter for survival than the long-headed. There are very few broad-heads in either the extreme north or extreme south, but in the center and east they constitute the majority.

The law of adaptation limits the habitat of every species, and it was discovered long ago that all living forms were distributed in zones whose boundaries were isothermals.<sup>6</sup> Though a species may be sharply limited in its northern and southern extensions and though it may range long distances east and west, it is never found out of its zone. It is tied by a short tether, because migration is either fatal to all individuals, or only to the most unfit. The survivors are variants which are better adjusted to the new place and constitute a new species which cannot return to the old home. A gradual change in the environment has the same effect of producing a new species without migration. On the other hand, types which escape from a changing environment may survive unchanged if they reach a fit one. The reindeer, for instance, now confined to a limited arctic zone, roamed over most of Europe in post-glacial times. Similarly Arctic types survive in the tops of high mountains, though separated many hundreds of miles from closely related or identical types in the far north.

Migratory birds survive because they are able to move with the seasons so as to escape enemies and obtain food. *Professor W. K. Brooks* thought that their evolution was the result of the survival of types which were able to go the far-

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<sup>5</sup> Translation in Smithsonian Report, 1912.

<sup>6</sup> Smithsonian Reports, 1891.



thrust to the breeding grounds to escape heat or living enemies. In this sense they have a very restricted physical environment, and though their geographical zone is very wide they must remain in their seasonal zones.

The origin of variations which cause better fitness to the environment has never been satisfactorily explained, although there is almost unanimous agreement that external influences affect the germ cells of the parent in thousands of different ways, causing the offspring to depart from parental form. There is positively no purpose in these hit or miss forms, and it may happen that none of them are fit to survive in a changing environment. Indeed, the vast majority of ancient forms now found as fossils have no living descendants. If the environment modifies the parent's body, these somatic changes are never transmitted because they have no effect upon the germ cells. For instance, if a man loses a finger by amputation, his children are born with the full number of digits. The subject is well discussed by *G. Archdall Reid* in his work on Heredity. In spite of all this, there is a growing suspicion in the minds of many biologists, that characters acquired by parents are sometimes transmitted. Botanists are particularly inclined this way. Nevertheless the facts presented have not convinced the zoologists, with whom we must side as we are dealing with the human animal.

Origin of species is to be likened to change of form of a hedge or bush by cutting off the unsuitable parts and not by training all to assume the required shape as we do with vines. If the environment does not change, the variations perish as unfit and a species remains fixed for millions of years as in some low forms of life, but if there is a change which unfits existing forms to it, they must die. The line is carried on if suitable variants should happen to arise.

Acclimatization means change of form by survival of the best adapted, and death of the unadapted. There is no such thing as the acclimatization of any living thing in a place to which it is unadapted. Migrants invariably suffer more or less from the new adversities against which they have no defenses, and the study of these illnesses in human migrants



constitutes medical ethnology. The older generation of naturalists could not conceive of these changes in the case of man, and since they found different types which were limited to very restricted environments and that acclimatization was impossible, they got over the difficulty by imagining, as Agassiz did, that there was a separate Adam and Eve created for every locality on earth.

➤ There are "critical periods" in evolution, when rapid changes of climate have caused rapid changes in species. The evolution of intelligent man from anthropoids occurred in such a period. Migration creates a critical period, and we find a great amount of disease and death among the least fit and a rapid evolution of a new type if there are any suitable variations to survive at all. These changes are never noticed at the time, because no one ever knew what his great-grandparents resembled. We do not even realize the elimination of an unsuited type in a mixed population. For instance, no one has ever noticed that the blond type has relatively lessened among the Canadian French, more so among the New England British types, and completely disappeared from the Louisiana French. If there is no change in environment there is no change in type. The Egyptian peasant, for instance, is identically the same now as he was pictured several thousand years ago, in a land which has destroyed every invading type.

Until a few years ago, biologists were of the opinion that all types of men were really only varieties of a single species, but now a few of the best authorities are not quite so sure about it. Of course, cross-breeding in man produces fertile offspring as a rule to which there are said to be a few exceptions, but the exceptions are mostly hearsay. That is, the evidence seems to show that all men must be specifically alike, since hybrids between different species are generally sterile. Nevertheless, it is pointed out that in lower forms of life such great differences as we see between "races" of men would compel us to class them as of different species. Since a species is limited to a much more restricted zone than a genus, the new theory would seem to indicate that types of men are species



which are tied by a very short tether to their respective environments, and disease must result if they wander to unfit places. Dr. C. B. Davenport stated in *The Journal of Heredity*, in 1914, that mulattoes are among the most fertile families of Jamaica.

It is very remarkable that *Tacitus* should have guessed so long ago that the environment makes the type. Describing the Britons, probably from information given by his father-in-law, the Roman general Agricola, he says: "The russet hair of the inhabitants of Caledonia and their large size attest German origin. . . . The Britons nearest to the Gauls resembled them, either by reason of the lasting impress of the same origin, or because in these countries, which face one another, the likeness of the climate has given the body the same form. But it is probable that the Gauls had settled in the country so near to them."<sup>7</sup>

It has often been said that the small legs of canoe races and thick legs of mountain types are racial characteristics, but as a matter of fact they are merely occupational changes. Professional fencers, who constantly use the right arm and hold the left up in the air, find in time that the right arm lengthens and the left shortens. The difference in length may be as great as three inches. These acquired characters or modifications are in the class of mutilations as far as heredity is concerned, for offspring may develop entirely different characters by different treatment. They cannot then be considered racial, and they do not have any relation to medical ethnology. The children of canoe savages have normal legs, which remain normal if canoeing is not an occupation.

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<sup>7</sup>Life of Agricola, quoted by Bloch, Smithsonian Report, 1912, p. 624.



## CHAPTER II

### RACIAL PHYSICAL CHARACTERS

If a genus of wild animal, such as bear, is spread over a long distance in latitude, the species nearest the equator are the smallest and the others are progressively larger as they approach the arctics. The same rule applies to a species, for the varieties increase in size from hot to cold regions. Domestic animals follow the same rule. The big horses, for instance, have been developed in northern Europe and the varieties are smaller toward the tropics, the Javanese being but little bigger than Newfoundland dogs. The subarctic pony is an exception, for here it is a question of lack of food, and a big horse cannot survive. No one knows the reason for this phenomenon, particularly as the biggest land animals are confined to the tropics and have no closely related species in the cold climates,—elephant, rhinoceros, hippopotamus, etc. There is a pygmy elephant and hippopotamus, but the reasons for their adaptation are unknown, as they live near the large species.

Man follows the same rule. The tallest and bulkiest are in the extreme north and south,—Baltic type and Patagonians,—and the others diminish in size as we approach the tropics, where we find the pygmies. In the United States there is a marked decrease in stature from the North to the South as a result of changes of less than fifteen generations. There is, at present, no explanation; indeed the exceptions, such as the Zulus and Sikhs, only increases the difficulty. The Shilluks, Dinkas and Yambos of eastern Sudan are very tall, "six feet being quite under the average."<sup>1</sup> Besides these, there are unaccountable instances where tall types have been created by the side of the short, as in the case of the

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<sup>1</sup> Duncan Brodie.



tall variety of the old English black-breed or primitive Briton—the Abraham Lincoln type. Warfare could not have caused this evolution, since all primitive men, big and little, were perpetually at war. Intelligence, co-operation or mere numbers might make up for less individual strength as the Japanese have shown.

The liberal meat diet of Americans has unquestionably been one cause of the better development of the children of immigrants. The population has so vastly outgrown the beef supply that exports have ceased, as the home demand takes it all and needs importations as well. The price is naturally rising to the relative level of Europe, and as a diet for three times a day, meat is already out of reach of the poor as in Europe. The more recent immigrants in the cities are not now growing as tall as those of a half century ago. There may be another factor in America which causes people to grow taller than in Europe.

It has been proved in several instances in Europe that shortness of stature is the result of deficient nutrition, as in those types, mostly Alpine, which have been forced into the inhospitable less productive highlands.<sup>2</sup> After migration to places where food is more abundant, the children grow to much larger size than the parents, as we commonly see among the Irish in America. Still, there are tall types where food is lacking, and short ones where it is abundant.

There is no escape from the conclusion that tallness is a disadvantage in some places, and that the tall disappear through more sickness and shorter life. The reverse process occurs where shortness is a disadvantage. There must have been a dreadful destruction of the unfit to have caused the great differences we find among existing races.

*Sir Wm. Church*<sup>3</sup> has shown that acute rheumatism is especially prevalent on the coast of Cumberland and in the Isle of Man, two of the tallest, fairest, and most purely Norwegian districts in the British Isles. *Dr. F. C. Shrubbsall* of London mentions another area along the Severn in Hereford

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<sup>2</sup> Ripley's Racial Geography of Europe.

<sup>3</sup> Clifford Allbutt's System of Medicine.



and Shropshire in a fair population with much rufousness. Fairness and tallness generally go together.

The average stature of a city population is always less than that of the surrounding rural districts. City families tend to die out. To replace them there is a constant stream from the country. Consequently these tall immigrants must have a shorter life than the small. *Professor H. H. Holmes*, of the U. S. National Museum, has called attention to what he calls "the pygmies of London," who can survive in that locality. They are too feeble and too short to make a living at most trades or at unskilled labor, and if they have not sufficient intelligence for tailoring, watchmaking and other trades where stature is immaterial, they sink into abject poverty. Such types exist in all cities because they cannot earn a living on farms. The point to enlarge upon is the fact that something in cities kills off the tallest but preserves the shortest. The tall policemen of London are almost invariably imported countrymen who do not maintain themselves. The city families of long residence furnish but few policemen.

*Shrubsall* has found that shortness increases with each generation of city residence, but is uncertain as to the diseases which carry off the tall. There is a doubtful correlation in London between tallness and rheumatism, osteoarthritis, tonsillitis and heart disease. Shortness seems to be related to nervous disorders, tuberculosis and malignant growths.<sup>4</sup> These correlations may really refer to complexions.

Many observers have noticed that tall men do not stand tropical residence very well. In 1902, an examination of 1,300 white soldiers who had been in the tropics several years revealed the following results as to their resistance in relation to height.

	Retained Health.	Deteriorated.	Invalided.	Died.
Average height.....	5 ft. 6.8 in.	5 ft. 7½ in.	5 ft. 7.1 in.	5 ft. 7.4 in.

Experiments subsequently mentioned prove that if nourishment is provided and other conditions are the same, both

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<sup>4</sup> St. Bartholomew's Hospital Reports, 1903, and *British Medical Journal*, 1904.



plants and animals grow faster in the dark than in the light. However, there does not seem to be any correlation between tallness or bulkiness in a type of man and the amount of light in the climate evolving that type, though, to be sure, both characters increase in a general way from light to dark countries. Pigmentation disturbs the correlation, as we will later explain. The Eskimo of northern Greenland are said to be much taller than those of the south, some being over six feet high, but there is no explanation of the phenomenon.

Slenderness of tree-dwelling animals is of self-evident utility. The heavy would break the limbs of the trees. It is difficult if not impossible to fatten monkeys very much. The newborn monkeys are excessively slender and apparently devoid of all fat. They remain so as long as it is necessary for the mothers to carry them. Otherwise survival would be impossible. There is an apparent contradiction in the bulkiness of gorillas and ourangs, but these animals must confine themselves to the heavy branches and besides spend much time on the ground. They are scarcely tree-living in the sense of those which spend all the time off the ground.

*Tacitus* mentioned the large size of Caledonians and Germans, and *Cæsar* said the Gauls were bigger than the Romans. *Strabo* says:<sup>5</sup> "The Britons are much taller than the Celts <sup>6</sup> and less blond, but of a gentler temperament. To give an idea of their stature, we have seen with our own eyes in Rome that when scarcely emerged from infancy they would surpass the tallest people in the city by half a foot. It should be added that along with this they are bow-legged and their bodies are generally ill-proportioned."<sup>7</sup>

In time the Roman legions were composed almost exclusively of these tall bulky Northerners, and their leaders became emperors, but as they died out, in the hotter southern climates, the Empire was an easy prey to the still barbarous northern tribes of Goths, Lombards and Vandals. In our Civil War the tallest men came from Vermont, New Hamp-

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<sup>5</sup> Geography, Chap. V, 2.

<sup>6</sup> Gauls.

<sup>7</sup> Quoted by Adolphe Bloch, *Smithsonian Reports*, p. 623, 1912.



shire and the mountains of Kentucky, and at the present time the army is recruited largely from the North.

*Galen* says: "It is said that in cold countries man becomes stout, and, as examples are quoted, the Celts, the Thracians, the Bithynians, the peoples of the Pontus and the Galatians. All these peoples inhabit a cold country, and are generally stout."<sup>8</sup> *Mr. Arthur Hunter*, actuary of the New York Life Insurance Company, in a report from the joint committee of actuaries investigating weight, height and age, says<sup>9</sup> that a comparison of German and Austrian companies shows that, "excluding the extremes of both height and weight, the average weight of the German insured is about 10 per cent. higher than among the insured in the United States and Canada, and that the smaller the stature of the German the more does he exceed in average weight the American."

In the explanation of relative weight we are on safe grounds for there have been careful statistical studies. Bulkiness is certainly a great advantage in cold places in retaining body heat. The greater the bulk the less radiating surface is there per pound of weight. Heavy men can be comfortable in their shirt-sleeves where slender men require heavy clothing. This alone could account for the evolution of stocky men in cold climates—such as northwestern Europe, Greenland and Thibet. On the other hand, slenderness is of vital survival value in hot places, for such men can keep cool where the heavy will die of thermic fever. Europeans in Bengal averaged  $.41^{\circ}$  higher temperature than at home, and in Africa they have an average axillary temperature of  $99.5^{\circ}$ , Arabs,  $99.1^{\circ}$ , and negroes,  $97.8^{\circ}$ , and there is an increase of  $.05^{\circ}$  for every degree rise of the air temperature.<sup>10</sup> Though most of this is the effect of pigmentation, as subsequently explained, bulkiness of the northman is also a factor. *Hartigan*<sup>11</sup> noted that big men did

<sup>8</sup> Quoted by Bloch, *Smithsonian Reports*, 1912, p. 615.

<sup>9</sup> *Journal of the Institute of Actuaries*, London, October, 1912.

<sup>10</sup> Felkin, *Archives of the Roentgen Ray*, October, 1905.

<sup>11</sup> *Journal of Tropical Medicine*, January 15, 1906.



not stand the tropics as well as the small and slender ones like Livingstone, Stanley, Emin and Johnston. Lords Wolseley and Roberts were even below par physically. Big men break down soon, as a rule. Few last many years. The extreme slenderness of the negroes of Central Africa is evidently a great advantage. As subsequently explained, nature goes to the greatest extremes in providing against overheating, since a very slight rise of temperature is invariably fatal in the long run in the case of animals with a well developed nervous system.

The matter has been subjected to statistical study by *Dr. Brandreth Symonds*,<sup>12</sup> who finds from life insurance records that in America overweights suffer an undue mortality from diseases of the nervous, circulatory, urinary and digestive system, and though they have an immense advantage in respiratory diseases, their average length of life is decidedly less than the underweights. Among the cases studied not one overweight reached eighty years of age, while many underweights passed that birthday.

*Mr. Arthur Hunter*, actuary of the New York Life Insurance Company, has reported the matter in greater detail,<sup>13</sup> showing that those slightly overweight (five pounds) are at an advantage at all ages as are also those ten to twenty pounds overweight in the early years, but the rest suffer from high mortality at all ages. The underweights, though having a higher mortality in early years, twenty to thirty-five, are at a very great advantage in later life. This discrepancy merely means that in youth great underweight is often an indication of poor vitality and that a slight overweight indicates greater vigor. An amazing thing is the thinness of very old men in America, the bulky not surviving. These differences would be more marked if Canadians were compared with Americans from our extreme South. The mortality rates as to stature are also vitiated by taking in all parts of the country.

There are no statistics from Europe to compare with the

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<sup>12</sup> *New York Medical Record*, September 5, 1908.

<sup>13</sup> *Journal of the Institute of Actuaries*, July, 1913.



above, but it is safe to predict that in the places cooler than the United States, the mortality rates will not be so great for heavy men nor their lives so short. This evolution has already proceeded so far that in our extreme South the families resident many generations are markedly more slender on an average than those of more recent arrival and more slender than Northern families. The hypothetical types of "Uncle Sam" and "John Bull" are really based on scientific facts dimly observed over a century ago.

Not only is the average life shorter in the United States than in northern Europe, but the power to do hard physical labor disappears five to ten years sooner. In Norfolk, England, nearly every village has some people over eighty, and not infrequently one or two over ninety, while seventy is not considered too old for severe farm labor. Germans as a class are reported to be of much shorter life in America than in their native climate, and though no statistics have been published on the subject it is safe to say that the big heavy men are the greatest sufferers. The hotter the climate in America, the higher is the morbidity and mortality of the bulky men.

Stout tropical natives are found a plenty, but they are almost invariably aristocrats or those whose callings permit them to protect themselves against the climate. The men who must expose themselves in agriculture or the trades are almost invariably slender. Similarly the big tropical animals, like elephants, cannot expose themselves with impunity to the sun, and are largely nocturnal in habit.

The colon is receiving much attention now that *Metchnikoff* and *Lane* have independently concluded that it is not only of no use but an actual harm. It must formerly have been of vital importance to have become so large, but if civilization with its enormously changed food habits has obviated its necessity, and rendered it a nuisance, those races which have been under the influences of civilization the longest should have the smallest colons by ordinary selection. It has been asserted by *Churchward* in the *British Medical Journal* (1910) that savages do have bigger colons and also



a different colonic bacterial flora than the civilized, but I have seen no statistics bearing on this point. Indeed *Dr. G. A. Turner*, of Johannesburg, has been unable to detect any differences between the intestines of Europeans and negroes.

Evolutionists are inclined to deny the harmfulness of the colon on the ground that harmful parts very quickly undergo involution. Some physiologists assert that the organ is still a useful storage, digestive and absorptive apparatus, but that the use is a minor one, as we can do without it for awhile at least. We can do without many of our fingers and toes, but that does not prove their uselessness. Besides, the after histories of cases of excision of the colon are yet to be written. There is unanimity of opinion, nevertheless, that a bad colon is infinitely worse than no colon.

*Sir Wm. Lane* has proved that nephritis and rheumatic conditions are often due to colonic auto-intoxications, and it is remarkable that negroes with supposedly larger colons than white men, have a nephritic death-rate in our registration area of 170 and whites have a rate of 94. The negro also has more "rheumatism," his death-rate being about 10 as compared to the white rate of about 7.

The variations in the length and diameter of the appendix vermiformis have been studied, but no data are known as to whether there is any difference from race to race. If it were as useless as some physiologists think, it should have dwindled more in the civilized. It has recently been reported that it secretes a substance which stimulates peristalsis. If this is true, its persistence is understood, and there should be no differences between the races in respect to it. Its diseases therefore are not in the sphere of ethnic medicine. As with the colon we can live without it.

The beard is an illustration of a character once of survival value, but which is now useless and persists by organic inertia because not specially harmful. Soldiers campaigning in the jungle have found that their faces are badly lacerated unless they let the beard grow as a protection. There is no question then that it was evolved in forest-dwelling primitive men as a protection in hunting. The women who did not



need it did not evolve it. Similarly the female lion and bison did not evolve the heavy mane so necessary for the males in their fights for the possession of the female. Plains dwelling types of man necessarily did not develop a beard. *Dr. L. W. Lyde*, Professor of Geography, University of London, has found that, as a rule, the broad-headed type of man, which is largely beardless, avoids or fears the forest; while the long-headed type, mostly bearded, avoids or fears the plains.

Sexual selection has been thought to be the cause of the development of the beard, those with the most of this ornament being more attractive to the female. Modern women do not think so, as a rule, and yet the beard persists. Besides, the capture of the females was the result of prowess and a beard would give the opponent a better hold in the fight for her possession. As a matter of fact, mating occurs before the beard is well grown. So the only reasonable explanation is that of protection in forest-living types. There can then be no ethnic diseases due to the beard or lack of it in modern man, and its removal is largely a matter of fashion or convenience.

The body hair was quite profuse in primitive men as shown by some prehistoric engravings discovered in the last decade.<sup>14</sup> It seems to have been largely a protection from mechanical injury, as in monkeys, but it disappeared by selection of the least hairy variations. When the climate became cold the hairy were killed off and the only reasonable explanation was greater morbidity from inability to stand the rapid daily and seasonal changes of temperature of glacial climates. We clip our horses so that they will not get overheated and wet under exertion, and we prevent chilling later by careful blanketing. Primitive man soon learned how to clothe himself in skins, and from that moment the hairy were at a disadvantage. The hair has thus disappeared from all types, even the forest dwellers, so that at present the difference between minor variations in this respect do not seem to

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<sup>14</sup> G. G. MacCurdy, *Smithsonian Reports*, 1909.



have any appreciable effect on health. Still, it would not be out of place to look into the question as to whether an excessive hirsuteness is correlated with "colds" or any other disease. During the involution of the hair, there must have been much greater mortality of the hairy.

Certain tropical animals have lost nearly all their body hair,—hippos, rhinos, elephants and carabao. The unknown reason applies to tropical man whose body is remarkably denude of hair as compared with the Baltic type. The latter has even been thought to be nearer the Simian because of this persistence of body hair. The Mongols and Chinese are also very free of body hair so that the cause is not necessarily tropical.

The hair would have been retained if it were of use against cold. Indeed, its absence was no bar to residence in cold climates. *Cæsar*<sup>15</sup> mentions the fact that the land of the Sueves was very cold, but that they wore only a short skin or fur as a garment, leaving part of the body bare.<sup>16</sup> The hair on the head must have been retained for the other purpose of shading the cerebral cells from sunlight. The hair is distributed quite accurately where the cells are nearest the surface. This will be taken up in discussing the effects of the sun.

The patches of hair on the brow, eyelid, pubis and axilla are of self-evident protective use, and the variations between the races are probably explicable.

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<sup>15</sup> Gallic War.

<sup>16</sup> Quoted by Bloch, Smithsonian Reports, 1912, p. 613.

## CHAPTER III

### RESPIRATORY CHARACTERS

The shape and size of the upper air-passages vary considerably from hot to cold countries. For instance, the Arab horse and to a certain extent the thoroughbred English racers and hunters have large open nostrils, large trachea, larynx and lungs. The head is held high and is articulated to the neck in a very obtuse angle, so that when running there is almost a straight line from the nostril to the bronchi. There is no impediment to air-currents, and these animals can endure great exertion without dyspnœa, providing, of course, the heart is also hypertrophied by preliminary training. The larynx is so large in the Arab horse that the angles of the lower jaws are widely separated to accommodate it. One reason for all this is the fact that the air of the habitat of this species is hot and rarefied, so that more of it must be inhaled at each breath to prevent dyspnœa from a too rapid rate of respiration.

This type of horse cannot be established in very cold climates, indeed it generally dies in a few months of pneumonia unless carefully housed. Similarly the English and Irish thoroughbreds cannot stand rigorous climates, and even in the comparatively mild temperatures of their insular climates at home, they must be carefully housed and protected. The Japanese have ceased to import them for breeding purposes, as the winters of the northern islands are prohibitive. The French cavalry are said to have taken Arabs or Barbs to the Boxer campaign in northern China, but all the horses died within six or twelve months of respiratory diseases and the soldiers were remounted on local stock.

Cold climate horses need less bulk of the condensed air,



and their air-passages are much smaller than the Arab's. The nostril is smaller, and admits the air in a ribbon-shaped stream, which is easily warmed and thus expanded. The nose is quite large to supply much warming surface, such as the turbinated bones and septum, and the air must take a tortuous course because the nostril opens obliquely outward and the head is set at a right angle to the neck. This horse is comfortable in very low temperatures, as in Siberia. The bulky forest type of Central Europe cannot stand tropical heat, though the effect is not so marked or intense as the effect of cold on the tropical horse. The highly intelligent Arab horse is said to have a large brain, and his "forehead" with small nose makes the face concave, in marked contrast to the convex face of the more stupid, small-brained Roman-nosed draught or forest horse. The same difference is found between the arctic or polar bear and those living farther south. The former does not hybernate and must stand excessive cold. Its nose is curved like the northern horse, and the type is so unique that it has been erected into a genus by itself, *thalarctus*. The other bears escape the worse cold by hybernation, the nose is smaller, and the face flat or concave, like the Arab horse.

There must have been a severe elimination by disease to have evolved all the separate species of horses which have become fitted to survive after being carried by man all over the world, and man himself should have experienced similar changes at the same time. The nasal index of man, or width of nose divided by its length, decreases from the tropics to the arctics. Negroes, for instance, have wide flat noses with open nostrils pointing forward, while the cold climate types have thin prominent noses with narrow nostrils pointing downward to the mustache. In the former the larynx and trachea are large. In northmen the air is admitted in a very narrow ribbon which is easily warmed in the tortuous course around the turbinated bones. These changes have even affected the anterior nasal aperture. In an examination of skulls at the American Museum of Natural History some years ago, it was found that though the



aperture varied greatly in every type, many of the arctic specimens were very narrow and the tropic very wide. The turbinateds were so generally missing that no comparison could be made, though the impression was gained that they were large in the cold climate specimens.

There is then a climatic reason for the anatomical characters which give the Negro his resonant bass voice, the Britisher his throaty voice, the Yankee his nasal twang, and the Baltic type a rather weak, high-pitched voice in spite of a big body. We rather expect a big larynx and bass voice in a big man and a small larynx and tenor voice in a small man, but the reverse may be the fact in people evolved in hot and cold climates respectively.

*F. Denker* says <sup>1</sup> that the Eskimo, Arabs, Berbers, English and some others are thin-nosed (leptorrhinian); the Chinese, Japanese, Hindus, and Malays are medium-nosed (mesorrhinian) and the negroes and Australians are flat-nosed (platyrrhinian). *Turner*, of Johannesburg, found that the nasal index was greatest at the equator, and with a few exceptions lessened toward the south, showing an undoubted reverse evolution in their migrations to the south after having undergone an evolution of wide nose.

Recently found engravings of primitive man of Europe, fully several thousand years old and possibly of glacial times, depict him as possessed of a very large, prominent nose. Even if these are caricatures, as a few critics believe, they indicate that large noses were such prominent features as to lend themselves to ridicule. It indicates evolution in a cold climate.

When this type wandered to the tropics it must have suffered a dreadful mortality to have evolved such a marked change as the negroid form. Medical literature has no recorded data as to any excess morbidity of narrow nosed types in hot places, but the suggestion has frequently been made that the large, open negroid nose is partly responsible for that race's morbidity from respiratory diseases in cold places.

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<sup>1</sup> Races of Man.



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.

Elevation has the same effect as latitude in narrowing the nostrils. "Abyssinians being hill people have slender nostrils, except where mixed with negroes. The Gallas also have slender, straight, well-shaped noses."<sup>2</sup>

It is generally believed that the tropical races have smaller lungs than cold climate peoples, in comparison to the size of the body. In fact, it is called the "small tropical lung," but there is now reason to doubt this generalization. No statistics have been published on the subject, but recent observations and comparison with animals seem to indicate that the tropical lung is the larger, as with horses, and that it is a factor in the prevalence of respiratory diseases in tropical types which have migrated to cold climates.

In the registration area of the United States in 1910, the negro death-rate from respiratory diseases, except tuberculosis, was nearly double that of whites. Writers have often mentioned the fact that the phthisical quite frequently have large ischæmic lungs and small hearts, while the small lung, or one congested by a big heart or leaky mitrals, is more or less immune. The negro death-rate from tuberculosis of the lungs in the registration area of the United States, 1910, was 405, but the white rate was only 126. There are plenty of causes for this high negro mortality, such as poverty and unhygienic living, but the large size of the air-passages may have some effect. We are frequently astonished at the resonant bass voices of white consumptives. The correlation to big air-passages—too big for our winters—should be investigated.

There has long been a suspicion that a correlation exists between the size of the nose and the catarrhal affections so common in America, where the tropical heat of the summers—particularly in the cities—must cause much distress in those

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<sup>2</sup> Note by Duncan Brodie.



having large, narrow noses, evolved for cold conditions. Unfortunately there are no known recorded statistics on the subject, but as types change in this character as the result of migration, there must be disease and death due to these causes.

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.

The effects of atmospheric moisture have given rise to much speculation, but rarely have writers noted the vast racial differences in respect to the ability to stand extremes of dryness or wetness. Dry climate types do not flourish in moist countries, nor do those evolved in wet climates stand the dry. There must have been great changes in physique to adjust one to these extremes, but beyond the matter of complexion and heat regulation, to be discussed later, nothing is known of any other racial physical differences such as variations in the air-passages and mucous membranes. The Baltic type of man seems to demand a dry soil<sup>3</sup> and does not persist in the marshy districts of England, which are solidly brunet.

Residence of low-level races in high altitudes causes the following changes:<sup>4</sup> more ample and frequent respiration, increased pulse-rate, particularly on exertion, slight rise of temperature, increased oxygen intake and lowered respiratory quotient, increased metabolism of fats and carbohydrates, but diminished metabolism of proteids, increase of body weight of young is relatively more rapid, blood is capable of absorbing more oxygen, the red blood cells are increased in

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<sup>3</sup> Mackintosh, *School Hygiene*, September, 1911.

<sup>4</sup> Watkins-Pitchford, *The Transvaal Medical Journal*, December, 1910.



number roughly proportional to the altitude, the viscosity of the blood and arterial tension are increased, hæmoglobin is increased, and the red marrow of the bones hypertrophies. These changes are not very marked below 5,000 feet, and they are more pronounced in the young.

The red blood cells increase almost at once, according to altitude as follows:

Place.	Altitude.	Red Cells.	Observer.
London .....	50	5,000,000	Gowers
Tübingen .....	1,030	5,322,000	Reinert
Reiboldgrün .....	2,278	5,900,000	Koeppé
Johannesburg .....	5,480	6,864,000	Watkins-Pitchford
Arosa .....	5,905	7,000,000	Egger
Cordilleras .....	14,409	8,000,000	Viault
Balloon ascents .....	15,000	8,800,000	Gaule

*Bauman* is quoted as finding among Johannesburg school boys that 59 per cent. had hypertrophied hearts, 6 per cent. had subsequent dilatation and only 34 per cent. seemed normal. It is quite evident that the body must undergo great evolutionary changes to make it fit to survive high altitude and conversely high altitude races must suffer at sea level.

Perhaps increase of pressure produces the reverse effects and may explain the benefits of such treatment at the Baths of Ems, in bronchitis, emphysema and the sequelæ of pleurisy and pneumonia, the pressure being raised nearly a half atmosphere. *Rooaz* and *Delmas* were very successful in whooping cough by seven-nineteenths of an atmosphere, 30 to 60 minutes daily. The whole effect of increased pressure resembles that of venesection and might be used in place of it, as *Watkins-Pitchford* suggests.

It has often been asserted that race horses raised in high altitudes develop bigger lungs and hearts on account of the need for much bulk of the rarefied air. It is alleged that for this reason they can outrun those raised at low levels. On the other hand, these hypertrophies must be injurious in time. It may be one of the reasons why the Scotch, Swiss, Bohemians and Austro-Hungarians have a high tuberculosis death-rate in New York City.

The increase of red blood cells by altitude may be one of the reasons why mountain resorts are so beneficial to some



consumptives from low levels, though a sudden change may cause hemorrhage. On the other hand, elevation is extremely injurious in pneumonia, and it has been the custom in Montana and Mexico to send such patients to lower levels (2,000 to 3,000 feet) as soon as the diagnosis is made. This injury may be caused by the increase of red blood cells and consequent increase of congestion in the lung.

There is a reaction setting in against the sending of all consumptives to very high altitudes. *Dr. Paul M. Carrington* called attention to this in 1905 <sup>5</sup> in reference to Fort Stanton, N. M., where, at an elevation of 6,000 feet, many do badly. He shows that in many of these cases it is due to defective breathing power where the chest expansion and volume of air inspired are both too small. There is dyspnœa, some cyanosis, increased cough and expectoration and an increase of the infiltrated area.

It is a rule that no part of the body can be markedly changed by evolution without the coincident change of many other related parts or organs. The whole system readjusts itself. There must then be many differences between high and low level types, which make each unfit for the other's environment. We must not be too reckless in recommending change of altitude until all these anatomical differences are worked out and their significance explained. The only things we know at present are the observed facts as to lung affections. This lack of adjustment to a high environment may be the last straw in the case of types of men struggling for existence against other adversities.

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<sup>5</sup> Military Surgeon.



## CHAPTER IV

### PIGMENTATION

The necessity for concealment has caused the evolution of color patterns on all animals which are exposed to the sight of enemies. Natural selection goes to such an extreme that the resemblance to the background may be so exact as to make it impossible to detect the animal unless it moves. Thus the animals of the plains are tawny color, the tiger and zebra have vertical stripes like the lights and shades of tall grass, forest animals are mottled like the shadows cast by the trees, animals on the snow are best concealed if white, and those of nocturnal habits are often black. Birds and many other animals are dark on the upper surface and light beneath, for the sunlight above and shadow below cause them when viewed horizontally to appear of a uniform shade like the background.<sup>1</sup> Man, because of his intelligence in avoiding enemies and stalking his quarry, has obviated the necessity for resemblance to the background.

The law of opacity was first announced by Von Schmaedel in a paper read before the Munich Anthropological Society in 1895. *Dr. R. W. Felkin* was the first to call attention to the matter in English literature.<sup>2</sup> By this law it is meant that light is harmful and must be excluded by pigment. *Bie*, of Copenhagen, long ago discovered that pigmented forms of lower organisms resisted the lethal effects of light longer than the naked. The short rays are the most harmful, and the skin stops them in proportion to the amount of pigment. Protection from the sun is also afforded by hair, feathers or some other arrangement. As a rule, in races of men, the amount of pigment is sufficient to protect from the maximum amount of

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<sup>1</sup> Albert H. Taylor, *The Auk*, April and October, 1896.

<sup>2</sup> *Journal of Tropical Medicine*, September, 1900.



ultra-violet light to which he is exposed at any time in the year in the climate which evolved the type.

Skin pigment is so effective in screening out ultra-violet rays of the uviol lamp that it requires 45 minutes to cause an evanescent redness on a dark skin, while the same exposure for only 10 minutes on the delicate skin of a young girl would raise a blister. One case is reported of indurated eczema in which daily exposure of a half hour to an hour for a week had no apparent result, so effective was the pathological pigment present in such cases.<sup>3</sup> Though strong ultra-violet rays can penetrate quite deeply,<sup>4</sup> they cannot penetrate the pigmented<sup>5</sup> and may be stopped by very thin layers, such as a rabbit's ear. The visible rays penetrate in proportion to their length.<sup>6</sup>

The law of radiation has a very great influence in modifying the intensity of the pigment. Black bodies radiate heat to cooler ones much faster than bright bodies do. The water in a black tea kettle, for instance, will cool off very rapidly in a cool room, and to preserve heat we put the water in a bright tea-pot. For similar reasons, the thermos bottle is brightly silvered to fortify the effect of the vacuum. As a rule, black animals are in the tropics and white ones in the arctics, and this arrangement must aid the former in losing heat and the latter in retaining it. Hence we find that where coldness is combined with darkness the people have the least pigment. Blond men can stand cold far better than the negro, who radiates so freely that he needs more clothing and warmer houses. The inability to radiate heat makes the white man suffer from overheating in the tropics, his temperature rising with that of the air, as mentioned in discussing bulkiness.

The law of absorption is the reverse of that of radiation. The darker a color the more heat it absorbs from a source hotter than itself. A piece of coal lying on the snow will

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<sup>3</sup> Stein and Hesse, *Archives of Roentgen Ray*, August, 1907.

<sup>4</sup> Kline, *Journal American Medical Association*, March 30, 1912.

<sup>5</sup> Sambon, *Journal of Tropical Medicine*, February 15, 1907.

<sup>6</sup> Winkler, *Monatshefte für praktische Dermatologie*, lxvii, No. 9, 1908.



warm up in the sunshine and melt the snow around it, but the snow itself reflects the heat. The tea-kettle is black to facilitate absorption of heat from the fireplace. It is quite evident that the blackness of some nocturnal tropical animals evolved to radiate heat at night is a great disadvantage in the heat of the tropical noon-day sun, so that they are compelled to seek the shade in the daytime like elephants or pass the time in water, like hippos and carabao. In the opposite case of white arctic animals, the whiteness would be a disadvantage if there were any heat to absorb. If there is great heat to reflect, the color is white or a light yellow as we see in those tropical animals which must expose themselves to the sun.

In the case of man, the necessity to radiate heat in hot climates causes the evolution of blackness. The air temperature is always less than body heat, where the blackest men are found. As in the case of other black tropical animals, the negro is at a great disadvantage in temperatures above body heat and has never maintained himself in the hottest climates. In his wild state he is more or less nocturnal, except where fear confines him at night. Throughout the tropics, the dark native, if left to his own instincts, hides away in the shade during midday. In Java, no field work is done on the farms between 9 or 10 A.M. and 3 or 4 P.M. In hot fire-rooms the negro collapses from heat sooner than white men, though the latter, too, will collapse in time.

Some remarkable photographs were made by *Michaud* and *Tristan*, of Costa Rica State College, using ultra-violet and infra-red rays.<sup>7</sup> A negro, a white boy and an Indian woman were photographed together. The negro skin absorbed the infra-rays and reflected so little to the camera that they scarcely affected the plate. The white face reflected so many that it looks unduly blanched. The Indian was between the two extremes. Ultra-violet light was almost totally destroyed in all three and they appeared black—the Indian being the blackest as though the native's skin was more efficient than skins evolved in other climates. In another series

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<sup>7</sup> *Scientific American*, July 27, 1913.



of photographs it was found that a white skin destroyed the shorter ultra-violet better than the long.

In pathological pigmentation the spots break up ultra-violet light better than the clear skin, so that they appear darker in photographs by ultra-violet light than to the eye, as they reflect less to the camera. In some of the exanthems they do this before they are visible, and it is possible to recognize them in ultra-violet photographs a day or two before the eye can detect them. In infra-red photographs they do not show out unless they are very dense. Tanning, then, is an exceedingly efficient protection against ultra-violet light.

Sexual selection unquestionably has a great effect in evolving the best for each particular place. Those with improper pigmentation are necessarily the most sickly and may not marry at all, as each sex is attracted to the healthiest in the opposite. Similarly, the pure-bloods of a race instinctively shun the half-breeds who must marry among themselves, and the type, if unfit, will degenerate to extinction. In Haiti the negroes have ostracized the mulatto. In this country there is an antagonism between the two. In the Philippines the dominant mestizo, or half-breed, despises the "Indios," or pure-blood Malay. In India, China and Japan, the dominant pure-bloods ignore the half-breeds.

In domestic animals, the protection given by man obviates the necessity of concealment from enemies by resemblance to the background. Hence many varieties of animals lose their wild coloration under domestication, if such is in any way disadvantageous, and they assume a shade or color which is a better protection in the local conditions of heat or cold or light or darkness. In our selection of breeders we take the best performers, no matter what their color. Consequently the healthiest, which necessarily have the best colors, survive in time, unless we deliberately breed to color and keep the animals alive by greater care. The horse, for instance, has been carried by man to all parts of the world, though possibly domesticated in southern or southeastern Asia. When "pure-bred" or inbred at one spot for a long time, the survival of



the fittest shades eventually makes all of a uniform color, which may be entirely different from that of another variety only a few score miles away in a different environment. In this way the coat becomes tawny or white where there is great heat to reflect. In hot climates black horses are overheated in the sun, although they do very well if housed in mid-day, because they can radiate so well. Similarly, in conditions of great cold, white becomes common from the advantage of conserving heat by preventing radiation, but blacks die out from chilling. Further illustrations will be given in discussing the effects of heat.

*John Burroughs*<sup>8</sup> quotes Sir John Ross as saying that the Hudson's Bay lemming did not turn white until exposed to a temperature of  $-30^{\circ}$ , when it at once began to whiten and was nearly pure white within a week. Other arctic animals seem to turn white before the great cold comes, but there may be a reflex action from cold itself, causing pigment granules to withdraw from the surface. Light causes remarkable rearrangements of skin pigment in a great variety of fish, lizards, etc. *G. H. Parker*, as a result of experiment,<sup>9</sup> seems to think that as a general rule in both vertebrates and invertebrates, light and cold cause a distal movement of melanophores, and darkness and heat a proximal one; but the degrees of light and heat used are not mentioned.

There is a possibility that some of these changes in skin pigment are due to reflex action through the eye to cause a greater resemblance to the background, as in certain lizards and fish. It is said that in experiments at the Vienna Biologic Experimental Station, blinded specimens did not show the chameleon-like changes of skin pigment when the color of the background was changed. *Pernet* suggests<sup>10</sup> that skin freckling which occurs under the clothing in man, may be due to a similar reflex through the eye.

Day animals generally incline to colors near the lower end of the spectrum, for they thus reflect the rays which are

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<sup>8</sup> *Atlantic Monthly*, June, 1905.

<sup>9</sup> *The Journal of Experimental Zoology*, September, 1906.

<sup>10</sup> *British Medical Journal*, July 6, 1912.



most heating, and destroy the 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 make the animal inconspicuous in its particular background, the commonest color being shades of yellow, with black markings.

The foregoing remarks refer mostly to the coat color, but the skin pigment of animals is of great survival value. *Professor Robert Wallace* is the pioneer observer in this matter. In a paper read in 1887 before the Royal Society of Edinburgh,<sup>11</sup> he announced the great generalization that all the animals of the tropics if exposed to the sun had well pigmented skins—generally black. The few exceptions have red or yellow pigment or are so thickly covered by hair or feathers as to need no other protection. That is, they are all negroid, to exclude light, and if they are exposed to the sun they clothe themselves in a coat which serves the double purpose of reflecting heat and concealing them from enemies. As no color serves each purpose perfectly, the domesticated stock assumes the proper shade as soon as concealment is no longer necessary.

If the fur is very thick the year round, there is no use for skin pigment. In the fox, caribou, glacier bear, musk-ox of the arctics and the snow leopard of Thibet, the skin is white, though the exposed surfaces, lips, nose, etc., are dark or black. In the Rocky Mountain goat the skin is cream color. All the bears—grizzly, black and brown of Siberia—seem to have unpigmented skins. In the white arctic bear, I am uncertain, as the tanned skins are stained and the live specimens could not be approached. It is dark under the thin hair of the snout. Both the red and white fox have white skins, as also have the rabbit and beaver. If the thick winter hair drops off in summer the skin is black as in Prejevalsky's wild horse, or if the hair is thin the year round, as in the Arab horse, wild ass and blanketed tapir, which has a white patch of hair on the back and sides. The skin of the zebra is black,

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<sup>11</sup> Proceedings, vol. xv, p. 64.



even under the light stripes, and the inner third of all the hair is said to be of a uniform dark color—a phenomenon also seen in certain horses, which are dark color when clipped. The only horses with white skins are found in the cloudy dark northwest corner of Europe, and even they are yellowish or pinkish rather than white. They cannot survive light climates. The same may be said of other white skinned domestic stock.

The skin of tropical monkeys is black on exposed surfaces as a rule, but under the hair it is generally light. If the hair is a very good shade, as in the red-howler of South America, the skin is white. In those which never leave the dense shade of trees the pigment of exposed surfaces is less dense, the chimpanzee being of a purplish gray and the Rhesus of central India a pinkish light yellow. The pithecia is a Brazilian monkey with long black hair all over, even to its tail, like a Persian cat. Its skin is white up to the tip of the nose, which is black. The young gorilla on the other hand has short hair and its skin is very black. The mouse deer, the smallest of the deer family, scarcely bigger than a guinea-pig, lives in the dense shade of the tropical underbrush, and has white hair and skin. The bush-buck lives in the shade of tropical forests and is the only tropical antelope with a light colored skin. The colors of domestic stock are explained in the chapters dealing with the effects of light and heat.

The following facts are taken from *Watkins-Pitchford's* work on the etiology of cancer.<sup>12</sup> The earthworm is pigmented red only on the half of the body which is protruded into the light. The rear half in the burrow is slate gray. The intestinal worms of man are devoid of all pigment. The metallic chitine on the surface of insects is a great assistance in reflecting light, likewise the scales of reptiles and fish and of the legs of birds. Animals which expose the whole body to light are equally pigmented all over, but those living on the ground are almost always lighter on the ventral parts as in some frogs, lizards and snakes. The "feathers" or "hairs"

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<sup>12</sup> Wm. Clowes & Sons, London.



of many insects are of great assistance in reflecting light and may replace pigment. In lower vertebrates exposed to light, the mesoderm which lines the body cavity is pigmented if the ectoderm is not, and the pigment only appears under the surface which is turned to the light. The peritoneum of certain colorless fishes is sometimes very black and is colorless in those of dark skin. The genuinely black-beetles are usually remarkably white within. On the other hand *Burke* says <sup>13</sup> that "apparently the peritoneum is never white or silvery when the epidermis is black." The pigment on the parts of oysters exposed to light when the shells separate a little is evidently protective, for it is lacking at certain depths and when covered with mud. If one shell is removed and the oysters exposed to light, 80 per cent. die in a few days, but the survivors turn brown and then black while they are regenerating the shell. <sup>14</sup> If kept in darkness the pigment is not produced.

Similarly in white men the pigmentation of the pia mater, particularly of the cervical cord, seems to be protective, but nothing is reported as to whether it is present in the negro. This pigment may become very profuse in disease where the skin pigment is also affected. *Maclachlan* reports a case in the *Journal of Medical Research*.<sup>15</sup> The pigment may appear in the pia mater, arachnoids and ependyma of the ventricles.

The birds are so thoroughly shaded by feathers which are opaque, even if white, that there is no need of skin pigment. *R. M. Strong*, of Haverford, Pa., has investigated this point as to white feathers and his work has been commented on by *Science* <sup>16</sup> 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

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<sup>13</sup> *Science*, October 6, 1911.

<sup>14</sup> Schiedt, *Science*, August 21, 1914.

<sup>15</sup> January, 1914.

<sup>16</sup> February 13, 1903.



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, 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."

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. Nevertheless, the black birds do seem to seek the shade now and then in mid-day in contrast to the way the white ones stand in the sun all day, such as the crane and carabao bird.

The brilliant metallic colors of certain insects or birds are due to an exceedingly thin layer of pigment on the epidermal scales or feathers. It absorbs some wave lengths and reflects the rest like a metal, giving the appearance of gold, silver or copper or of any color of the spectrum. They are all light-proof, but there is no known cause for the variety of reflected colors. In some cases a silky sheen is due to the hairs grown for protection from light. In others there are parallel ridges a thousandth of a millimeter apart, and these cause diffraction and the appearance of any color in the spectrum.

It is generally accepted that in man's skin there are at least three separate pigments—black, red and yellow,<sup>17</sup> and that these never blend in hybrids. The mulatto's color is due to the fact that the darkest "characters" are recessive and the lighter dominant. In later generations the pigments reappear and the children present every variation from black to near white. By the death of the unfit, the descendants of

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<sup>17</sup> Ramaley, *Science*, April 10, 1914.



mixed types may revert in time to one type, and all trace of the other be lost, not even a memory of it remain, as among the ancient Greeks and Romans after the death of the blond prehistoric invaders who really began European history. That is, by *Mendel's* law, a pure human type may be in time extracted from a mixture. Such a process of course requires the constant elimination of one type to prevent further contamination of the other. It is therefore within the bounds of possibility that men of Mediterranean type which constitute the modern Greek, may be lineal descendants of blond, Homeric Greeks who married the dark autochthones whom the invaders conquered. Similarly the dark Hindus who pride themselves on being Aryans may be descended from blond Aryans, but every bit of Aryan blood may have been distilled out two thousand years ago. The chances as explained later are nevertheless all in favor of those who declare that the blond mixtures all perished and that the modern Greeks and Hindus have not descended from Aryans.

The significance of color in man's skin has never been explained. The only generalization possible at present is that where the climate is cold as well as light, as in northern Asia, and where a dark color would be unsuitable as radiating too greatly, a color at the lower end of the spectrum, yellow or red, is selected, since it is opaque enough to stop the ultra-violet and yet not so dark as to endanger the organism by radiation. This is seen in the northern Mongols, Thibetans, Esquimaux and Indians of northeastern America. In great heat, as in Arabia, where the black man is exterminated, the color must be light to reflect heat, and yet opaque enough under the protection of white outer garments to exclude ultra-violet. The red tint of the cold climate complexions is very efficacious in preventing the transmission of shorter lengths. Experiments have shown that the red color of the blood absorbs the Finsen light so effectively that photographic paper on the opposite side of the ear is not affected in five minutes, but if the blood is squeezed out by pressure, the paper blackens in twenty seconds.

The disappearance of pigment of cave animals, which



have wandered in and taken up permanent residence, can be explained by the law of survival of those not so burdened. Food is very scarce and economy necessary. Still, there may be a disadvantage of pigment, such as too great radiation of heat. Fish develop pigment only where needed for concealment, generally on the upper surface. Whether looked at from above or below, they are inconspicuous. Under the direction of *Milne-Edwards* of the Paris Museum, *A. Viré* watched other changes going on in fish kept in the catacombs, as described by *Cosmos* a few years ago. *Viré* believed that many species of cave animals were survivors of very ancient forms, which have disappeared from the surface fauna.<sup>18</sup>

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, the upper being dark. Perhaps this is the way it seeks food from a lower level. Other animals have phosphorescent spots which seem to lure their prey, as described by Hoyle of the Challenger expedition. The eye is absent in deep sea fish which do not move around, but some kind of an eye is present in all free-swimming species.<sup>19</sup>

The pigment of deep sea animals has never been explained. Some are devoid of any, but when present it is uniformly distributed over the body and might be of use in concealment from the flashes of light produced by its enemies in the otherwise intense darkness. The animal is inconspicuous whether seen from above or below. Pigment would be a tremendous disadvantage in radiating heat if the ocean bottom were as cold all over as we know it to be in some places. Water is densest at 40° F. and sinks to the bottom, but it is said that arctic currents keep it still colder, even below 32° here and there, since salt water under pressure freezes at a lower temperature than this. There might be variations from place to place, due to warm currents and differences of

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<sup>18</sup> See also *Cave Vertebrates in America*, by Carl H. Eigenmann, Prof. of Zoology, Univ. of Indiana.

<sup>19</sup> M. E. Hérichard, *Cosmos*, 1905.



elevation in the same way that both air and water currents and elevation modify terrestrial temperatures. Moreover, we know nothing of the laws of radiation and absorption of heat in water under such tremendous pressures.

The brilliant colorings of fish in the upper layers are said to be always for concealment against a background of brilliantly colored vegetation. The color varies with the amount of light. *Hjort* says <sup>20</sup> that in temperate latitudes the black fishes and red prawns taken in the daytime, were from a depth of 500 meters or more, where there are no red rays. At night or in northern latitudes they are nearer the surface. Above the 500-foot level the fish have silvery sides—probably a protective coloring, as they are invisible from below as well as from above. Medusæ above 250 to 300 fathoms are iridescent and have little pigment. Those below are red or brown, and *Bigelow's* observations on cyclogasteridæ seem to show that while variegated colors exist in the upper strata, pigment increases with the depth as a rule. He also states that there may be a faint phosphorescence at great depths from light-producing organs or decaying animal matter, for which some species are furnished with very large eyes. Fish at depths below the light line "are typically of a uniform coloration, which is usually black." There is no explanation for this increase of pigment with diminishing light—the reverse of the rule in cave animals, unless it be to make them inconspicuous in phosphorescent light. The relation of the pigment to the temperature of the water has not been studied.

There is no explanation of the manner in which most substances break up light impinging on them, change some of the wave lengths to other forms of energy and reflect the rest as a color. It, of course, has some relation to the size and shape of the molecules, their distance apart and relative positions, but only a beginning has been made in this study.<sup>21</sup>

We have been so overwhelmed with literature alleged to be scientific in which it is repeatedly said that sunlight is absolutely necessary to animal life, that it is well to examine the

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<sup>20</sup> *Geographical Journal*, May, 1911.

<sup>21</sup> *Curtiss, Journal American Chemical Society*, June, 1910.



facts and see if they do fit into the above observations. *Professor Morgan*, in his work on "Regeneration,"<sup>22</sup> states that there is only one animal (endendrium, a hydroid) in which light (violet) is needed for regeneration of a new animal from a part. 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 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 animals seen were a few butterflies with black wings.

The ocean covers three-fifths of the earth's surface, and the 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 we thought depended upon the 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.

As for the colors of animals, irrespective of "protection," "mimicry," "sexual purposes," protection from light and heat, 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

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<sup>22</sup> Macmillan, p. 30.



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.<sup>23</sup>

The method of the production of pigment is unknown, though many investigators have spent years on it.<sup>24</sup> The only thing we should keep in mind is the fact that it must be a benefit, and that the main use is a protection from the sun's rays, and that it is preserved by heredity and perpetuated by natural selection.

Primitive man had the same needs as the lower animals and must have been pigmented sufficiently to prevent injury. Modern man is invariably covered with a pigment in proportion to the light and heat of the country to which his ancestors have proved their adjustment by millenniums of survival in health and vigor. The air absorbs both heat and light according to the obliquity of the rays or the distance they must traverse. Until the rising sun is ten degrees above the horizon, its rays have scarcely any actinic power, and its effect increases slowly until  $65^{\circ}$ , after which it augments rapidly to the zenith maximum. More than half the total light at any place is received between 10 A.M. and 2 P.M. and more than seven-tenths between 9 A.M. and 3 P.M. The amount of light transmitted by the air varies slightly with the temperature, so that hot days are really lighter than cool ones, and the afternoons lighter than the mornings.<sup>25</sup>

In high latitudes where the sun is never near the zenith there is then little need of pigment, except as a protection from snow glare. For instance, at a place  $48\frac{1}{2}^{\circ}$  north, the noon midsummer sun is only  $65^{\circ}$  degrees above the horizon,

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<sup>23</sup> Hargitt, *Science*, January 22, 1904.

<sup>24</sup> Schiedt, *Science*, August 21, 1914.

<sup>25</sup> Dr. Thomas Nogier, *La Lumière et La Vie*.



but for every degree nearer the equator the actinic effect in mid-summer rises so rapidly that man's pigmentation increases rapidly. This parallel might be said to separate the blonds from brunets. At a place  $47^{\circ}$  north, the noon mid-summer sun has the same altitude ( $66\frac{1}{2}$ ) as at the equator, but on every other day of the year the equatorial sun has more power and the rays at  $47^{\circ}$  north have less. The farther north of  $47^{\circ}$  we go the less, then, is the need of pigment and the farther south the more. Blonds apparently arose north of  $50^{\circ}$ , the olive between  $45$  and  $35^{\circ}$ , the brown between  $35$  and  $30^{\circ}$ , and the black negro within  $25$  or  $30^{\circ}$  of the equator. Elevation causes these zones to assume irregular shapes. 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, brunet in central Europe, and blond in the northwestern section of Europe, embraced by a curve passing through northern France, northern Germany and northwest Russia. No race on earth is wholly devoid of pigment, even the most xanthous have some. The Albino is a pathologic variation and appears in all races.

In every country of the world the population darkens toward the equator. In America the aborigines had every grade of complexion from the near white of the New England tribes to the near black in the tropics of South America. The white Americans already show the same trend, and observers have reported that in each of the following countries the northmen are lighter than the southmen: Italy, Spain, France, Germany, Scotland, Ireland, England, Russia, Egypt, Persia, India, Japan and China. When nationality or language prevents migration across a political line, the above rule is slightly disturbed, for we may find that the types just north of the line are slightly darker than those immediately south of it.



From a comparison of *Ripley's Map of Complexions*, and *Bartholomew's map of cloudiness*, we can deduce the further law that in Europe the blondness of a place is proportional to the cloudiness. Southern Norway seems to be the cloudiest part of Europe and the blondest, and if we draw a line from this center in any direction, the proportion of brunets increases. For this reason the northern third of France has more blonds than the southern third of Germany. They flourish best where there is less than 1,250 hours of sunshine per year—Scandinavia and the northern parts of Ireland and Scotland. Exceptions to this rule are found where snow glare is excessive. They barely hold their own up to 1,500 hours—a European zone around the above with an extension into Switzerland and the northeast and southwest corners of the United States. They tend to die out if there is more than 1,700 hours—south central Europe and the northern half of the United States. They perish more quickly if there is more than 2,500—the Mediterranean basin and the southern half of the United States, and they cannot stand more than 3,000 hours without serious injury in one generation or even a few years—as in our extreme Southwest and the tropics generally. Elevation may reduce the sunshine to less than 1,000 hours, and this fully accounts for the blondness of certain mountaineers mentioned later.

The kind of clouds affects the amount of light, for those which reflect the sun's rays may cause more glare than comes from a clear sky, but fogs, mists and thick clouds diminish it. The per cent. of cloudiness therefore does not indicate the amount of light. In some climates, also, the sunny days are in the winter and in others in the summer. The latter would necessitate more pigment. Besides, 50 per cent. of possible sunshine in the tropics would be much more powerful than 50 per cent. in the extreme north. Hence the isonephs (lines of equal cloudiness) or isohels (lines of equal duration of sunshine) do not correspond with the zones of complexion. More information could be derived from isophots and isotheres or lines of equal light and heat, but there have not been sufficient observations to construct them. Even these would



not be perfect, as pigment must protect from the maximum intensity rather than total amount.

Maps of humidity and rain in a limited area such as Europe, show that blonds flourish where there is much moisture as in the northwest, and that brunetness increases with aridity. This does not apply in the rest of the world. Places in the tropics may have enormous rainfall, but the sunshine in the intervals may require much pigmentation, though in the rainy season the clouds reduce the light so greatly that even blonds do not suffer. For this reason blonds last longer in tropical wet climates than in the dry.

The great pigmentation surveys were made by *Beddoe*,<sup>26</sup> *Virchow*, who shortly after the Franco-Prussian war induced the government to take a census of the colors of hair and eyes of school children, *Guillaume* in Switzerland, *Ranke* in Germany and *Tocher* in Scotland.<sup>27</sup> *Dr. C. B. Davenport*, of Cold Spring Harbor Laboratory, has written very largely as to the transmission of human pigmentation.

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<sup>26</sup> *The Races of Britain*, 1885.

<sup>27</sup> *Biometrika*, 1908.



## CHAPTER V

### ETHER WAVES

In order to explain the use of pigment as a protection from heat and light, it is necessary to have some understanding as to what constitutes these rays or waves and how they affect matter, living or dead. The discovery of radium has completely revolutionized our conceptions of matter and energy, and though the discoveries since then have allowed physicists to orient themselves, there are still some unsettled points. 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 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 [or period], dashing about in all directions or rotating with inconceivable velocity."<sup>1</sup> The number of corpuscles composing atoms 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. They are emitted from radium in a much greater degree than from any other radio-active substance known.

When an electron is started to move, or is stopped from

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<sup>1</sup> Sir William Crookes, *Science*, June 26, 1903.



moving, it causes a strain or stress in the ether and this strain travels out like a wave with the velocity of light. These 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 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.

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

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 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

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<sup>2</sup> *Science*, February 5, 1904.



the longest ones we receive from the sun, and there is probably no gap between them and the shortest *Hertz* waves. 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.

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, 400 to 750 trillions per second. 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. Forel* states<sup>3</sup> 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 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.

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 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-

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<sup>3</sup> *The Sensation of Insects*, Paris, 1902.



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.

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 the retina in addition. The red and infra-red cause heat vibrations better than the others, and the violet and ultra-violet 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.

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. The wave length of X-rays is smaller indeed than the diameter of a molecule.<sup>4</sup> They are probably beyond the smallest ultra-violet in the sun's rays. *W. Wien* calculates the length as  $6.75 \times 10^{-9}$  centimeters, while the value assigned by *Haga, Wind* and *Sommerfeld* is  $1.34 \times 10^{-8}$ .<sup>5</sup>

*Roentgen* rays are produced in the same way as other ether waves, that is, by the alterations in the movements 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. Not all the corpuscles of the *Cathode* rays are stopped by the glass tube as the physicists once taught. *Sir Oliver Lodge* says <sup>6</sup> that some penetrate 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. 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

<sup>4</sup> Norman Shaw, *Revue Scientifique*, Paris, Aug. 16, 1912.

<sup>5</sup> Gesell. Wiss. Göttingen, Nachr., Math. Phys. Klasse, v, p. 598, 1907.

<sup>6</sup> *Archives of the Roentgen Ray*, April, 1904.



ultra-violet. The penetrability of X-rays depends 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. *Crookes* says,<sup>7</sup> 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."

Radium has been shown to emit two streams of material particles, named alpha and beta. The beta rays are composed of negative electrons or corpuscles moving at great speed, probably two-thirds of the velocity of light, or even faster. The alpha 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—six to sixteen thousand miles per second.

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, though the corpuscles themselves lose half their energy in forcing their way through five millimeters of aluminum.

*Shaw* has shown that the gamma rays are "harder" than

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<sup>7</sup> *Science*, June 26, 1903.



the X-rays, and the wave length much shorter, "probably not less than one-tenth or at any rate one-hundredth," probably less than atomic size. There is then every size of ether wave, from the longest *Hertzian* to the shortest gamma rays.<sup>8</sup>

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 farther with no more loss. The slow positive stream of course gives rise to much longer ether waves than the negative or beta stream.

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.

*Di Brazza* claims to have found other rays coming from the brain during psychic effort. He calls them I rays, but their existence is not confirmed. It may be fluorescence from the skin. Indeed every little while an announcement is made of some new ray. Whether it is possible to have a shorter ray than the shortest gamma remains to be seen.

All ether waves are produced by the same cause, i.e., changes in motion of the atoms of electricity called corpuscles, which compose 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 is of the same character but more intense than the ultra-violet which, in turn, is more intense

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<sup>8</sup> Bragg, *Science*, Dec. 4, 1914.



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, atoms, or molecules 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 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 its stress, as we do of the ether stress, yet we cannot deny either. Since the discovery of corpuscles, not a few physicists have decided that to explain these rays, it is not necessary to assume the existence of the ether at all, though Sir Oliver Lodge thinks that we will find that all matter is composed of ether, and that the connection between the two is electrical.

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<sup>9</sup> "we have actually touched the borderland where matter and force seem to merge into one another." Many physicists have elaborated 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 or chemical means alone.

In speaking of the nature of nerve stimulation and changes in irritability *Professor A. P. Mathews*, of the University of Chicago, says:<sup>10</sup> "It is well known to all that the

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<sup>9</sup> *Science*, June 26, 1903.

<sup>10</sup> *Science*, March 28, 1902.



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."

While we are far from understanding the construction of the atom, we are making progress, and recent discoveries suggest that electricity is the only constituent of matter.<sup>11</sup> Each atom is composed of negative atoms of electricity or corpuscles moving in planetary orbits which have not yet been worked out, though several theories are under discussion.

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 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. Under the influence of short rays of any kind some substances give out a brilliant color. The bombardment of corpuscles from radio-active substances is particularly efficient in bringing out these responses. The 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 toward the slow end of the spectrum. They have little or no actinic effect.

*Schott* has devised a modified uviol lamp which he calls the fluorescent lamp. It gives very little light but is so strong in ultra-violet that it brings out brilliant colors in all fluo-

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<sup>11</sup> Wilson, *Science*, March 29, 1912. The Structure of Atoms.



rescent substances brought near it—rhodamin, fluorescin and uranium glass, also vaselin, lanolin, soap and even the human skin itself.

The cold light of fireflies has never been explained beyond the fact that it depends upon a curious chemical substance, and that it needs water and oxygen. Fully 96 per cent. of the energy used appears as light waves. The relation to phosphorescence and fluorescence is very close, depending on its own energy like the former and producing only a limited range of vibrations like the latter.

Radio-activity seems to be of as great importance in ethnic medicine as in therapy, and a clear idea of it is necessary, at least as far as physicists have explained it. There seems no doubt now that corpuscles are flying off from all substances. That is, everything is radio-active, though only a few substances of high atomic weight possess the property in a great degree—the metals in the group of uranium, radium, thorium, barium, strontium and calcium. The alpha rays flying off from radium constitute helium charged with negative electricity and radium itself is derived from a similar disintegration of uranium. When corpuscles leave an atom, those remaining form a new substance. Hence it is stated <sup>12</sup> that dissociation of atoms is a general property of matter, a general phenomenon of nature. It is slow of course, as according to *Soddy* it requires 2,500 years for radium to disintegrate, and infinitely longer ( $7\frac{1}{2}$  billion years) for uranium. Radio-activity is increased by various chemical reactions, electric discharges, heat and by the impact of light and particularly by ultra-violet rays. The corpuscles stream out from the negative pole of a *Crookes* tube, or any clean negatively charged surface, especially a metal, and all hot bodies such as white hot metals.

There is an enormous amount of energy released when an atom breaks up. Radium, for instance, heats an equal mass of water from the freezing to the boiling point every hour, but in a year it loses only one twenty-five hundredth of its mass in doing so. A gram of it could transport the British

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<sup>12</sup> Gustave le Bon, *Smithsonian Reports*, 1903.



fleet to the summit of Mont Blanc. *Professor Frederick Soddy*, University of Glasgow, explained this matter popularly in *Harper's Monthly*, Dec., 1909, taking the facts from his own book on "The Interpretation of Radium," *Professor Rutherford's* "Radio-Activity," and *Professor Jolly's* "Radio-Activity and Geology."

*Bacon*<sup>13</sup> has found that tropical sunlight enormously increases the radio-activity of the air. He showed that the decomposition of oxalic acid by the short sun's rays (using uranyl acetate as a catalyzer) was five to twenty times greater in Manila in July than in Chicago in June. The sun impinging on the skin must then cause a great disintegration of atoms unless the ultra-violet rays are filtered out and destroyed or "stepped down" to harmless waves of slower rate. This is what is done by skin pigments.

The emanations from radium and thorium (mesothorium) are becoming of considerable therapeutic importance, but as far as known they have no relation to ethnic studies. It is not necessary then to give the complex classifications of these substances. *Dr. Carl von Noorden* described them in his American lectures<sup>14</sup> together with the length of time it takes each to disintegrate, i.e., from a few seconds in the case of thorium A, to billions of years in the case of uranium.

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<sup>13</sup> *Philippines Journal of Science*, 1910 (A.).

<sup>14</sup> *New York Medical Record*, January 18, 1913.



## CHAPTER VI

### ACTION OF ETHER WAVES ON PROTOPLASM

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. 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 temperatures, though they could at much lower ones. 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, as 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 the



particular note, on a violin for instance, until the resonator vibrates so violently as to be bent beyond its limit of cohesion, and is shattered 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. 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, as a rule far below  $212^{\circ}$ , 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  $99^{\circ}$  or  $100^{\circ}$  F., and is destroyed promptly by a temperature of  $120^{\circ}$  F., though a temperature of  $105^{\circ}$  may take some days or weeks to break up the molecule. The short rays also are able to increase the orbicular motion of the atoms in the molecule and cause such a rearrangement of them as to constitute a new substance. For instance, if glass contains manganese, ultra-violet rays cause a change of color, which varies from a pale amethyst to a deep violet black, but upon heating, the atoms and molecules rearrange themselves and the glass becomes clear.<sup>1</sup> Old window panes thus become tinted, and at high elevation in the tropics, as in Bolivia, the color comes on more quickly because the ultra-violet are more intense. The glass globes of *Welsbach* lights are also colored very quickly.

The chemical changes in rubber are due to the ultra-violet rays of the sun. Hence rubber ages or loses its elastic properties very rapidly in the tropics. The rays of an ultra-violet lamp will age rubber in one or two hours as much as three years' exposure to the diffused light of the temperate zone. This lamp is now used in the testing of rubber for commercial purposes. The changes in paints are also due to ultra-violet rays, but as they do not penetrate graphite it is the most durable. There is probably some such reason for

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<sup>1</sup> *Archives of Roentgen Ray*, August, 1905.



the durability of zinc oxide and lead carbonate paints. They are said to absorb the infra-red as well as carbon pigments.

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.

Living substance is composed of three inert substances—nitrogen, carbon dioxide and water—formed of elements of low atomic weight. In the atoms there are few corpuscles as compared with the poisonous elements, like mercury and arsenic, all of which are of high atomic weight. The other elements, like sulphur, sodium, calcium and chloride found in living cells are in exceedingly small amounts. The cells use calcium and other elements in building up their environment, such as the supporting framework and fluids. It seems that the more corpuscles there are in an atom, the easier it is for that atom to disintegrate, and the firmer are the unions it forms with the more inert substances of lower atomic weight—oxides, sulphides, carbonates, chlorides, etc. The atoms composed of the smaller numbers of corpuscles, hydrogen and helium, are stable enough to constitute hot nebulae, which are primitive worlds. That is, a few corpuscles can group themselves into a more or less "satisfied" or inert chemical, such as argon or nitrogen, but the greater their number the more unstable the grouping, as in radium. When these simple stable atoms group themselves together, the resulting molecule, such as a nitrate, must be very easily modified or destroyed. Elements of high atomic weight on the other hand are "unsatisfied" and their compounds, such as oxides, are very stable and unsuited for vital processes.

Physicists, chemists, geologists and biologists agree that living modern protoplasm arose by gradual steps from these simple groupings of nitrogen in the primitive hot earth. The



simple nitrogen compounds were in their turn derived from the helium or hydrogen gas of which the earth was composed when in its nebulous state. *Dr. Shaefer*, Professor of Physiology at Edinburgh University, made this evolution the subject of his presidential address to the British Association in 1911. *Prof. L. P. Henderson*, of Harvard, has recently gone a step farther and announced the essential unity of "living" and "dead." A cooling helium nebula necessarily forms unstable combinations between the elements formed from its corpuscles. Hence, in the evolution of worlds, life necessarily appears. It is an essential property of the things matter is made of—the instability of the large groups of corpuscles, and the instability of the molecules formed of stable atoms composed of small groups of corpuscles. All worlds must harbor some form of life between the primitive nitrogen compound and perhaps a superman. A dead world is impossible unless it be cold.

Many dead substances exhibit phenomena which we formerly considered vital and we have found that many vital phenomena are purely physical. This great overlapping borderland of phenomena common to the living and dead has been erected into a special science of "plasmology" by certain French writers. Incidentally it might be mentioned that the old materialism of the early nineteenth century has collapsed, because living things exhibit co-operative phenomena not explainable on the theory of their material nature, similarly the old vitalism is no longer held, because all vital phenomena can be explained without calling in a special transcendental thing called life.

In an article on "Modern Vitalism,"<sup>2</sup> it is shown that everything we consider alive is an unstable community of dependent specialized units which are so different from each other that they exist merely by mutual aid. This is true of humanity composed of nations, nations composed of men, men composed of cells, cells composed of still simpler organs, these in turn composed of groups of molecules of protoplasm, these

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<sup>2</sup> *New York Medical Journal*, August 26, 1911.



molecules composed of atoms, and atoms composed of corpuscles of electricity.

We can destroy the "life" of any living thing without killing the units of which it is composed. Indeed, *Leo Loeb* cultivated mammalian cells in glass as early as 1898, and reported it in *The Johns Hopkins Bulletin*. For similar work *Carrel* received the Nobel prize. We can kill a nation without injuring a man, and will some day be able to kill a cell without killing the protoplasmic units composing it. When we destroy a molecule of protoplasm its constituent atoms are not hurt, and if we disrupt the atom the corpuscles live on forever.

"Life," then, seems to be the team-work of groups of specialized unstables which unite for survival through mutual aid. Life may be said to exist wherever such dependent groupings exist. The stability of certain compounds like mercuric chlorid prevents the formation of living combinations, and they cannot be made to "live." Therefore the idea of a special vital principle, fluid or ether which enters a dead thing to make it alive, and departs at the instant of death, is gradually being abandoned by the scientific world.

The "soul," by the way, is a theological conception of an immortal non-material "spirit" which comes from without and dwells within a very few living groups of cells called mammals, but there is no unanimity of opinion as to whether it enters at the instant of union of the spermatozoon and ovule or defers the matter until later. The present trend is to exclude the soul from scientific discussions of matter, and a man can be truly scientific whether he believes in it or not, for it is a matter of the belief or faith which is the foundation of all religions. This whole subject is discussed to emphasize the extreme instability of living things, and how easy it is to disrupt that co-operation which keeps the group and units in existence. Then we can appreciate the profound effects of all ether waves on living protoplasm as described later.

It may be said that death is mere disruption of team-work. A man may be "part dead" from gangrene and yet be conscious. A severed aorta ruptures co-operation and the mam-



mal is "dead" in one sense, even though conscious a short interval. But by quick work we can unite the artery, and "consciousness" or brain function will return. Again, an animal may be "dead" from an electric shock, and yet every cell remain alive for a long time, hours or days perhaps.

Both the old terms, "materialism" and "vitalism," are being replaced by the idea of "co-operation." The words "life" and "death" do not convey the exact state of a body which has received a lethal disruption of co-operation, but which is still functioning for a few instants. In the new sense of the words a man can really be brought from death to life as we see in resuscitation after suffocation or electric shocks. The chemists are certain that in time they will make from dead things the living substance called protoplasm, and feed it and watch it grow as *Loeb* did with bits from animals.

Protein substances<sup>3</sup> are complex aggregates of certain large and small groups, and it is possible for protein to exist after the elimination or destruction of several of the smaller groups. This explains the gradual fading of function of a cell exposed to various rays which are not strong enough to kill it outright.

Not only do animal cells pass their whole existence in more or less darkness, but vegetable cells are even more protected. The growing and multiplying ones are under the bark or in the roots. Therefore the popular idea that light is "life giving" and that living protoplasm depends on light, has no basis in fact. Moreover, all biologists are now quite unanimously of opinion that the first appearance on earth of a material which could be called "living" in the general sense of that word, occurred at a time when the earth was so surrounded by clouds as to be in almost if not complete darkness. If we trace this primitive protoplasm back through its ancestors to the first unstable nitrogen compounds formed in the cooling atmosphere, every step was in complete darkness and at each stage we could call it living. Later these compounds all perished except those which received protection and accretions in the aqueous or solid crust of the earth, evolutionists

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<sup>3</sup> Professor J. H. Long, *Science*, July 1, 1904.



being divided as to whether these steps occurred in the land or water.

The sole purpose of light is to furnish energy to destroy the combination of carbon and oxygen in the carbonic oxide of the air and the hydrogen and oxygen in the water derived from the soil, and deliver the products to the living cells of the leaf to manufacture into hydrocarbons. The essential food of plants is the nitrogen which comes up through the roots, together with the small amounts of calcium and other salts needed to build up the "house" of the cell—the cellular coverings and framework of wood. The engine for transforming the energy is the green chlorophyll, and the biologic physicists and chemists are making fair headway in working out all the steps. It is evident that primitive protoplasm and its simple nitrogenous ancestors existed for ages before any of them evolved this chlorophyll machinery for manufacturing part of their food from the air; indeed at first there was not any free  $\text{CO}_2$  in existence. They grew by assimilating accretions from the environment in other ways, like the existing plants devoid of chlorophyll.

It might be said here that the main difference between multicellular plants and animals is the fact that plants must have their food in solution, while animals secrete enzymes which dissolve solid foods. The protoplasm must have the food in solution in each case, and as far as we know there is no essential difference between the protoplasm of plants and that of animals. The non-chlorophyll plants, mostly unicellular, still absorb their food from the solutions around them, i.e., they float in their nutriment like their primitive ancestors. The rest of the living world, by grouping together for teamwork, evolved ways of getting some food from atmospheric gases by means of chlorophyll and energy, or they evolved ways of getting it from the solids built up by other organisms. Nevertheless, the living material in the cell still requires its food in solution; and, as a fact, in both plants and animals the cells really float in their nutriment—the juices of the plant in one case and the serum from the blood in the other. There is then absolutely no difference in their manner



of living, from that of the primitive simple unstable nitrogenous molecules which in the course of æons of time gradually became so complex that they deserve the name of molecules of protoplasm. These in turn, grouped in greater and greater number, and finally each group surrounded itself with a membrane for protection and constituted the first unicellular organism from which the multicellular evolved by mere grouping.

If organisms 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 multicellular organisms were originally motile and aquatic. Terrestrial forms are adaptations to changed conditions of water supply and to save themselves from death by drying.<sup>4</sup> But they are all essentially alike. Indeed, experiments show "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."<sup>5</sup> Plants must use kinetic energy of some form to build up their food, i.e., by photo-synthesis, chemo-synthesis, electro-synthesis or thermo-synthesis.<sup>6</sup> Animals and a few low organisms, bacteria, etc., which are often considered animals, must have their energy supplied in potential form to be used at their leisure. Plants grow only when the energy is delivered to them, but animals grow at all times, as they carry the stored energy with them. One resembles a trolley-car and the other a steamship. *Haeckel* says, "The whole marvelous panorama of life that spreads over the surface of our globe is, in the last analysis, transformed sunlight." In discovering the methods by which the vegetable organism builds up its nutriment from lower to higher forms by means of kinetic energy the botanists are making considerable headway. The details of the transformation of the carbonic

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<sup>4</sup> Campbell, *Science*, January 10, 1903.

<sup>5</sup> Green, *Science*, December 12, 1902.

<sup>6</sup> Macdougall, *Popular Science Monthly*, December, 1898.



oxide and water into starches through the stages of carbon monoxide, formic acid, or formaldehyde, etc., do not concern us. 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 carbo-hydrates from simple to higher forms. The hæmatin is the pigment in the 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 the 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 hæmatoporphrin and phylloporphrin 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 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 intensity 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 rays from the middle of the spectrum, i.e., 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. 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 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 carbonic oxide 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 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 entirely 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. 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. Seeds respire just as rapidly in the dark as in the light.<sup>7</sup>

Plants must have a certain intensity of light "beyond which there is no increased photo-synthetic activity and doubtless only injury." There are great differences between them, some requiring only a fraction of what others need. So necessary is it for plants to have the exact amount of energy needed to break up the carbon dioxide and water, that it is possessed of exquisitely delicate mechanisms to regulate the matter, and it has long been known that through the protoplasmic connections between cells which serve the purpose of nerves, certain fibers contract under stimuli like the muscle fibers of animals. When the light is too feeble the leaf surface is turned to the strongest source, as we see in all window plants. Most northern plants do the same outdoors.

So delicate is this mechanism of phototaxis that some plants<sup>8</sup> can detect a difference of one three-hundred-thousandth of a candle power. *Darwin* is quoted as saying that in a certain grass (*phalaris*) the stems bend toward a light which was hardly strong enough to cast a shadow of a pencil on white paper. All wave lengths have this effect, which increases with the refrangibility. *Von Sachs* thought that only the blue and violet caused phototropism, but red has a feeble power.

For the purposes of the plant it does not seem to matter where the actinic rays come from. Those grown under acetylene lamp light do as well as under an equal amount of sun's rays, as the spectra of the two are very nearly the same. Sim-

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<sup>7</sup> Duvel, Bul. 58, Dep. Agri., 1904.

<sup>8</sup> D. T. Macdougall, *Scientific American*, September 12, 1908.



ilarly the electric arc light is useful and trees near the street lights grow much faster than those farther removed, for they grow day and night. Nurserymen thus have a means of forcing the growth of flowering plants in cloudy weather and in winter. Even the sun's rays reflected from the moon have a marked effect on growth of water plants.

*Sir Oliver Lodge* has described some experiments by *J. E. Newman*, of Gloucester, in the use of radiations from high-tension currents.<sup>9</sup> The wires were overhead and thirty feet apart, and it was found that the plants underneath grew faster than those dependent on the variable sunlight. It was also found that excess was harmful, as when the sun was shining brightly and giving the plants as much light as they could stand. *Lemström*, a Swedish professor, performed the same experiments in his green-house thirty years before.

*Dr. C. Stewart Gager*, of the New York Botanic Garden, has shown that the decaying emanation of radium can also be used by plants and those immersed in such an atmosphere grow much more rapidly than the controls. The radio-activity of air, when there is much ultra-violet light, must have an influence on the growth of tropical plants, but nothing is definitely known on that subject.

Plants have equally marvelous mechanisms for avoiding excess of light. Chlorophyll bodies, for instance, 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. "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

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<sup>9</sup> *Collins' Wireless Bulletin*, Newark, N. J., January, 1910.



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. *Duvel*<sup>10</sup> has shown that in seedlings the cells multiply toward the light and the stems bend in that direction.

A 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, but plants adjusted to the mild light of cloudy climates cannot survive transfer to sunny ones—the shamrock, for instance. European trees do not thrive in the northern half of the United States as well as Manchurian species.

In the littoral zone or beach covered at low water, the plants are green, 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 littoral from forty to one hundred and forty meters. They seem to take a color which will absorb all the available actinic rays in this subdued light. At lower depths there is so little light that there are few plants, though an alga is said to come from one to two thousand meters. The mopane tree of Mashonal, Africa, has red leaves which later change to brown and then green. Similar phenomena are seen in some of our trees. These seem to be for protection from excessive light rather than to absorb it.

Phototropism is the movement of living beings in response to the stimulation of light. It also includes the reactions to infra-red and ultra-violet rays. It is such a favorite subject of experiment that biologists have published an enormous literature dealing with it.<sup>11</sup> There is little in this mass of

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<sup>10</sup> *Ibid.*

<sup>11</sup> S. O. Mast, "Light and the Behavior of Organisms," 1911, and Cleaves' "Light Energy," 1904.



facts of value to our present purpose of showing the harmful effects of light, as the intensities used are rarely strong enough to do appreciable harm. There is still wide difference of opinion whether the action is purely mechanical or purposeful, though there is unanimity of opinion that in each case the result is to place the organism so that it gets more benefit if it needs light, or to escape excessive amounts which are doing harm. For instance, it is thought that if light comes from one side of an elongated monocellular organism, that side contracts from the irritation, and thus points the organism to the light, so that it receives less harm than by a broadside bombardment. Higher organisms move toward or from a light as though possessed of a will power, the existence of which most biologists strenuously deny.<sup>12</sup>

All adult insects which pass their larval stages in water, are in search of water to lay their eggs. They find the water by the sheen of reflected moonlight or starlight, so that they are attracted by any source of light, even though it kills them like a moth in the candle flame. The house fly which avoids the water is not attracted to the flame, though it is positively phototropic, and will leave a darkened room by a small opening in the door. Swarming bees move to the light as they are searching for a new home. If the exit of the hive is dark and the upper part light, they will not swarm.

Metabolism is profoundly modified by ether waves of all kinds, as will be mentioned later. The discrepancies in the reports of experiments will probably be cleared up when the chemists have found out more definitely the action of ether waves in modifying the rate and character of all chemical reactions. As far as protoplasm is concerned, it may be safe to say that in moderate amounts all the rays stimulate metabolism but check the process if they are in excess. For instance, cattle kept in the dark need less food to fatten them than if they are stimulated by light. *Moleschott* found that the excretion of carbonic oxide in frogs was lessened in the

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<sup>12</sup> H. S. Jennings, "Contributions to the Study of the Behavior of Lower Organisms."



dark. Hibernating animals lose very little weight, and the same may be said of the Siberians and Eskimo, who are able to sleep long periods in winter in their dark hovels. It has been suggested that light stimulates the appetite, but this reasoning seems to be using effect for cause, since appetite is the result of increased metabolism.



## CHAPTER VII

### EFFECTS OF INFRA-RED

Although each form of protoplasm can function in a certain range of temperature, there is evidently a point at which the movements of the molecules are best. Every degree above or below that optimum must interfere with function and in time modify, coagulate or destroy the protoplasm. At the upper limit or thermal death point, the molecules are instantly disrupted by the violence of their own movement. Lowering the temperature merely suspends activity and quiets the molecular movement. Cold is not necessarily fatal at once, though it is invariably so in time. Some bacteria will develop after several hours' exposure to the cold near the absolute zero, and ice is invariably sterile after some months. Mosquito ova are not harmed by the cold of Alaskan winters, but the larvæ of *trichinella spiralis* are killed in two days by a temperature of 0° F., only one in a thousand examined survived six days. They are not harmed by 11° to 15° F. for six days, and frozen meat to be safe must be kept below that temperature, though freezing may be effective in a long time.<sup>1</sup>

Only higher animals are equipped with apparatus to keep them warm. Their greatest need is to prevent overheating, and numerous methods have been evolved for this purpose, beyond the mere habit of hiding in the heat of the day. We need only refer again to the bulkiness of northern types of animals as compared to the thinness of closely related tropical varieties or species. The former can keep warm and the latter can cool off. Though the biggest animals are in the tropics, none of them are able to expose themselves to the

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<sup>1</sup> B. H. Ransom, *Science*, January 30, 1914.



direct sun's rays, but must hide in the heat of the day. Indeed, none of these big animals can exist permanently where the air temperature is above body heat—say in southern Arabia.

By the law of radiation, skin pigment is of enormous value in helping the body to radiate surplus heat if the environment is cooler than the body. It is a common observation in the tropics that the dark races are quite comfortable at room temperatures which cause white men to drip with perspiration. This seems to be the reason why most of the dark or black animals are native to hot countries. On the other hand, dark pigment by the law of absorption, is a disadvantage when the environment is hotter than the body, for then the dark surface absorbs heat to a fatal degree. For instance, *Cunningham* experimented with fleas<sup>2</sup> and found that in Bombay there are at least six hours daily in which sun exposure is fatal in ten minutes, those on the under surface living for 45 minutes, but on a sandy surface they die soonest of all. A temperature of 120° is necessary. These animals are well protected against light.

The evaporation of perspiration is a vital provision for disposing of surplus heat. It seems that the body is like every other heat engine and cannot turn all of its heat into energy. There must be some to escape to keep up the flow, just as a turbine cannot work unless the water has some "head" at the outlet. We must dispose of heat all the time, and invisible perspiration carries it off. Sweat-glands seem to be developed in most of the animals which live in the tropics or were evolved there, horses, cattle, etc. Animals which are covered with wool or feathers have no sweat-glands. When overheated they cool off by evaporation through the mouth from respiratory surfaces, as we see in dogs, cats, sheep, birds, etc. *Hans Aron* has stated that monkeys have no sweat-glands, but *Freer* quotes others who say the opposite.<sup>3</sup> Negroes<sup>4</sup> have more sweat-glands per square

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<sup>2</sup> Report of Government Printer, Calcutta, 1911.

<sup>3</sup> *Philippines Journal of Science*, February, 1912, Section B.

<sup>4</sup> Däubler, quoted by Aron, *Philippines Journal of Science*, 1910.



inch than cold climate types. This seems reasonable, but it requires confirmation.

So necessary is it to lose heat by evaporation in hot weather, that a host of observers have reported serious results from failure to drink enough water. Under ordinary circumstances<sup>5</sup> a white man needs nine pints per day in the tropics. The dark man probably needs far less, as he perspires less though apparently possessed of more glands. In cases of excessive perspiration more is needed. Soldiers are often foolishly advised not to drink water on the march, and they frequently drop out from that cause alone. During our civil war *Da Costa* taught that the main reliance in avoiding overheating was to drink water in moderation very frequently. No soldier should drink up his supplies at once or early in the day, for he will have none when he most needs it.

*The Lancet* (1913) has called attention to the experiments of *Dr. Vittorio Puntoni*, of the University of Bologna, proving that varnished frogs do not die from the accumulation of bodily poisons as formerly taught, but from overheating, due to checking the evaporation of perspiration. If the air temperature was below 38° C. (100.4° F.) the evaporation was not necessary and death did not occur.

There is a current delusion that man must have wool next the skin in all climates. As a matter of fact, wool takes up perspiration very slowly, becomes soggy and prevents rapid evaporation. That is, it defeats the very purpose of perspiration, which is to be evaporated at once when there is need for it to carry off heat. After the exertion is over and the man rests, he is enveloped in wet garments whose evaporation chills him. Wool is used by lower animals to keep out external moisture. Having no sweat-glands, the skin is always dry. Animals which perspire have no fur and the hair lies flat so that the moisture is quickly evaporated. Experience in the arctics shows that woollen socks keep the feet wet and cold, but if a thin cotton sock is worn next the skin and the thick woollen over it, the feet are dry and warm. Similarly a thin cotton undershirt is necessary under the heavy

<sup>5</sup> Dr. Rubner, of Cameroon, *Archiv für Hygiene*, vol. xxxviii, p. 154.



woolen one to keep the skin dry by quick evaporation of perspiration. A man who never perspires through exertion or living in hot rooms and is not exposed to intense cold might wear a woolen undergarment safely, but there are few who are so situated. Luckily wool is so expensive that few can afford it, the vast majority of mankind has cotton or linen next the skin and is the better for it. The diseases due to improper clothing thus come within the sphere of ethnic medicine, for the amount of perspiration varies from type to type in similar conditions. The types which perspire the most in a given environment will be the most injured by wool next the skin. A rational underclothing is that made with wool on the outside and cotton on the inner, but it is not necessary if the outer clothing is woolen.

We have already shown that the body temperature in the tropics rises with the blondness. Recent studies have proved the wonderful efficacy of pigment in facilitating radiation of surplus heat when the surroundings are below body temperature. For every grade of pigmentation there is a critical air temperature above which men cannot cool off sufficiently for health. My own observations seem to indicate that for the average European pigmentation, the critical temperature is about  $80^{\circ}$  to  $82^{\circ}$ . For blonds the point is lower, for brunets higher, and for brown Malays or dark Chinamen it is about  $88^{\circ}$  or  $90^{\circ}$ . For every degree above the critical point there is increasing danger from the difficulty of disposing of surplus heat. Many observers have reported the fact that bedridden sick men who were not improving if the temperature of the air were over  $86^{\circ}$ , would soon be on their feet if a storm would run the thermometer down below  $80^{\circ}$ —say to  $75^{\circ}$ . Every one has noted the amazing improvement in tropical invalids on shipboard as they encounter cooler weather, or when they go to the highlands. All fevers in white men are higher in hot weather and in the tropics.

In negroes the critical temperature is near the body heat,  $98^{\circ}$  to  $100^{\circ}$ . Below that point they radiate sufficiently, but above it they absorb so much that they cannot get rid of it even by evaporation of the profuse perspiration which pours



from the skin. Hence in hot fire rooms they collapse sooner than white men. Where the tour of duty is short the only victims are men of dark or black skins. It has often been remarked that in our navy, negro firemen suffer most and in the Red Sea steamers it is the dark East Indian coal passer or fireman—the white Irish being able to stand the watch as a rule, though they, too, would die in time. I have seen white invalids die in temperatures which apparently facilitated the recovery of malays and negroes. I have even seen blonds suffer and die in temperatures which were perfectly comfortable for brunets.

Clothing, of course, by conserving body heat lowers the critical room temperature. The above observations were made in the tropics with a minimum of covering. The New York State Commission on Ventilation made very extensive observations of the relation of rectal temperature to that of the outside and room air, the subjects being mostly brunets. The charts kindly furnished by the chairman, Professor C.-E. A. Winslow, show that "the body temperature at 3.30 P.M. varied closely with the mean temperature of the observation chamber, while the rectal body temperature at 9 A.M. varied with the mean outdoor temperature for the twenty-four hours preceding. The variations in body temperature ranged between  $36^{\circ}$  and  $38^{\circ}$  C., corresponding to a range of room temperatures from  $68^{\circ}$  to  $86^{\circ}$  F." No critical temperature could be deduced from these averages, but they seemed to indicate that with this amount of clothing the body temperature was normal if the air temperature was about  $70^{\circ}$  F. or a little higher.

With less clothing it would have been as high as we found in the tropics. Nor could any relation between the air and body temperatures be formulated, but on a rough estimate it is safe to say that the body temperature rose or fell about one or two tenths of a degree F. for each degree rise or fall of air temperature from the critical point. Observing practitioners have long known that fever is much higher if the room is hot and the patient overclothed. This is more marked in blonds until the air temperature is above



body heat, but in air temperatures below the critical the brunets cool off more.

It might be objected that the brunet skin of the Eskimo, evolved to exclude light, is a distinct disadvantage by facilitating radiation. So it would be were it not for the heavy, thick fur clothing. It is to be noted that they remove their clothing indoors and keep the huts entirely too hot for a white man. These people are rather late arrivals in the far north, and if it would be an advantage to have dark exposed surfaces and yet a white body skin, as in the case of other arctic animals clothed in fur, there has not been time enough for such evolution. At present the dark body skin is preserved by organic inertia, though of no known use. Consequently, when unclothed indoors they must have very warm houses, and probably more clothing than white men when outdoors.

Black negroes are at a disadvantage in cold weather from the excessive radiation of heat. They require warmer houses than white men and more clothing, and if improperly protected they suffer unduly from chilblains and frost bite. They instinctively engage in indoor labor. The negro Pullman porter cannot understand why passengers complain of heat when he is so comfortable. The blacks die out so rapidly in the north that there is a constant drift from the south to replace them. Moreover, the lighter mulattoes and quadroons are better fitted to the north than the full-blood negro and are in higher percentage than in the south.

Movement of air profoundly modifies the critical temperature, for then the evaporation of perspiration carries off the heat which cannot escape by radiation. In still air<sup>6</sup> the rectal temperature of a white man at rest does not rise until the wet-bulb of the air thermometer is 88° F., above which point it rises rapidly irrespective of humidity. When the air is moving at the rate of 170 feet per minute, a wet bulb temperature of 93° does not cause a rectal rise. When at work the critical wet bulb temperature was 85°. These observations of course extended over only a few hours, but if they could

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<sup>6</sup> Haldane, *Journal of Hygiene*, vol. v, 511-512.



have been prolonged over days or weeks the critical points would be lowered to what I have found in the tropics.

These observations are in accord with the experiments to determine what constitutes bad ventilation.<sup>7</sup> Many observers have proved that the ill feelings in crowded, badly ventilated rooms are not due to decrease of oxygen or increase of carbonic oxide and "animal vapors," but solely to the heat and moisture which prevent escape of body heat. If the temperature is lowered below the critical point or the air is stirred up by electric fans, the ill feelings disappear as soon as the body cools off, though the composition of the air has not changed.

*Flugge* and his co-workers found that the ill feelings in crowded rooms began when the temperature rose to 75.2° F. or 77° F., but disappeared by agitating the air with a fan.<sup>8</sup> The New York experimenters did not find any improvement when an electric fan played upon the faces of their subjects from a distance of a few feet. On the other hand, in the tropics the slight air movement of a fan over twenty feet from the bed will cause comfortable sleep when the heat of stagnant air prevents.

The Russian soldiers did not seem to suffer from foul air in the cool unventilated dark underground dugouts in which they passed the winters in the Manchurian war, nor do the Esquimaux in their unventilated dugouts. *W. G. Anderson*, of Yale, has taken exception to some of the above conclusions, and thinks that the carbonic acid of the air is deleterious when in excessive percentage, but the matter of the critical temperature and the cooling of the body by air movement seem to be the same as in his experiments.<sup>9</sup>

When discussing migrations we will see that if there is a constant breeze, white men can survive much longer in health in hot climates, otherwise utterly unsuitable. If there is no breeze it must be created. In tropical business houses, the European must sit under a punka or large fan suspended from the ceiling and kept moving by a small boy. The native

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<sup>7</sup> Leonard Hill, *Proceedings Physiol.*, October, 1910.

<sup>8</sup> *Zeit. f. Hyg.*, 1905.

<sup>9</sup> *Medical Times*, January, 1914.



clerks who lose sufficient heat by radiation, are chilled by the air movement necessary for the white man. Similarly an electric fan, while necessary for sick white men in hot weather, would probably kill a negro.

It is well known that typhoids do far better in cool rooms than in hot, and that they are vastly improved in hot rooms if a very gentle draught of air plays on them from an electric fan. The darker the complexion the less need is there for cold air and electric fans. That is, the temperature of the sick room must not be the same for all races. Different races must not be kept in the same wards. Moreover, houses and hospitals should be cooled in hot weather to below the critical temperature for the race they shelter. The good results in Mount Sinai Hospital, New York City, of cooling a children's ward in 1913 amply prove this ethnic necessity of spending as much to cool the air in summer as we do to warm it in winter. In 1910 I strongly advised cooling all hospital wards for sick white men in the tropics. Where it is not done there is still the old deplorable difficulty of curing the curable. The profession at home has done better. For instance, *Manning*<sup>10</sup> used a current of air directed against a wet sheet to lower the temperature of a sick room. *Hess*, of New York,<sup>11</sup> partially surrounded the child's bed with a tank of ice water. Compressed air, as used in refrigeration, could also be used in ventilating, for it markedly cools the room, as the air loses heat on expanding. It has been used successfully for this purpose in hot climates on shipboard.

We can stand a very high degree of heat providing the air is dry enough to facilitate the necessary evaporation of perspiration. The dryness of the air in American homes is the reason we can stand the high temperatures maintained. If the air is moist it prevents evaporation and brings on ill feelings at once. In cold air the conditions are reversed, for then the moisture itself assists in chilling the skin, even if there is no evaporation. Now the races in the northwestern part of Europe have become

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<sup>10</sup> *Jour. Amer. Med. Assn.*, June 4, 1910.

<sup>11</sup> *Archives of Pediatrics*, May, 1912.



physically adjusted in some unknown way, to the prevailing mists, clouds and general coldness and humidity. They do not thrive in hot air, dry or moist, and there is some evidence that dry cold air is not the best for them as in elevated arid regions. The negro seems to need moisture in the temperatures best for him,  $75^{\circ}$  to  $98^{\circ}$  F., for it seems that the moisture assists convection even if it checks evaporation and radiation. The arrangements for evaporating water in our houses may make them more comfortable for negroes, but are wholly unnecessary for white men at the high temperatures we insist upon, and are possibly injurious.

The relation of heat to infant mortality in Berlin has been investigated by *Leifmann* and *Lurdemann*.<sup>12</sup> They have shown by records extending over several years that the death-rate of infants rises and falls with air temperatures above  $73.4^{\circ}$  F. ( $23^{\circ}$  C.). It was irrespective of infected milk, since breast-fed infants also suffered, and infants living in cool underground rooms did not, though fed on cow's milk often decomposed in transit. The sufferers have convulsions and other symptoms referable to the heat, and the deaths increase promptly on or immediately after especially hot days. A spell of cool weather checks the mortality promptly, as we also observed in the Philippines after a cooling typhoon. The critical temperature ( $73.4^{\circ}$ ) is rather low in these blond German babies, probably because they are overclothed.

The effects of indoor heat and moisture on infants have been greatly underestimated, as they are probably more disastrous than dirty or stale milk. Thermic fever is extremely common and is not infrequently the only cause of death.<sup>13</sup>

Head hair must have been of some use in preventing loss of heat in cold climates, but it is no longer so, as artificial covering is universal. Its main use is unquestionably to shade the cerebral cells against the harm of the short rays. To prevent overheating in the hottest climates, the hair has become very flat in cross section and therefore very curly or

<sup>12</sup> *Deutsche Vierteljahresschrift für öffentliche Gesundheitspflege*, 1912, vol. xliii, Parts 2 and 3.

<sup>13</sup> Schereschewsky, Public Health Reports, December 5, 1913.



kinky, thus standing out from the scalp and allowing ventilation. This evolution must have taken place in the very remote past before man attained sense enough to use a head-dress. Those who have wandered to hot places since neolithic times have not therefore evolved kinkiness of hair, as it was of no use under a head covering. The American Indians of the tropics have not been there long enough to have evolved this character even if they did not use a covering of some sort.

*Doctors Schmidt and Stephen* conducted many experiments in the Institute for Naval and Tropical Diseases in Hamburg <sup>14</sup> to show the great penetrability of heat rays through the scalp and skull into the brain if there is no hair protection. In a few minutes the cerebral tissue is raised considerably in temperature, and this may explain the cases of sunstroke occurring after a few minutes' exposure of the bare head to the vertical rays of the tropical sun. *Schmidt* later showed <sup>15</sup> that heat was transmitted to the brain in other ways as well as by radiation. He also advised dark head covering as in tropical animals to keep out light rays. Of course black hair will heat up in the sun <sup>16</sup> more quickly than light hair, but as in the case of feathers, the heat is not transmitted to the scalp if the hair is kinky.

Baldness seems to be an advantage in modern life, as we can better adjust ourselves to rapid changes in air temperature, and the headgear protects from light or heat. Indeed, tropical natives of intruded types remove the hair and substitute turbans. Such late appearing characters are not transmitted to children born in early married life, and an evolution of a bald race is not at all likely since the hair is of so much use as a light screen, particularly in children.

Thermic fever or heat stroke is the condition of high body temperature, full rapid pulse and more or less coma, due solely to overheating the body from an external source. Though some cases are due to exposure to the sun, it is not

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<sup>14</sup> *Neue Militärische Blätter*, August 20, 1903.

<sup>15</sup> *Archives für Hygiene*, 1908.

<sup>16</sup> *Aron, Philippines Journal of Science*, April, 1911, B.



correct to call it sunstroke, since many and perhaps the most and worst cases are due to dark heat indoors, particularly in infants. *H. C. Wood*, of Philadelphia, produced the condition experimentally in lower animals a half century ago. Observations in India show that the cases vary with the heat by hour, day and season.<sup>17</sup> A continuous hot bath has been known to produce serious or even fatal thermic fever. Similarly the great heat of the closed cabinet used for light baths has been known to cause it in very serious forms though the light had no effect whatever in raising the body temperature.

The old theory that the symptoms were due to auto-intoxications from the heat has no longer any adherents and the same may be said of *Sambon's* suggestion that it was an infection. *Colonel Andrew Duncan*, I.M.S., advanced the theory that the cause was the light and ultra-violet rays,<sup>18</sup> but negroes suffer more than white men when the temperature is over blood heat. The black skin absorbs and transmits the heat rays but breaks up the ultra-violet and light rays. In temperatures below 98° or 100° F., but above the critical temperatures for white men (73° blonds to 83° for brunets), Europeans are at a disadvantage and furnish more cases than the negro because of the difficulty in radiation from light surfaces. Among 146 cases of sunstroke in American cities several years ago there were 113 blonds to 33 brunets. It will probably be found that in the lower ranges of temperature blonds predominate, but in the upper the brunet. In some of the hottest days in Washington, D. C., the negroes furnish most or all of the cases. We have already mentioned the frequency of cases among the dark-skinned fire-room workers on shipboard, and I am now informed by *Mr. Duncan Brodie* that Abyssinians suffer more from sunstroke than the better clothed Europeans living among them. On the other hand, *Aron* found that if radiation and evaporation are not hindered brown skins do not heat up as greatly as white, when exposed to the sun.

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<sup>17</sup> Major Leonard Rogers, I.M.S., *Journal Royal Army Medical Corps*. January, 1908.

<sup>18</sup> *Edinburgh Medical Journal*, March, 1903.



*Dr. J. B. Nichols* says <sup>19</sup> that if all escape of heat were prevented for three hours, our body temperature would be 109° F. The fatalities of the Black Hole of Calcutta were therefore due to thermic fever and not to air poisoning.

*Hans Aron* <sup>20</sup> exposed dogs and monkeys to the tropical sun, and caused death by thermic fever in an hour or two. If the animals are shaded as in their natural habitat or exposed to a gentle draft of air, thermic fever is prevented. Similar results were obtained by *Scagiosi* with rabbits in Sicily, and by *Castellani* and *Chalmers* in Ceylon. The latter found that if the rabbits had the head shaved they died after about an hour in the sun, but they lived if the heat rays and ultra-violet were stopped by red glass. That is, animals are so adjusted to their natural medium that heat stroke is prevented. Only when we take them out of their normal do they heat up.

The carabao of the orient absorb so much heat in their black skins that they must be wet down or allowed to cool off every little while if exposed to the tropic sun. Wherever practicable they are driven into the water every two hours. Otherwise they may become delirious from thermic fever and do great damage. Black horses and mules, if worked hard in the tropical noon-day sun, are liable to "blow-up"; that is, develop high fever, delirium or coma and die. White animals with black skins rarely have thermic fever in like conditions. I have seen white teams that have been on tropical trails daily for five or six years without a day's sickness. Black or dark brown horses and mules bleach to a yellowish color if exposed to much light, and this assists reflection of heat. In the dark season they resume the black color, especially if well stabled. This black color is best to assist radiation of heat in moderate climates which have no extremes of heat or cold to be guarded against, such as our northwest coast. In no part of the world I have visited have I seen such a high percentage of black horses and mules as in Portland, Oregon, and its vicinity, where horsemen find that the white or gray animals are weakly, though such types are

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<sup>19</sup> *New York Medical Record*, February 14, 1914.

<sup>20</sup> *The Philippines Journal of Science*, April, 1911, B.



the only ones which can withstand high or low temperatures. In American cities during hot waves when many horses are overcome by thermic fever, the white ones largely escape damage, the victims being of the dark shades. On the other hand, if the black horses of western Oregon are given hard work in long journeys in the sun, they collapse in greater numbers than the other colors. If they are taken to cold climates they chill off so greatly that they suffer unduly from "colds" and pneumonia, unless carefully blanketed and housed, where the native horse can safely remain outdoors unblanketed.

It is amazing what differences we find in the color of horses according to the heat of the climate where the type has been evolved. The sunnier and hotter, the lighter the color, white being the rule in the Arab of the hot lowlands, but chestnut and light bay in the cooler uplands. In northern Japan the colors are dark, in the south shades of yellow, in Corea red brown and in cold Manchuria white, all being descended from Prejevalsky's red-brown wild horse. In the tropics the light colors prevail, roans bringing a high price because they can stand what kills the darker shades. The successful race horses in Manila are gray or white, though the slow phlegmatic gray of the north never wins a race. The carefully housed English racers and hunters run to light bay. In France the Percherons, which must endure the sun, are largely gray. They are born black but lighten with age, proving that they are descended from dark forest types which predominate all over Europe, but the gray variations are surviving. It is a recent evolution apparently coincident with the growth of modern cities and is said to have had its origin in a white Arab cross. This Arab type has spread to India where it has become a shade of yellow. In the United States, grays and whites have become common in the cities and in the sunny climates, while in the north-eastern quarter the bays are giving place to lighter shades. Sorrels are common already in the Southwest, and dun colors are proving their hardihood everywhere in our hot summers, both becoming popular because of prolonged use-



fulness. In tropical South America whites are becoming common. The arctic horse runs to white like the arctic bear to lessen radiation. The Siberian horses taken to the antarctic by Captain Scott were all white or gray.

The hair of monkeys is mostly for protection from mechanical injury. As in other tropical animals it is generally dark or black in those which rarely if ever leave the shade, but is much lighter if there is exposure to the sun. The gorilla has a jet black skin and short jet black hair, which are in marked contrast to the brown skin and long red hair of urang-utangs. This difference also exists in the men of the two places, and evidently has some relation to the heat. It seems also that the color of the hair has been modified by the necessity here and there for concealment.

The colors of wild horses, asses and zebras <sup>21</sup> vary according to the heat, all having black skins. The color of hair also is always related to that of the background.

*Heat cramps* is the condition due to withdrawal of water from the blood by excessive perspiration. It has been quite common in the navy and may be fatal in a few minutes. It seems to be the same condition as found in cholera when several quarts of fluid have escaped by the bowel. All the muscles of the body are in a condition of more or less contraction and the heart may stop in a spasm. The naval medical officers have learned to cure it almost miraculously in a few minutes by restoring the fluid to the blood—intravenously in desperate cases. We cannot do this in cholera, as the fluid leaks through into the bowel almost immediately. There may be a complication of uræmia as in cholera, but not as a rule, for the restoration of fluid cures the cases before the kidneys have secreted any urine. Since negroes absorb more heat than white men in conditions of great external heat, and also seem to perspire more, they furnish most of the cases of heat cramps in the navy. They apparently lose water by perspiration faster than they can absorb it through the stomach.

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<sup>21</sup> Professor Wm. Ridgway, Cambridge University, *Popular Science Monthly*, December, 1908.



It has been reported from Singapore that those who abstain from alcohol suffer from the effects of heat more than the drinkers.<sup>22</sup> My own statistics<sup>23</sup> show that the moderate drinking white men in the tropics were in better health than the abstainers, though some observers have reported the opposite. I have always thought the curious phenomenon was due to the large amount of water taken with the alcohol. Nevertheless a very prominent life insurance actuary informs me that in all tropical and sub-tropical countries, the moderate drinking natives have less mortality rates and longer life than the abstainers. In 1829, *Twining*<sup>24</sup> noticed that the victims of sprue were generally of light complexion, active habits and sober. In cool climates the abstainers have an advantage over the moderates, though much of this may be due to the fact that abstainers are a selected class who naturally take great care of themselves. The moderate drinking men are more thoughtless and deliberately run this alcoholic risk, as well as many others, and may suffer higher mortality in consequence of the latter rather than of the alcohol.

The far-reaching results of excessive perspiration in those who live in a climate too hot for their pigmentation, have been noticed a long time. The concentrated urine sets up an irritation along the whole urinary tract. Latent infections are lighted up and new ones developed. Cystitis and pyelitis may result, and old gonorrhœas reappear, though believed to have been cured. *Hindale* mentioned such phenomena in Arizona.<sup>25</sup> There is more than a suspicion that parenchymatous nephritis is also a result, and if it already exists it gets rapidly worse in white men who go to the tropics. This form of kidney disease is said to be far more common among white men in the tropics than in cooler lands, more common in our South than the North, in hot cities than in the cooler suburbs, and in the United States

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<sup>22</sup> *Journal of Tropical Medicine*, December 15, 1904.

<sup>23</sup> *New York Medical Record*, December 17, 1904.

<sup>24</sup> *Clinical Illustrations of Disease in Bengal*.

<sup>25</sup> *Lectures to Medico-Chirurgical College, Philadelphia, Pa., 1907.*



than in northwest Europe. There are no statistics to verify these statements, as the disease is not separately classified as a rule, and may run on into the interstitial variety. The 1911 Census reports the white death-rate from nephritis of all kinds as 118 and the negro as 208, which would seem to negative the above generalizations, but in very hot summers and places the negro is at a decided disadvantage since he is the main sufferer from heat cramps. He is also prone to other forms of nephritis from unhygienic living and perhaps intestinal autointoxication.

Active outdoor exercise in the tropics, besides exposing one to the climate unduly, causes a harmful amount of perspiration. It is not true, as often stated, that those who exercise the most outdoors are the healthiest. Indeed the athletes occasionally astound us by their collapse. Some to my personal knowledge become tubercular.

The effects of heat on metabolism are not very well known and the reports are rather discrepant. It is generally believed that moderate heat increases chemical changes in vital as well as inorganic substances. At least this is the theory on which we base our hot-bath treatment of the rheumatic states due to the presence in the blood of incompletely oxidized proteids. *Sutton* found that respiratory exchange was increased by heat.<sup>26</sup> This may account for the fact that babies do not increase in weight normally in very hot summers. It is also one explanation of the fact that consumptives improve during the cold dark months. Although the lack of appetite and depression of digestive activity in hot weather must be considered, too, it is counterbalanced by the excessive radiation in winter which calls for more fuel. Animals exposed to high degrees of heat lose their resistance to bacterial invasion. *Schereschewsky*, from whom these statements are quoted,<sup>27</sup> also gives a wealth of data showing the serious results of overheating.

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<sup>26</sup> *Journal of Pathology and Bacteriology*, 1908-9.

<sup>27</sup> *Ibid.*



## CHAPTER VIII

### EFFECTS OF LIGHT AND ULTRA-VIOLET

In most of the recorded experiments as to the effect of light, there is no attempt to exclude the ultra-violet, but as the actions of the two are identical except in degree, they may be considered together. The effects of the infra-red also complicate and confuse the results unless it has been carefully screened out. Hence much of the literature on the subject is of little scientific value.

As already explained, plants are exquisitely sensitive to excessive amounts of ether waves of any kind, from the infra-red to the gamma rays. Growth is impossible if the temperature is too low or too high, and it is common knowledge that excessive light is deadly to naked forms. From two to ten minutes' exposure of the tubercle bacillus to sunlight is fatal.<sup>1</sup> Later experiments have shown that death may result in two minutes, not only with this bacillus but with those of diphtheria, typhoid and cholera. If the light is diffused, as from a north window, death may not occur for several days. In this interval bacteria lose virulence and become "attenuated" even though able to reproduce. Most of this is due to ultra-violet, for the effects are delayed sixty or ninety minutes, or even prevented if the short rays are excluded by glass covers. The red-rays are also stopped by glass, but not to the same extent as the ultra-violet.

Experimenters rarely mention the intensity of the light used, and this causes considerable discrepancy in the results reported. For instance, *Finsen*, by concentrating a cold sunlight, has caused death in five to eight minutes of bacteria which resisted an "electric light" from five to eight hours.

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<sup>1</sup> Weinzirl, Bulletin University of New Mexico, 1907, No. 12, Biol. Ser. III.



The bactericidal effects of various colors have been studied by many experimenters.<sup>2</sup> Enamel paint seemed to be more efficient than the ordinary oil or water mixtures, and as a rule the lethal effect increased with the shortness of the ray, ultra-marine leading the others and showing some effect after twenty-four hours, while yellow required four days. As long ago as 1882 *Engelmann*<sup>3</sup> showed that if a spectrum was thrown upon bacteria they moved to the red end from the violet, which was almost entirely deserted. *Green* rays have the least effect on plant and animal protoplasm, but *Downs* and *Blunt*, in 1877, found that the effects of light on small organisms were due to the blue, violet and ultra-violet, the red end having no effect in the intensities they used.

Sunshine has a lethal effect on the plankton or plants and animals living near the surface of the ocean. "Tropical and sub-tropical seas are relatively poor in plankton while the colder polar regions are rich."<sup>4</sup> The minute forms are fewer in the dark winter and become very numerous when sufficient light appears in the spring to start the growth of the vegetable forms depending on light, but with the excessive light of summer they are killed or reduced in vitality.

About 80 per cent. of the heat of the sun's rays<sup>5</sup> is absorbed in the first meter of lake water, scarcely one per cent. reaching to four meters, and that which penetrates six meters is too small for accurate measurement. *Dr. Johan Hjort* found on the Michael Sars North Atlantic Expedition in 1910<sup>6</sup> that the red rays are absent at a depth of 500 meters but the blue and violet were still present. The ultra-violet are perceptible at 1,000 meters, and there is no trace of any ray at 1,700. These depths of course vary with the latitude and season. The rule seems to be that the shorter the wave length the deeper the penetration in water.

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<sup>2</sup> Dr. G. Beauvils, *Presse médicale*, August 23, 1905.

<sup>3</sup> Quoted by Loucheux, *La Nature*, 1909.

<sup>4</sup> Prof. W. A. Herdman, *Science*, November 26, 1909.

<sup>5</sup> Birge, *Science*, November 14, 1913.

<sup>6</sup> *Geographical Journal*, May, 1911.



The rays upon which vegetation depends are not sufficiently strong at a depth of 400 to 600 meters in the ocean for plant purposes and this is the lower limit of vegetable plankton, though an alga has been found lower where the sun is strong.

Near the surface, the ultra-violet are very strong, and the pigment in the backs of whales, porpoises, etc., protects them from serious injury. It is quite evident then that strong sunshine sterilizes the upper layers of the ocean as effectively as it does a garment infected with diphtheria bacilli. Vegetable plankton, like disease germs, flourishes only where it is not too light for life. Where there are perpetual clouds and mists and fogs, as in the Irish and North Seas, and the Banks of Newfoundland, the plankton is especially abundant. *Herdman* says<sup>7</sup> "Man feeds upon the cod, which in turn may feed upon the whiting, and that on the sprat, and the sprat on Copepoda, while the Copepoda feed upon peridinians and diatoms. . . . Diatoms may be regarded as the ultimate producers of food in the ocean." Thousands and perhaps millions of human beings thus depend for existence on the fact that fogs and clouds prevent the sterilization of certain northern waters yet permit enough light to filter through to support an abundant minute vegetable life.

Other ocean animals are distributed in swarms, though nearby the water may have none. No reason is known for this, though the northern migration of fish and seals in summer is unquestionably due to the disappearance of the minute vegetables from the sterilizing action of the southern summer sun. Examination of the bacteria in the water of New York Harbor has shown that they are far more numerous in winter than in summer.<sup>8</sup>

Of course, cloudiness may be so excessive as to check plant growth, and as a fact *Herdman* quotes those who have correlated the mackerel catch with the abundance of phytoplankton and hours of sunshine of the previous three months;

<sup>7</sup> *Geographical Journal*, May, 1911.

<sup>8</sup> Reports of Metropolitan Sewage Commission.



but the light is never strong enough to be deadly. *Kofoid* has proved a twenty-nine day pulse in the plankton of the Illinois River, the maxima lagging six days behind times of full moon and thus showing that the light of the moon is sufficient for photosynthesis, and is not accompanied by the harmful rays which check the process in strong sunshine.

A writer<sup>9</sup> has asserted that moonlight is more or less polarized, and for that reason has less germicidal power than unpolarized light of equal intensity. Decay is more rapid in moonlight than in the daytime.

In the air and upper soil of the tropics pathogenic micro-organisms are exceedingly scarce, for they require shade or even darkness.<sup>10</sup> Many observers have noted that the infectious diseases of northern climates do not flourish in the tropics, some never being found. *F. Ruheman*<sup>11</sup> noted the coincidence of an epidemic of cerebro-spinal meningitis and a long period of uncommonly cloudy weather. These seem to be phenomena of a class with the relative scarcity of plankton in summer and in the tropics.

The Finsen light, which is so effective in curing lupus, does not seem to harm the deep tubercle bacilli as they are shaded by the red pigment of the blood.<sup>12</sup> After one hour the bacilli are destroyed only to the depth of 0.2 millimeter by a light strong enough to kill epithelial cells at a depth of 0.5 millimeter.<sup>13</sup> Cultures placed on the surface of the skin during ordinary treatment, and afterward cultivated, regain their ordinary vitality and virulence.<sup>14</sup>

It might be possible to cause a permanent change in bacteria by light of a degree not lethal. *Mme. Victor Henri*, of Paris, has been reported as creating a new pathogenic species by exposing anthrax bacilli to ultra-violet rays. When introduced into guinea-pigs they produced an entirely

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<sup>9</sup> *Chemical News of England*, 1913.

<sup>10</sup> Martin, *Münch. med. Woch.*, December 18, 1906.

<sup>11</sup> *Berliner klinische Wochenschrift*, 1906.

<sup>12</sup> Jansen of the Finsen Institute at Copenhagen.

<sup>13</sup> *Ziegler's Beiträge*, July 13, 1907, p. 277.

<sup>14</sup> Mally, *Revue de chirurgie*, August 10, 1907.



different disease and the bacilli showed no tendency to revert to the ancestral form. She suggests that sunlight may have been a factor in the creation of so many varieties of pathogenic organisms which are evidently descended from a common harmless ancestor.

The uviol or ultra-violet lamp invented by *Schott*, of Jena, is rich in ultra-violet but devoid of red and infra-red rays. It kills insects of one and one-half centimeters distance in one minute. In a summer's night it kills thousands. Other mercury vapor lamps will kill bacteria in a few seconds.<sup>15</sup> It is then the ultra-violet of the sun of Texas which kills the yellow fever mosquito in two hours.<sup>16</sup> The tropical sun is fatal to all mosquitoes.<sup>17</sup>

The penetrability of ultra-violet rays in water has been put to use in sterilizing drinking water, using a quartz mercury vapor lamp.<sup>18</sup> Many observers have found that the rays produce peroxide of hydrogen, which they think is the indirect lethal agent and not the rays themselves.<sup>19</sup>

An attempt was made by *Gabriel Vallet*, of Paris, a few years ago,<sup>20</sup> to sterilize milk by passing it in a thin layer under a source of strong ultra-violet rays. It succeeded, but has not become a practicable measure. Indeed *Von Behring* has been reported as saying that light injures some of the desirable properties of milk in the same way that heat reduces the digestibility of caseine. He advises bottles of green or red glass and the use of perhydrol.

*W. T. Bovie*, of the Harvard Plant Laboratory, has reported that ultra-violet light coagulates certain proteins and that this coagulum is not formed at 0° C. If tubes which have been exposed at 0° are warmed a few degrees the coagulum appears, but if recooled it redissolves.<sup>21</sup>

<sup>15</sup> Berthelet, President of the International Society of Electricians.

<sup>16</sup> Berry, Public Health Service.

<sup>17</sup> Giles, Health in Hot Countries.

<sup>18</sup> Marks Foulds, *Journal Royal Army Medical Corps*, February, 1911.

<sup>19</sup> *La Nature*, Paris, 1909.

<sup>20</sup> *Cosmos*.

<sup>21</sup> *Science*, 1913, vol. xxxvii, pp. 24 and 373.



Insects are harmed by ultra-violet in proportion to their own lack of protection. White ants, for instance, cannot be exposed to any light at all and must build elaborate tunnels between their food and nests. Even diffused light kills them in a few hours, while the direct rays are fatal in a few seconds. The pale brown ones come out of their nests only at night, dark brown ones come out in daylight but shun the sunshine, while the black ones do not seem to be bothered by the direct rays. *Mary A. Kingsley* has noted the same thing as to African ants. When the sugar bowl becomes full of them, she says: "Just stand it in the full glare of the sun. Sun is a thing no ant likes, I believe, and it is particularly distasteful to ants with pale complexions; and so you can see them tear themselves away from their beloved sugar and clear off into a Hyde Park meeting smitten by a thunder storm."<sup>22</sup>

The white grubs of bees and wasps must be shielded from strong light, some of the nests being very dark. I have exposed a wasp's nest to sun on a lawn, and the next day all the larvæ were found dead. Fly larvæ require shade, as they have no protection from light. It is remarkable that the winged males of white ants assume a brown color when they emerge at the time of the matrimonial flight.

The light is shunned by all albino animals, such as rats, guinea-pigs, rabbits, and even by those which burrow, though fairly well pigmented. I have exposed young white rats to excessive light and found that they were markedly checked in growth. Pathologists have informed me that if the animal room is brilliantly lighted and their experimental animals kept in cages with no dark places to run into for shelter, breeding is checked or entirely stopped. It is found that when such animals are placed in shaded rooms or dark cellars they thrive at once, and moreover even in these places they prefer the darkest retreats they can find. Tropical light will kill young brown rats in twenty minutes.

The effects of all rays are much more marked on immature or multiplying cells than upon the mature or those which

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<sup>22</sup> *West African Studies*, p. 34.



have ceased to multiply. For instance, the superficial skin epithelium is never injured by rays which are extremely stimulating, irritating or destructive of the deeper epithelium which are undergoing rapid proliferation.

Embryonic or dividing cells are particularly susceptible, and the germ cells (spermatozoon and ovule) are the most susceptible of all.<sup>23</sup> Incubating chicken eggs subjected to strong light in various ways produce monstrous forms—some being killed. Colored light was also found injurious. *Féré* had previously obtained different results with more subdued light.

It has been reported that in animals exposed to strong light, the ovules disappear from the ovary and spermatozooids from the semen. It is suspected that some effect of this kind results in white men long resident in the tropics if they are careless in exposing themselves to much light.

Innumerable other experiments have been made on developing animals. *Cleaves* has noted many such in "Light Energy."<sup>24</sup> It is impossible either to epitomize them or unravel the apparent discrepancies because no experimenter gave a quantitative statement of the light used, nor how much pigment protection existed. Nevertheless it seems that they tended to show that all rays have some effect depending upon their intensity and increasing with the wave frequency. It varied from a mild stimulation of weak light to the lethal effect of intense rays. In a few properly pigmented forms, light had no effect.

In some experiments with puppies, those kept in the dark seemed to have been retarded in growth, but the other abnormal factors may account for this. Frog spawn are said to die in the dark, and will develop under glass, but here, also, doubts are justifiable. *Hoyt*, of Rutgers College, in some experiments on the liberation of eggs and spores of *dictyota dichotoma*, concluded that the effect of moderate light was due to the well being of the plant rather than to a direct stimulus to the cell.

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<sup>23</sup> L. Blanc, Compt. Rend. Soc. de Biol., Paris, 1892, iv, p. 795.

<sup>24</sup> Rebman Co., New York.



All colored lights have depressing effects on the rate and volume of the pulse, the yellow affecting it least and violet most.<sup>25</sup> The strength of the light was not mentioned. *Dr. A. J. Ewart*, of Birmingham Technical Institute, has shown that weak light under certain conditions accelerates protoplasmic streaming in plants, and strong light retards it. Red also seemed to restrict it, but here too no strength was mentioned.

*Finsen* stated that barbers had long noticed that men needed more frequent shaving in summer and that hair often grew on parts exposed to concentrated light. Little children who go bare legged in summer develop quite a growth of hair, but this is not noted in the very dark types. The toe-nails grow much more slowly than the finger-nails. Excessive light, on the other hand, seems to retard growth in both plants and animals, as already explained. It has been accused of causing baldness from the destruction of the hair bulbs, as in the case of X-ray, though it is difficult to see how the light can reach the bulbs if the hair is not shingled.

It seems that all light rays, but particularly the blue and violet, can weaken or paralyze nerve cells without actually destroying them, though of course if strong they can disrupt the molecules in the same way that ultra-violet does. *Dr. E. C. Titus* demonstrated the anæsthetic effect of short rays before the Boston Physio-Therapeutic Society.<sup>26</sup> A mat made of slender glass rods of cobalt blue, transmitting no red rays, is placed over the part and a strong light transmitted from a tungsten bulb. In twenty minutes sufficient local anæsthesia is produced to allow of incisions, and it lasts a half hour or more. In the Royal Dental Hospital,<sup>27</sup> as well as in America, many experiments seem to indicate that the blue light will also cause optic anæsthesia and induce sleep sufficiently deep to allow extractions or minor operations. The effect might be due to, or increased by, suggestion.

The Minin lamps are merely incandescent bulbs of dark

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<sup>25</sup> Trivus, quoted by Katz, *Roussky Vrach*, September 7, 1902.

<sup>26</sup> *International Journal of Surgery*, January, 1912.

<sup>27</sup> *Archives of Roentgen Ray*, August, 1905.



blue glass which stop all infra-red, and light rays from the red end.<sup>28</sup> They are exceedingly efficient anæsthetics applied ten to fifteen minutes to painful burns, poison ivy and tuberculosis of the upper air-passages. This blue light can cause general anæsthesia in two or three minutes sufficient for minor operations, if red or yellow light is absolutely excluded from the eye.<sup>29</sup>

Oral anæsthesia can be produced by blue light from a small mercury vapor tube made of blue glass. The tube is inserted in the mouth and in three to five minutes sufficient anæsthesia is produced to relieve pains of tonsillitis, abscessing teeth, ulcers and permit opening of pulp cavities. Strong sunlight will stop the pains of cancer.

Light has a profound effect upon the oxygen-carrying power of the hæmoglobin. *Haldane*, in 1896, has been quoted as showing that when blood is shaken in a flask with air containing carbonic oxide, there was a striking diminution of affinity for the carbonic oxide in the light. Under the influence of light there is a marked change in tension of oxygen in the blood and a modification in the respiratory affinities of the cells.<sup>30</sup> This may have some bearing upon the alleged anæmia of the tropics.

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 our remote ancestors evolved in dark, rainy, misty, cloudy regions. Such an atmosphere filters out the ultra-violet. Hence there

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<sup>28</sup> Schauffler, *Med. News*, December 17, 1904.

<sup>29</sup> Redard, Professor of Medicine, University of Geneva, *British Medical Journal*, June 10, 1905.

<sup>30</sup> K. A. Hasselbach, *Upsala Läkareförenings Förhandlingar*, vol. ii, 1906.



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 by excluding the harm which was not sensibly appreciated. Hence our present ignorance of the injury we receive when out of our proper zone.

*Dr. G. Bohn*, of the "College of Science" in Paris, wrote a long article showing the lethal effects of excessive light on plants and animals, and it was widely commented upon both here and in Europe, but the materials seemed to have been largely taken from the first edition of this book.



## CHAPTER IX

### THE EFFECTS OF X-RAYS

Plants and animals, including primitive man, were never exposed to X-rays and therefore evolved no protection from such short waves. Nevertheless, there is no interval between the shortest ultra-violet wave from the sun and the longest rays from a *Crookes* tube, indeed the two overlap. Consequently the pigments needed to exclude ultra-violet do have the power to stop the slower X-rays. The effects of X-rays, then, though having no ethnological significance, are of importance as they all show what ultra-violet rays do in minor degree. Moreover these rays illustrate the fact that the short rays of the sun have powerful effects irrespective of the heat rays, for there are no heat rays whatever in the X-rays. The effects are purely actinic, and it seems that all can be referred to protoplasmic destruction from the rapid atomic movements set up in the molecule.

So many observers have reported the facts subsequently mentioned, that it is unnecessary to mention names and sources of information except for a few special points.

As in the case of ultra-violet, the embryonic, or multiplying cells are far more easily destroyed than the mature. Small doses stimulate the growth of germinating beans, but large doses check it.<sup>1</sup> With small doses the stimulated plants produce more and better beans. In less than therapeutic doses, the growth of young animals and tree buds was checked.<sup>2</sup>

Though X-rays have no appreciable effect on red blood cells they are exceedingly destructive of the white, particu-

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<sup>1</sup> Schmidt, *Berliner klinische Wochenschrift*, May 23, 1910.

<sup>2</sup> Försterling of Hanover, *Centralblatt für Kinderheilkunde*, September, 1906.



larly the polynuclears and mononuclears. The density and coagulability of the blood, and the output of uric and phosphoric acids are increased. They have been used in leucæmia, but are followed by extensive destruction of kidney epithelium,<sup>3</sup> similar to mercuric chlorid poisoning, probably from the toxins due to leucocyte destruction. In rabbits and cats the diminution of leucocytes is followed by a slight increase, mostly of polynuclears.<sup>4</sup> In man this increase becomes permanent and a writer in Berlin<sup>5</sup> says that "leucæmia may be regarded as an occupational disease of radiologists, seven cases having already been reported."

The long continued exposure of the hands, as in X-ray operations, in time causes extensive destruction of the epithelial cells. The connective tissue cells do not seem to be so sensitive as the multiplying epithelium, though one observer<sup>6</sup> reported the opposite. "After a time the color of the hands or face changes; on this swelling ensues; then a few pruritic papules or pustules, with bran-like scales; or an 'itching' warmth, local diaphoresis, cutis anserinus and a glossy appearance of the parts with œdema. Muscular action becomes inhibited. Further exposure induces inflammation, disintegration, intense itching, with successive crops of papules, followed by a honeycombing of small, indolent ulcers which may become confluent, with a sanious malodorous discharge. As sequelæ may occur loss of skin with appendages, dreadful disfigurements—scars, pits and pigmentation—the loss of sebaceous and sweat-glands, anæsthesia, hyperæsthesia to all forms of radiant energy, increased vasomotor activity, defective vision, and many other unfortunate manifestations."<sup>7</sup>

In the early days of the X-ray, and to some extent since, excessive exposures caused very marked lesions from the simple erythema to extensive ulcerations which sometimes

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<sup>3</sup> Warthin, *Amer. Jour. of the Med. Sciences*, May, 1907.

<sup>4</sup> Morris, *Amer. Medicine*, December 2, 1905.

<sup>5</sup> *New York Medical Record*, February 21, 1914.

<sup>6</sup> Scholtz.

<sup>7</sup> *Journal American Medical Association*, May 4, 1907.



extended to the deep connective tissues. Even if the cells were not killed outright they were so modified that they could not regenerate lost parts by the normal proliferation. Hence the ulcers were very slow in healing—some taking years.

Finally some of these cells would take on riotous growth and produce cancers which have been fatal in an appalling number of operators. These cancers do not take on the pigmentary changes so common after the minor grades of X-ray dermatitis. It seems therefore that in the latter, as in "tanning" after ultra-violet light, the more superficial pigment cells are irritated into increased activity, as they do after the irritation of the poisons or parasites of syphilis and other skin affections. Cancers seem to arise from the deeper unpigmented cells of the skin, which are stimulated rather than weakened.

X-ray applications have been followed by a darkening of the hair of the neighborhood of the applications. Even gray hairs have become pigmented and in some instances where the rays caused the hair to fall out, the new hairs were perceptibly darker. This phenomenon seems to be of the same nature as the increased skin pigmentation after sunburn or X-ray of less than lethal degree.<sup>8</sup>

The earliest lesions are said to occur in the lymphatic glands where the lymph cells undergo degeneration and absorption, like the leucocytes of the blood. Bone marrow and the spleen are also seriously affected, the former being very susceptible. The changes in metabolism seem to be due solely to tissue destruction which increases the nitrogen output.

The delicate germ cells seem to be the most susceptible of all—even in cases long exposed to very mild rays. In the strong rays the results are seen quicker. There is degeneration of the *Graafian* follicles in the ovary, and of the epithelium lining the seminiferous tubules of the testicles. In time the spermatoids disappear from the semen. In the case of animals experimented upon, the spermatozoids which

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<sup>8</sup> Imbert and Marquès, *Semaine Medicale*, July 25, 1906.



are not killed are still able to fertilize the ovum, but the resulting larvæ may be deformed and monsters result.<sup>9</sup> Pregnant cats exposed to the rays of only sufficient strength to make a radiogram, gave birth to dead kittens, though before and after there were normal live kittens. Incubating ova of chicken eggs exposed to X-rays may be killed outright or give rise to monstrous forms—many developing no feathers. All these results followed exposures which were harmless to the developed and non-proliferating cells of the adult body.

Azoospermia has even followed application of X-rays to cure pruritis ani, though the cells reappear in the urine after several months if the exposures have not been very frequent or prolonged. *Schönberg* caused azoospermia in rabbits through the abdominal wall, and *Burdick* reports sterility in man from a single exposure.<sup>10</sup>

The damage to the nervous system from the X-ray atmosphere is in the nature of exhaustion, and differs in no respect from "tropical neurasthenia," due to ultra-violet light. Many have described it, but the best account is probably that of *H. W. Van Allen*.<sup>11</sup> "Indigestion is present, especially of the intestinal kind. These men complain of lack of ability to concentrate their thoughts for any length of time and are drowsy, although many suffer from inability to have continuous restful sleep at night. The disposition is somewhat irritable. These operators complain of an unnatural sensation of cold. Radiographs in some instances of the thinner parts of the body show a premature sclerotic condition of the arteries." The symptoms therefore are largely secondary effects of the arteriosclerosis, which in turn may be toxæmic in origin and due to the broken-down proteids.

It is remarkable that exposure of the head to X-ray has sometimes caused symptoms of vertigo, headache, etc., suggesting "actinic shock," described later. *Kaposi* reported

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<sup>9</sup> Bardeen, *Science*, June 29, 1906.

<sup>10</sup> *American Journal of Clinical Medicine*, April, 1909.

<sup>11</sup> *Boston Medical and Surgical Journal*, March 9, 1905.



that the action on the vessels in the deeper layers of the skin closely resembles that of light.<sup>12</sup>

The delay in the appearance of symptoms is a characteristic of all injuries due to short rays. Sunburn may not bother us for some hours, X-ray burn or dermatitis for some days, and the more profound effect of small doses frequently repeated may not be seen for months or years. Similarly in the tropics, the effects of light may not appear in white men for many years.

Among the effects reported,<sup>13</sup> besides the ordinary dermatitis were alopecia, periostosis, precancerous keratosis, clouding of cornea in guinea-pig, optic neuritis, conjunctivitis, cellulitis, telangiectasis, subcutaneous effusions of blood in areas subsequently necrosed, involvement of nerve trunks with subsequent pain or paralysis, cardiac palpitation with distress and sense of oppression, general cachexia in cases of cancer treated by the rays, probably due to absorption of degenerated cells, and changes in blood-vessel walls, with destruction and occlusion. Diabetics seemed to be very susceptible to injury.

The application of X-ray may cause chills and a general fever lasting a variable time up to three weeks, accompanied by an eruption resembling scarlet fever.<sup>14</sup> *H. E. Schmidt* named this eruption "Frühreaktionen," and showed that it was not a dermatitis but a systemic reaction. It is probably a vasomotor paresis, similar to the anæsthesia due to blue and ultra-violet light, but other writers suggest that the phenomenon is due to the absorption of the necrosed tissues.

Pigment of the skin stops X-rays from penetration in proportion to its density. Brunets are not injured by amounts destructive to the tissues of blonds, and the skin of the negro absorbs the most of all.<sup>15</sup> Serious burns are mostly in the blond, but a preliminary tanning by mild applications will prevent these accidents. The skin of the trunk

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<sup>12</sup> Milton Franklin, *Arch. of Roentgen Ray*, January, 1905.

<sup>13</sup> Milton Franklin, *ibid.*

<sup>14</sup> Guido Holzkrecht, *Archiv für Dermatologie*.

<sup>15</sup> Horand, *Archives d'Electricité medicale*, March 25, 1909.



is more easily injured than the hands and face, because the latter are more pigmented, but if the trunk is deliberately tanned by preliminary applications of light or X-ray, the skin becomes as resistant as that of the hands.

To avoid injury to themselves and patients operators have adopted most elaborate precautions, the details of which do not concern us here. Yet, in spite of all care, we still hear of serious "burns," "ulcers," cancers and death, though the situation is not nearly so alarming as in 1905-9, when the disasters were attracting so much attention.

Since the above chapter was put in type, *Jacques Loeb* reported <sup>16</sup> that both ultra-violet and X-rays in moderate amounts will cause the development of unfertilized sea urchin eggs, in the same way as any other cytolytic agent.

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<sup>16</sup> *Science*, Nov. 6, 1914.



## CHAPTER X

### THE EFFECTS OF RADIUM

No organism in its natural surroundings has ever been exposed to radium rays and consequently no protection was ever evolved. The effects are the same in all races of men and the subject is outside the sphere of ethnic medicine. Nevertheless it is necessary to give some account of them, as they are of the same order as the actinic effects of ultra-violet and X-rays, though of different intensity. *Dessauer*, of Frankfort-on-Main, indeed has produced X-rays having the same properties as gamma rays and probably of the same wave length, which is one-tenth to one-hundredth of the length of the shortest X-rays hitherto known.

Within a few months of the discovery of radium it was accidentally learned that it had very marked biologic effects, and experiments were at once begun the world over to find out what they were. An enormous literature at once grew up. It was reviewed by *Hussakof* of Columbia University.<sup>1</sup> The best and most concise synopsis of it was later published by *Professor Wm. Allen Pusey*, Dermatologist, University of Illinois.<sup>2</sup> With his permission practically his whole article is copied below.

"When the human skin is exposed for a sufficient length of time to an active radium salt a peculiar and definite reaction is set up, of which the first striking feature is that it does not develop until after a relatively long period of quiescence—as a rule about two weeks. In a skin containing a considerable amount of pigment, there is first an increase of pigment, shown by an ordinary 'tanning' of the exposed surfaces. If there are any freckles or pigmented spots in

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<sup>1</sup> *New York Medical Record*, July 20, 1907.

<sup>2</sup> *Science*, June 30, 1911.



the exposed area, these become darker. Along with this pigment stimulation there occurs a reddening of the skin, with a feeling of irritation and burning such as one has from sunburn. The reaction may stop at this point and after a few days gradually subside; the redness and irritation diminish, there is some scaling from the surface, and in a few days more no evidence of the reaction remains, except the increased pigmentation which is very slow to disappear.

"In this reaction we have had simply the familiar picture of sunburn. But the process, in many cases, goes much farther, and then there occurs a reaction which is peculiar to X-rays and radium. After the development of an inflamed, reddened area of skin the surface becomes intensely congested, purplish, and then blisters form. At the same time, or before, the hairs loosen and fall out. Next the blisters rupture and leave a surface covered by a necrotic pellicle, like a diphtheria membrane. And the reaction may go still farther, with the formation of an ulcer whose striking characteristics are its painfulness and its extreme indolence, showing, it may be for months, no tendency to regeneration. The process may stop at any of the stages described above. If subsidence occurs short of ulceration the skin may again become normal, but after the severe reactions without ulceration, and after ulceration when healing takes place there may be very distinct permanent changes in the skin. The hairs grow sparsely or not at all; the pores are very fine or absent, from destruction of the glands of the skin. The skin is thinned, with here and there roughened horny points or patches up to the size of a finger nail, and the surface is reddened from numerous dilated capillaries which show through the thinned horny epidermis.

"The condition is in fact an exact, sometimes an exaggerated, picture of the atrophic senile skin, with its dilated blood vessels and senile keratoses. As a matter of fact the picture is so nearly that of senile skin that I was able, in the case of X-ray lesions, to predict that cancers of the skin would be found to develop in them because the keratoses of old age are so frequently the starting point of cancers. The identity



of chronic radium and X-ray changes in the skin with those of the senile skin, strongly indicate that the senile changes of the skin are in good part the result of the less powerful action over a long period of years of sunlight.

"When radium is applied to various pathological lesions in the skin the same phenomena occur that are seen in healthy skin, with the addition that under proper precautions selective destructive effects may be produced upon the diseased tissues. Take, for illustration, nodules of tuberculosis or of carcinoma or sarcoma (cancers) in the skin. With proper care in grading the applications a reaction may be produced which will cause these tissues to be entirely destroyed, while this reaction is not sufficient to destroy the normal stroma in which they are situated, or, if it does destroy the normal tissues in the involved area, they will regenerate with the formation of healthy scars. It is also found in itching and painful conditions of the skin that the applications have a definite anæsthetic effect.

"In the early stages of radium irritation sections show evidences of proliferation of the tissue elements, such as indicate an over-stimulation of the cells by a peculiar irritant. These changes are most marked in the tissues of the greatest functional activity. At first there are an increased production of pigment, and an exaggerated proliferation of the germinal and younger (deeper) cells of the epidermis, especially of the cells of the follicles of the epidermis; in the corium or body of the skin, there are dilatation of the capillaries, an infiltration of round cells, and œdema—the changes of inflammation. Later the changes become exaggerated: there is proliferation of the inner layer of the blood vessels (an obliterating endarteritis); the round-cell infiltration becomes intense; the connective tissue fibers are œdematous and stain poorly. In the epidermis the cells show extreme degenerative changes; they become vacuolated, the nuclei are fragmented, there is degeneration of the cytoplasm so that stains are taken poorly, and complete breaking down of many cells. These changes are especially intense in the highly specialized and active cells of the appendages of the skin—



the hair follicles and the sweat and sebaceous glands—and they may result in the obliteration of these structures, a phenomenon which, occurring as it may without destruction of the surrounding tissues, is not produced by any other known agent. In the last stage in a radium reaction there is necrosis of all of the affected tissues, the connective tissue stroma being the most resistant and last to break down. In diseased tissue of the skin such as epithelioma and lupus, there is the same sort of reaction; it is also found that the pathological tissues which are composed of growing cells, often of embryonic type, react in the same way as the active sensitive tissues of the normal skin. They are more sensitive to the effects than the stroma in which they are growing, disintegrate or degenerate readily, and are destroyed before or without destruction of the connective tissue around them.

“It is evident in this process that we are dealing with an agent whose results are produced by influencing the biological processes of the cells themselves. The effects are not produced by an immediate destructive action of the rays, as a heat burn, for example, is produced. There is no immediate effect from the application of radium; it is only after days, it may be two or three weeks, that the effects appear. The inference is that the radiations set up some process in the tissues which itself ends in their destruction. The whole process is one of exaggerated stimulation of the activity of the cells of the tissues: a stimulation which varies in degrees with the degree of specialization or functional activity of the different type of cells. In its slightest degrees it is the ordinary protective process that occurs under exposure to sunlight, but under the unusual and extreme irritation of this artificial form of radiant energy the reaction becomes destructive.

“These effects upon tissues suggest the possible use of radium for various therapeutic purposes, as follows: (1) To stimulate chronic processes. This principle has been successfully used in the treatment of some chronic inflammatory processes in the skin. (2) To destroy or diminish the follicles of the skin, particularly the hair follicles. This principle



has had practical application with X-rays, but because of the small quantities available, not with radium, except in the case of hairy nævi (birthmarks). (3) To obliterate blood vessels in the skin. This has had practical application, with very successful results, in the treatment of vascular nævi (birthmarks). (4) To destroy pathological tissues. This use is of course possible of wide application, and has been successful in various diseases of the skin and the adjacent underlying structure, especially in carcinomas and sarcomas (cancers). Its limitation in cancer is that it is only effective upon such lesions as can be directly exposed. As the action is to a degree selective, radium and X-rays have had very valuable practical uses in these diseases. (5) Finally the anodyne effect of radium has had some application in the relief of itching and of pain.

"Experiments on rabbits have shown that exposure to the radiations causes anæsthesia in peripheral nerves (*Beck*), confirming a fact established by clinical experience. *Danysz* and *Bohn* have shown that the nervous system of certain young animals is peculiarly sensitive to the effects of radium, exposures so arranged as to reach strongly the cerebro-spinal axis causing paresis, ataxia, convulsions and death. These phenomena with negative controls, were elicited in mice, which proved most sensitive, and in guinea-pigs and rabbits. The sensibility is very much greater in the very young animals, persists in older mice, but disappears in great degree in adult guinea-pigs and rabbits.

"Several experiments have shown the inhibitive or, under stronger exposures, destructive, effect of radium rays upon various bacteria in cultures—the bacillus prodigiosus, colon bacillus, typhoid bacillus, anthrax bacillus and the spirillum of cholera. These are the only biological findings differing from those with X-rays, and are probably due to the greater superficial effect of the alpha and beta rays because of their very slight penetration as compared with the softest X-rays. They indicate a close similarity, with a difference chiefly in degree in their biological effects between alpha and soft beta rays and ultra-violet rays.



"Similar results have been obtained by several observers from exposures of numerous forms of protozoa. Their growth is at first stimulated, then inhibited, and after intense exposures they are destroyed. Experiments on various eggs, embryos and larvæ have shown, as would be expected, in these embryonic tissues, a high degree of susceptibility. Growth is retarded, monstrosities develop, and, from prolonged exposure, death occurs. In plants the results of experiments may be summarized briefly as first stimulation of growth, and under stronger application, retardation or complete inhibition of growth. As to the emanations, it may be stated briefly that experiments with the emanations upon young mice, upon bacteria, and upon protozoa show results quite like those from exposure to the rays.

"There is apparently no difference in kind in the effects upon tissues between the different radium rays. Alpha rays have so little penetration that their effect is expended entirely upon the most superficial tissues, but when they are screened out the only difference in the reaction is one of intensity and depth. *Exner*, in a repeated experiment, by deflecting the beta rays with an electro-magnet directed them upon one white mouse while the gamma rays fell upon another mouse equidistant from the radium. Fifteen days after exposure, which had been for  $18\frac{2}{3}$  hours, a similar ulceration appeared on the tails—the exposed areas—in both mice. All three forms of radium rays then are physiologically active.

"They are a manifestation of the same actinic effects that we have long been familiar with in certain inorganic substances. Indeed, beginning with the red rays of light at one end of the scale and ending with the hardest X-rays and gamma rays at the other, we find physiological effects differing chiefly in degree and corresponding in intensity with the actinic strength of the respective rays.

"From experiments with radium upon eggs *Schwartz* proposed that all of the effects of radium upon tissues were due to decomposition of lecithin. *Hussakof* suggests from experiments of *Willcock*, *Zuelzer* and *Körnicke* that oxygen in some not understood way seems to play a part in the process.



There is every reason to believe that the process is not explicable by any simple chemical reaction. Radium rays do not produce an immediate effect upon living tissues, similar to the reduction of silver salts, for example. They have an effect upon the life processes of the cells, and these after a relatively long time produce the results that we recognize as a radium reaction. In other words the process is a vital process, and one, doubtless, involving all of the chemical complexity of cell life itself."

In mice killed by one to four days' exposure to radium, there were found hyperemia of the meninges with large and small hæmorrhages in meninges, brain and cord. The nuclei and nerve fibers of some cells were altered. The endothelium of vessels was fatty.<sup>3</sup> There were other changes more or less resembling those due to exposure of monkeys to the direct rays of the sun.

The emanations from radium are said to increase metabolic activity in the same way as light rays. *Silbergleit*<sup>4</sup> has shown the same thing as to radio-active drinking water of 5,000 to 50,000 units. *Brill* and *Zehner* state<sup>5</sup> that the injection of radium salts, in proper doses, has increased the number of red corpuscles almost at once to an enormous degree, and that the high counts lasted for weeks.

If radium is used in excessive amounts, the absorption of the necrotic tissues causes a toxic condition with fever and malaise for some days or weeks, which is the same condition as X-ray fever.

There was an early belief that the effects of radium were largely due to the corpuscles impinging on the tissues, breaking up the molecule either mechanically or through the ether vibrations which did the damage. The late *Dr. Henry G. Piffard* expressed the conviction, in 1904, that the skin lesions were chiefly due to the electrons or beta rays and not to the ether waves. It must be remembered that the alpha particles are relatively large and are stopped by a thin layer of sub-

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<sup>3</sup> Obersteiner, *Wiener klin. Woch.*, 1904.

<sup>4</sup> *Münch. medizinische Woch.*, June 22, 1909.

<sup>5</sup> *Berl. klin. Wochenschr.*, July 1, 1912.



stance through which the beta rays will penetrate for some inches perhaps. The beta rays are said to sterilize rabies virus. *Dr. Robert Abbe* states <sup>6</sup> that the beta rays are the destructive ones, that the gamma rays showed no results at all in the same time, and that the alpha particles have negligible effects. When the beta particles are stopped by a material barrier their energy of motion is transformed to exceedingly rapid ether waves, and these in their turn at their very source, where very intense, may do the damage ascribed to the corpuscular bombardment. The gamma rays, like all waves, lose intensity with the square of the distance. Simple pressure on the skin lessens the destructive effects of X-rays and radium,<sup>7</sup> but increases the effect of ultra-violet by lessening the redness which absorbs the rays. Pressure is thought to cause a reduction of metabolic activity and an approximation to the condition of spores and non-germinating cells which are very resistant.

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<sup>6</sup> *New York Medical Record*, Nov. 28, 1914.

<sup>7</sup> Schwarz, *Münch. med. Woch.*, June 15, 1909.



## CHAPTER XI

### ACTINO-THERAPY

Actino-therapy or radio-therapy is a general term to include the application of all the shorter ether rays in the treatment of disease—heat, light, ultra-violet, X-rays and radium. Thermo-therapy or the use of infra-red has been practiced empirically for thousands of years in the primitive “sweat-houses” of savages, and perhaps also a species of photo-therapy in sun-baths, though both probably did more harm than good. The modern scientific use of short rays began in 1894 with *Finsen’s* publication of the amazing cures of lupus by means of concentrated sunlight. A year later *Röntgen* announced the discovery of X-rays. In a short time they were found to have biologic effects, and were used therapeutically. Then came the discovery of radium and its effect upon living tissue. The literature of actino-therapy had already become enormous, but the last discovery started this system of cure on a course of advancement which has elevated it to a science of its own, with which but few practitioners can keep pace. Even a synopsis is impracticable here. Only those facts will be taken up which show why sunshine should have such widely different effects on different races.

After the first therapeutic successes, the profession became unduly enthusiastic and made claims and predictions which were not verified. Then came a reactionary period of five or six years after 1905, in which actino-therapy was considered inefficient or dangerous. Continued observations have shown its limitations and clearly outlined its sphere of usefulness. At present, the effects of short rays are so well known that the therapeutic applications are in very exact dosage to produce exact results.



*Finsen*, the pioneer, made the first false assumption. He knew of the bacteriocidal effects of ultra-violet rays and used them to kill the tubercle bacilli in the skin in lupus. He went to his death convinced that his wonderful cures had been due to the destruction of the bacilli in the skin. Many imitators have vainly tried to kill the bacilli in deeper lesions and so far with no success and possibly much harm, for few seemed to realize that if the bacilli could be killed so also would the surrounding cells. It was further assumed that pathological cells were composed of more complex molecules and would be destroyed by a dose harmless to the healthy.<sup>1</sup> This may be true—particularly as to the action of radium on superficial carcinomas, but it is yet to be proved. At present we have no other explanation than the proved fact that developing cells, healthy or pathological, are more susceptible to damage, as though the vibrations more easily broke up molecular groups or molecules while the chromosomes were in the unstable condition of karyokinesis.

It was first discovered<sup>2</sup> that though the violet and ultra-violet were the most bacteriocidal of sun's rays and caused a dermatitis the same as any other inflammation, they had the least power of penetrating the tissues. Not until after *Finsen's* death was it proved by *Jansen* that though the bacilli were not killed below 0.2 of a millimeter from the surface, there was severe exudation of blood and serum, with thrombosis. The connective tissue cells were unharmed, and produced fibrous hyperplasia as after any other inflammation. He concluded that the sun's rays acted like a caustic and not as a germicide. Many others have come to the same conclusion. *Verhoeff* and *Bell* say:<sup>3</sup> "So far as direct destruction of bacteria within the cornea or any of the tissues of the body is concerned, abiotic radiations possess no therapeutic value. This is due to the fact that abiotic radiations that are able to penetrate the tissues are more destructive to the latter than to bacteria."

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<sup>1</sup> Jicinsky, *Amer. Med.*, December 17, 1904.

<sup>2</sup> Bang, *Berliner klinische Wochenschrift*, December 9, 1902.

<sup>3</sup> *Science*, September 25, 1914.



It was then realized that *Finsen's* cures were not due to any beneficent action of the rays, but to the irritation which caused an outflow of serum which brought more antibodies in contact with the bacilli, as in the *Bier* treatment by passive congestion. Hot applications seem to work the same way. "Hot rectal douches appear to be of use in the treatment of prostatitis, and probably produce their good effects by raising locally the opsonic index and by promoting a freer flow of blood through the inflamed parts."<sup>4</sup>

The same explanation has been given by the late *Dr. Ferd. C. Valentine*, of New York City, of the remarkable efficacy of heat in all the gonorrhœal infections. Being greatly impressed by the reports of the almost specific action of dry heat in curing gonorrhœal arthritis, and by the fact that the gonococcus is destroyed at 113° F. or lower, some say as low as 104°, I tried hot irrigations in acute gonorrhœa with success.<sup>5</sup> *Dr. J. A. Fulton*, of Astoria, Oregon,<sup>6</sup> and *Harrison* and *Houghton* of the British army<sup>7</sup> by the same reasoning tried dry heat with equal success—they all used a double catheter in which water of a definite temperature is circulated. *Grünspan* and *Faroy*<sup>8</sup> used hot air. *Dr. Hermann Strebel* apparently got just as good results in chronic gonorrhœa from the prolonged irritation of a glow-light in the urethra, completely eliminating the infra-red by a complicated cooling apparatus.<sup>9</sup>

Serous effusion explains the remarkable efficacy of very hot irrigations in chancroid<sup>10</sup> and old ulcers.<sup>11</sup> The sun cure for Madagascar ulcers is similarly explained,<sup>12</sup> as also are the cures of diphtheria by a five-minute application of a current of air at 80° C.<sup>13</sup> Though the bacilli are killed in

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<sup>4</sup> Ballenger, *New York Medical Journal*, July 2, 1909.

<sup>5</sup> *New York Medical Record*, 1901.

<sup>6</sup> *New York Medical Record*, February 12, 1912.

<sup>7</sup> *Journal Royal Army Medical Corps*, February, 1913.

<sup>8</sup> *Gazette des hôp.*, No. 26, 1910.

<sup>9</sup> *Archives of the Roentgen Ray*, May, 1907.

<sup>10</sup> Zinsser, *Berliner klinische Wochenschrift*, May 18, 1908.

<sup>11</sup> Veyrasset, *Journal de medecine de Paris*, 1905.

<sup>12</sup> Fontoynt and Jourdran, *Presse médicale*, 1906.

<sup>13</sup> Rendu, *Bibliothèque Universelle et Revue Suisse*, May, 1912.



one minute by  $80^{\circ}$ , they cannot be raised to that point without destroying the tissues. In corneal ulcers we cannot destroy bacteria without killing the tissue cells.<sup>14</sup>

The Jamaica negro is said to treat open wounds of the foot by exposure to the direct rays of the sun without dressings of any kind. These wounds are usually infected and become severe on account of the thick skin which prevents drainage, but by the sun treatment they become aseptic and heal kindly. Sunshine<sup>15</sup> will cure persistent bed sore if concentrated once a day into the depths of the excavation. *Haeberlin*<sup>16</sup> and many others have obtained quick healing of granulating surgical wounds or burns by sun exposure, but *H. Poth* obtains equal success by currents of very dry air.<sup>17</sup>

*Minin* reports excellent results with his blue electric light in checking hemorrhages from open wounds and in many conditions for which other wave lengths are equally efficacious or more so. For open wounds<sup>18</sup> an electric light filtered through blue glass will ease pain, dry up secretions, facilitate epithelial growth and produce a general hyperæmia.

Noma has been cured in two months by applications of a 16-candle power incandescent electric light with a red globe,<sup>19</sup> and excellent results in skin diseases are obtained by light screened through two layers of glass containing a solution of eosin.<sup>20</sup> That is, almost any length of ray will by its irritation produce a curative effusion of serum if strong enough.

*Stevens* says<sup>21</sup> that the *Finsen* light is best in lupus vulgaris and erythematosus, and that he uses it in xanthoma palpebrarum, some nævi and alopecia areata. The *Kromayer* light is more dangerous, destructive and superficial, but gives excellent results in port-wine birth marks, alopecia and acute X-ray dermatitis and its later telangiectasis, and is

<sup>14</sup> Verhoeff, *Jour. Am. Med. Assn.*, March 7, 1914.

<sup>15</sup> Ring, *Boston Medical and Surgical Journal*, November 22, 1906.

<sup>16</sup> *Wiener klinische Rundschau*, 1908.

<sup>17</sup> *Deutsche Zeitschrift für Chirurgie*, vol. cxxvii, Parts 1 and 2.

<sup>18</sup> Richter, *Deutsche medizin. Wochenschrift*, April 29, 1909.

<sup>19</sup> Motshan, *Wien. klin. therap. Woch.*, 1904.

<sup>20</sup> Jader, *Jour. de medecine de Paris*, August 11, 1907.

<sup>21</sup> *Detroit Medical Journal*, January, 1914.



recommended in acne, herpes, eczema, keloids, hypertrophic scars, pityriasis, ulcers, furuncle, vitiligo, etc. *Kime*, of Fort Dodge, Iowa, says <sup>22</sup> that sun's rays focussed through glass and thus freed of most of the ultra-violet are more effective in warts, moles and small non-malignant growths. Passed through blue glass they blister without destroying deeper cells, and through opalescent glass they neither blister nor destroy but merely blanch as in freezing, and are therefore best in lupus and nævi. These discrepancies are probably due to variations in intensity.

Ultra-violet light will relieve the pain of superficial new growths, lessen the odor and putrefaction. It is sometimes successful in relieving uterine cancers of the distressing symptoms. The anæsthetic powers of the shorter sun's rays have been successfully used in minor operations, neuralgia, acute or chronic neuritis, and muscular pains such as lumbago, torticollis and pleurodynia. The pains of tabes may also be relieved.

*A. I. Orloff* over ten years ago reported <sup>23</sup> that the ordinary electric light of five to sixteen candle power was quite efficacious in relieving uterine pains and lessening exudates and discharges, but this method of relief seems to have been abandoned.

In the case of erysipelas, variola, varicella, rubeola, scarlatina, pellagra and lupus—all parasitic diseases—it is believed that the toxins are unable to cause much inflammation of the skin, but that they render the cells more sensitive to irritation by light. On the basis of this theory there has been a revival in the last twenty years of the old discarded red light treatment to exclude the actinic rays. *Finsen* reported most excellent results in smallpox, but *J. F. Schamberg*, of Philadelphia, failed, and thought the treatment was suited only to mild cases such as are found in Europe. *Finsen*, in reply to critics, said that they began the treatment too late. *Piffard* said that *Schamberg's* red glass did not exclude the short rays like true ruby glass. Others

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<sup>22</sup> *Jour. Amer. Medical Association*, March 30, 1912.

<sup>23</sup> Roussky, *Vratch*.



have substantiated *Finsen*, and the question, after all these years, is still unsettled though little is said of it. Perhaps the new method of preventing the suppurations by early immunizing injections of staphylococcic and streptococcic vaccines will be more efficient in the dark or in red light.

*Finsen* said that the Chinese have used the red-light treatment of smallpox for many centuries. Throughout Europe in the Middle Ages, we find frequent references to the practice. *John* of Galleaden, the author of the earliest medical book in English, "*Rosa Medicinæ*," is reported to have successfully treated the son of Edward I by red light, and that the practice was common in the reigns of Elizabeth and Charles II. It is also said that in the Copenhagen Medical Library there is a medical pamphlet published by *Dr. Picton* of New Orleans in 1831, which mentions the fact that in a certain epidemic, a few soldiers confined in dark dungeons recovered without pitting.

*Goldman*, of Vienna,<sup>24</sup> found that by vaccinating in red light and immediately bandaging with an opaque cloth, the inflammation was prevented, but if the bandage was removed in two or three days pustules appeared. There were no constitutional symptoms, the eruption was wart-like, scar flat and scarcely perceptible, and the immunity short. Perhaps he did not really vaccinate his cases at all. *Cuoff* reported<sup>25</sup> that the red light treatment in scarlet fever lessened the duration but did not diminish complications.

Cures of malignant tumors by X-rays have been reported by radiologists too numerous to mention, though the failures have been disheartening. It seems that the effect on the diseased cells may be destructive in time even if it is not immediately lethal. For this reason many if not most radiologists advise the application before or after an operation to influence the cells which may be beyond the reach of the surgeon. There seem to be fewer relapses. It is interesting to note that the best results are obtained by the very short rays from "hard" tubes, for these have very great penetra-

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<sup>24</sup> *New York Medical Record*, October 26, 1904.

<sup>25</sup> *Münch. med. Woch.*, 1905, No. 32.



tion and can affect deep growths though not harming the overlying stable normal tissues. Modern success is due to these tubes which were unavailable in the early days.

The list of other diseases amenable to X-rays is now a very long one, providing the remedy is applied skillfully in proper doses of proper wave lengths and for a proper time—matters which are still somewhat empirical and to be decided by the judgment of an experienced operator. This very success is tempting the unskilled and inexperienced, so that we are hearing of more burns and other accidents than some years ago when the remedy was somewhat under a cloud of suspicion of ineffectiveness. Among the diseases recorded as cured are warts, rhinophym, sycosis, favus, eczema, acute and chronic psoriasis, sarcoma, ring-worm, rosacea, acne vulgaris, prurigo, lupus and nævus vasculosus. The ray is a depilatory, will make the nails and glands atrophy, and it causes pigmentation. *Skinner* and *Carson* of the British army have reported the cure of chronic malaria without quinine by a five-minute dose of X-ray to the enlarged spleen. In uterine myoma, the Germans report 50 per cent. cures and 30 per cent. improvement by X-ray, and equal success in uterine hemorrhages of all kinds. *Krönig* and *Gauss* of Freiburg are the originators of a practicable technique in these diseases.<sup>26</sup>

There are still wide differences of opinion as to their value in surgical tuberculosis, though successes were reported in tuberculosis of the testicles. Leprosy and elephantiasis have apparently been cured, and exophthalmia improved. *Manonkim*, of St. Petersburg, is reported to have benefited or cured hæmophilia by applications to the spleen to destroy the leucocytes. In all other cases the cures can be best explained by the serous outflow from the irritated healthy tissues.

For action on the skin and its diseases we need a soft or long X-ray which does not penetrate and we must exclude the very short penetrating frequencies. This has been accomplished by the use of a new glass mentioned by *Professor*

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<sup>26</sup> Holding, *N. Y. Med. Rec.*, February 21, 1914.



*Chas. Baskerville*,<sup>27</sup> in which lithium replaces potassium, beryllium replaces calcium, and boron replaces silicon. It has a much lower molecular weight and is more transparent to the long rays and more opaque to the short than the ordinary glass used in *Crookes* tubes.

Radium has been used to cure lupus, rodent ulcer and superficial cancers for over ten years, but only recently has the public taken up the matter as something new. Even in deep-seated growths a tube imbedded in the tumor for a certain time measured in hours and minutes will sometimes cause the complete disappearance of the mass in a few weeks, but the failures are more numerous by far than the successes. Indeed, the deep cells are sometimes stimulated. There are evidently different kinds of cancer having the same histological structure and different kinds of resistance in the normal cells. When these matters are cleared up, it will probably be found that short rays from any source will be specific according to their frequency and the kind of tumor. Some sarcomas seem to be as curable under short rays as the carcinomas, but we cannot differentiate the cases beforehand. Favorable reports have been made as to its use in trachoma, but as a bactericide it requires too long a time, twenty-four hours or more.

Radium seems to be more effective than X-ray in warts, moles, *nævi* and angiomas. Highly colored birth-marks are the easiest to cure. In all cases the cure is due to the occlusion of vessels from the irritation. *Wickham* and *Degrais* of Paris have devised very ingenious methods of separating the alpha, beta and gamma rays, and a method of filtration and of "cross-firing" to increase the effect.

Sluggish metabolism seems to be stimulated by rays of every length. Hot air and hot water baths have long been used for this purpose, and in the last twenty years light baths have produced excellent results. A short sojourn in the tropics is very beneficial in many cases of chronic gout and rheumatism, but the ultimate result of too long a stay is exhaustion. It has been said that light stimulates circulation,

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<sup>27</sup> *Journal of Industrial and Engineering Chemistry*, March, 1914.



metabolism and sweat secretion, but since the usual light-bath cabinet is very hot, the effects of the heat are not differentiated in reported cases. As both act alike it is immaterial for practical purposes whether we use one or both. It has been charged that the heat alone is responsible, but the general impression seems to be that the shorter the ray the quicker and more powerful the result. *Musser and Edsall* found<sup>28</sup> that the X-ray increased the excretion of nitrogen, phosphorus, uric acid and xanthin bases and made pernicious anæmia markedly worse. The number of cases of pernicious anæmia arising in the tropics indicates that ultra-violet rays and perhaps slower waves have a decided influence in causing this disease or making it worse.

The preparations of radium, thorium and mesothorium are now being praised for all cases of sluggish metabolism in the same way that X-rays were a decade ago. The literature of this alone is already enormous. There has been a remarkable renewal of interest in the therapeutic properties of the spas of Europe since it has been discovered that the most popular with profession and laity are also the most radioactive. Indeed their efficacy has been imputed to their radioactivity. *Carl Von Noorden's* article in the *New York Medical Record*,<sup>29</sup> and one by *Professor Ernest Zueblin*, *Maryland Medical Journal*, May, 1914, review the present status of radiotherapy, including the use of emanations.

Waves of all frequencies seem to be effective in reducing obesity. Cattle can be fattened quicker in dark barns than in light ones, and stout people often lose weight in hot seasons and hot climates when the light may be one factor at least. We are now informed that treatment by radioactive substances is also beneficial in obesity from the increased metabolism.

The use of short rays for anæmia cannot be reconciled with the evidence that light destroys hæmoglobin. The existence of a tropical anæmia in white skinned migrants has been denied, but the evidence seems to show that it does exist

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<sup>28</sup> *New York Medical Record*, May 24, 1905.

<sup>29</sup> January 18, 1913.



and to point to the light as a cause. The error has been due to misinterpretation of blood counts in people who have been in the tropics too short a time. Short exposure may temporarily increase hæmoglobin, since we know that it increases the absorption of iron,<sup>30</sup> but in the end hæmoglobin is destroyed. It is claimed that excessive tanning robs the blood of hæmoglobin and causes anæmia.

*Blackader* reported<sup>31</sup> that in Canada hæmoglobin rapidly rises in the cold dark season. The increase of red blood cells in high altitudes may have some relation to the cold as well as to the lessened pressure. Since both X-ray and tropical light may cause or increase leucæmia and pernicious anæmia, we are justified in expecting the same in light baths, particularly in the blonds.

Ultra-violet rays have been used in neurasthenia and the benefit seems to be psychic for the testimony is almost unanimous that in time all short rays produce neurasthenia. The irritating effects of light are so evident in nervous people that it is now the rule with certain physicians to insist upon darkening the room. *Dr. G. R. Rowe*, of London, called attention to this in 1817, in his work on "Hypochondriasis." In describing the rest cure, in which he antedated *Weir Mitchell* by over a half century, he says<sup>32</sup> that a darkened room prevents "the rays of light from offensively acting upon the retina and, consequently, the sensorium commune." In more recent years the popular mania for floods of light has caused architects to overlight most hospital wards, houses and school rooms and the nervousness of the inmates is increased. Formerly both patients and attendants considered the ill-feelings as part of the disease, and school-teachers blamed the natural perversity of children. In the treatment of maniacal states darkening the room is said to be remarkably soothing, but in depressed states the light is a beneficial stimulant. Avoidance of the direct rays of the sun is beneficial in hay fever, and *Jacobi*, in discussing the management of pneumonia at

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<sup>30</sup> Bleyer, *New York Medical Record*, January 30, 1903.

<sup>31</sup> *New York Medical Journal*, August 3, 1912.

<sup>32</sup> P. 43, second edition.



the American Climatological Society, warned against an excess of light.

Sun baths to the naked body are slowly going out of fashion, except in obesity, gout, rheumatism, and sluggish metabolism. The profession has begun to realize how harmful the short rays may be. They increase the pulse, respiration, temperature and blood pressure, and may start hemorrhages. In excess they cause headache, palpitation, insomnia and anæmia. They are also harmful in general weakness from any cause and in the hysterical or neurasthenic. *Grawitz* called attention to the serious nervous results often seen in children exposed to sun baths.<sup>33</sup> *Huddleston* found actual sunstroke in a child given a sun bath for pneumonia.<sup>34</sup> Even the ancient Jews knew of the damage of sunshine, for the twelfth Psalm says: "The Lord is thy shade upon thy right hand"; "The sun shall not smite thee by day, nor the moon by night." Indeed there are innumerable references to their constant effort to escape the sun by the shade of one's vine and fig tree. "The tree doth not withdraw its shade from the woodcutter."

The use of sun baths to the naked body of the tuberculous cannot be condemned too strongly, though it is highly praised by a few who get good results from the other factors in spite of the injury done by light. There is no question, of course, that all the short rays are as beneficial in local lesions as those from the sun are in lupus. But in all these cases there is every reason to believe that the cure is due to the irritating effect of the rays and the subsequent bactericidal effect of the increased flow of serum, and not to any beneficent effect on the body cells. Indeed, *Charles Heater*, at a meeting of the Royal Society of Medicine, called attention to the fact that, in a person under tuberculin treatment, ultra-violet caused a more violent and prolonged effect, and that in using the quartz mercury lamp in skin affections in the tuberculous, exposures must be halved. The ordinary dose of sixty seconds will cause troublesome ulcers.

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<sup>33</sup> *Deutsche medizinische Wochenschrift*, 1909.

<sup>34</sup> *New York Medical Record*, February 9, 1907.



*Lenkei*<sup>35</sup> was so convinced of the efficacy of light that he carefully avoided giving enough to tan the skin, as he estimated that the clear skin let through 50 to 100 times more light than a darkly colored one. Yet *Rollier*, at Leysin, Switzerland, found that the blonds who would not tan did not improve under light baths, while the best results were obtained in those who took on a heavy coat of tan. That is, the smaller the amount of light to penetrate the better the effect, but he explained it on the assumption that the light was changed into some mystical kind of energy, though it is only stepped down to infra-red frequencies in brunets and serious nervous effects were noticed in the blonds. Other physicians in Leysin get just as good results without sun baths and better results in the blonds by keeping them outdoors in the shade. In the cloudy lowlands of northern Europe equally good results are obtained, and one physician of Geneva takes his cases down to the Riviera in the winter with excellent results.

It is now claimed by *Martin-du-Pan* (*Revue Medicale de la Suisse Romande*, September, 1914) that surgical tuberculosis of children unsuccessfully treated by outdoor heliotherapy can be cured or improved by indoor applications to the whole body of cooled light from the 7,000 candle-power mercury vapor quartz lamp devised by *Vignard*, of Lyons. But he found it necessary to exclude "some" of the ultra-violet rays by 4 mm. of glass. The skin rapidly tans and protects the tissues from further injury. The applications are made from ten minutes to three hours at a distance of several feet or yards. *Jacques Loeb* found (*Science*, November 6, 1914) that only one mm. of glass prevented all effects on sea-urchin eggs of the ultra-violet light from the 3,000 candle-power Heræus quartz mercury arc lamp, even when applied sixty minutes at 15 cm. distance, though a few minutes of the naked light is lethal. In other words, tuberculosis cases injured by sun baths are cured by *Martin-du-Pan* by excluding the injurious ultra-violet.

*Rollier* reports that large doses, especially in blonds,

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<sup>35</sup> *Zeitschrift für Physikalische und Diätätische Therapie*, August, 1908.



cause acute attacks resembling actinic shock or heat exhaustion, and in time a chronic nervous condition differing in no respects from tropical neurasthenia. These states are accompanied by marked phosphaturia. The neurasthenia so common in adult consumptives seems to be made worse by sun exposure. Small doses evidently do no appreciable harm, but whether they do any good remains to be seen. The immense literature of the subject contains no proof one way or the other. *Knopf*, of New York, who advocates light "judiciously employed," whatever that means, has never furnished any proof that it is beneficial, but quotes in its favor very many worthless opinions from men who have never investigated it. Dozens of ineffective drugs have been used in tuberculosis by quacks, and all of them are harmless when judiciously employed, but lethal in excess.

When *Bodington*, in 1840, discovered that consumptives were cured by outdoor life and that the improvement was due to the cold air, the British profession was horrified at his temerity in thus maltreating cases which they believed incurable and so delicate that confinement in hot stuffy rooms was necessary. So they drove him out of practice and closed his sanatorium. When it was proved forty years later that outdoor life was curative, the profession still refused to recognize cold air as the factor, but imputed it to a mystical influence of the light, utterly regardless of the fact that cures occurred in very cloudy climates. For instance, *Trudeau* put some tuberculous rabbits out doors and kept some others in the warm laboratory. The better condition of the former was invariably imputed to the sunshine. Not for many years was the real reason proved by *Lannelongue* and *Achard*, in some experiments thus described:<sup>36</sup> "They took several parcels of guinea-pigs of the same age and as far as possible the same weight, and the same day inoculated them in the peritoneal cavity with the same amount of the same culture of tubercle bacilli. Then these different parcels of animals were placed in different hygienic climatic conditions: The country, the seashore, the coast of La Mancha, high altitudes, the South,

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<sup>36</sup> *Medical Record*, July 9, 1910.



the North; the last lot was kept in the laboratory in a dark room, but with a window constantly open. The guinea-pigs of each lot received daily the same food; whenever a pig died he was sent to the laboratory of *Lannelongue* for an autopsy. Those that resisted to the last were those in the laboratory." That is, *Trudeau's* rabbits would have lived longer in the shady laboratory if the air had been cold and constantly renewed.

The mania for sun baths led to such harmful excesses that I published such facts as were available in the *New York Medical Journal*, September 12, 1908, as a reply to an article published in the same issue by *Dr. S. A. Knopf*, of New York City, who had been using this treatment in tuberculosis. Previously, the damage was noticed by quite a number, the first being *Ransom*, of Dannemora Prison in New York, who was the great pioneer in the prevention and cure of tuberculosis in convicts. If patients misbehaved, they were punished by being quartered in the less desirable locations of the dormitory,—the dark shady corners,—but they improved so much faster than those in the sun that the shady places became the desirable ones. Then *White*, of Colorado Springs, noticed that those exposed to the sun had a rise of temperature and occasionally hemorrhage, so he learned to keep them in the shade. *Havorka* found that sun baths produced headache, palpitation, insomnia and hemorrhages in consumptives.<sup>37</sup> Then it was noticed that in every part of the United States, the improvement occurred in the dark season but not in the light months—Easter to August. In the lightest months of the North, there was usually retrogression, and in the Southwest, the patients were compelled to leave certain climates in summer or perish. The summer deterioration is so great in the Riviera that the patients all leave for the mountains.

Then certain curious facts came to notice as to the incidence of tuberculosis in the trades. For instance, coal miners are remarkably free from tuberculosis though living

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<sup>37</sup> *Zeitschrift für Physikalische und Diätätische Therapie*, July, 1907.



much in the dark, but policemen and teamsters who live in the light are dreadfully prone to it. Rock miners are as badly affected as in any other dusty trade, a fact which may partly account for the bad record of policemen, yet street cleaners are said to be less affected than policemen. As a class miners have a rate of only 6.4, the smallest of any trade, while stonecutters have the largest, 43.1,<sup>38</sup> and the two classes have equal amounts of fresh air and dust. The reports of the Phipps Institute of Philadelphia show amazingly high rates of some outdoor workers and low rates of some indoor trades, but no generalization is possible as the factor of poverty varies so greatly.

In spite of all such well-known facts, *P. Juillerat* and *M. Davy* went to great pains to correlate consumption with the lack of windows and doors in the rooms and houses of Paris.<sup>39</sup> They found that the more the means of admitting fresh air the less is the tuberculosis rate, and then most illogically ascribed the improvement to the light admitted, although doors do not admit much light and do admit air. Moreover, the poorer families with more children per family, and more people per room, who took the upper apartments because the rent was cheaper, had less tuberculosis than in the less crowded, less ventilated lower floors, though the difference in light was not marked.

Even the matter of ventilation is misunderstood. It is not the foulness of the air which does harm so much as the heat and moisture. In the old sailing ships which were unheated, tuberculosis was practically unknown, though the men's quarters were foul in the extreme. Much of their time was spent in the open and the life was recommended as a cure. The modern war-ship is vastly better ventilated, but is hot, and the men spend less time in the open. Tuberculosis is quite common, and a few years ago was alarming. This is also shown in the rapidity of tuberculosis in hot, moist climates, in the bad results of warm, moist inhalations

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<sup>38</sup> Hoffman.

<sup>39</sup> *Gazette medical de Paris*, January 5, 1907.



in tuberculosis of the larynx,<sup>40</sup> and the fearful prevalence of tuberculosis in convicts confined in hot cells.

Practical experience also showed that the tuberculous must be protected from both light and heat.<sup>41</sup> Even in England, with a minimum of sunshine, Sherwood Forest Sanatorium is so built as to shelter the verandas "from the wind in winter and the very warm sun in summer." The rooms with a southern exposure have "outside sun blinds and light inside curtains." In France the sanitoriums at Caignon and the Riviera are closed in the summer. In Switzerland, Austria and Germany, those in the forest seem to be more successful than those in the open, and this has been thought to be due to some influence of the trees. In the United States, *Carling* states that the inland institutions for children are more successful than those on the sunny sea-shore. In the sanitoriums of the suburbs of Berlin, it is found that the patients must rest at midday "in the cool shade."

The map prepared by *Koehler*<sup>42</sup>-*Hillier* shows that, omitting Italy, the tuberculosis death-rate increases with the mean annual sunshine. London and Amsterdam, with all their poverty, overcrowding and fogs, have almost the least rates in the world, but the highest are in the sunny cities of Moscow, St. Petersburg and Vienna. The three worst countries—Austria, Servia and Chili—are far from cloudy, but the three best, omitting Italy, which has cloudiness in the north, are the Netherlands, England and Belgium. The same phenomenon is found in America, the sunny South has more tuberculosis than the cloudier North, though much of the excess is the after-effect of typhoid fever and malaria, so prevalent in the South. Cases are very curable in the cloudy Adirondacks and in the smoke of Pittsburgh, but sunny Florida has been abandoned because of its bad results.

*Burton Fanning* noted the harm done by light<sup>43</sup> and *Leonard W. Ely* condemned the sanitoriums which contain

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<sup>40</sup> *American Medicine*, February 18, 1905.

<sup>41</sup> John Carling, *New York Medical Journal*, August 29, 1908.

<sup>42</sup> J. B. Huber, *Consumption and Civilization*.

<sup>43</sup> *The Open Air Treatment of Tuberculosis*.



"beautiful sun-parlors to let in the sun and keep out the air,"<sup>44</sup> and we might also state that the usual "sun bath" is not a sun bath at all, for the patient is carefully enveloped in opaque clothing and the only effect is a painful glare in the face. *Malgat* applies the sun's rays to the chest only, as in surgical tuberculosis, carefully shielding the rest of the body.<sup>45</sup> He finds that if heat accompanies the light it may interfere with cure by causing tissue anæmia and that the light may cause general anæmia.

In the enormous amount of literature on the subject, there is not a single mention of any control experiments, such as treating two lots of children exactly alike in all respects except giving half sun baths and shading the others. Nevertheless many physicians have taken it up seriously, and there is a curious agitation in the lay press in its favor. Few seem to know that living in cold air in the shade is a necessity of types evolved in the cold dark northwest part of Europe. Light does no good whatever, but the more pigment there is in the skin the less is the harm. Black patients can stand sun treatment which will promptly kill a nordic blond.

If guinea-pigs infected with tetanus are kept in cold air the disease is delayed or prevented, but hot air brings it out. Cold was therefore used in treating a human case in Omaha.<sup>46</sup> Malaria of both birds and man improves in cold weather, but recrudesces in summer before new infections are possible. Cold stimulates phagocytosis and constricts the superficial arterioles. Rats and guinea-pigs are much livelier in the cold room. After infection with trypanosomes, cold air delays incubation, checks the multiplication of the parasites and prolongs life.<sup>47</sup>

The necessity for cool or cold air in the treatment of pneumonia in the lighter types of Europeans is a well-known fact. They deteriorate or die in hot weather. *Simon Baruch* finds that the room temperature should not be above 60° F.

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<sup>44</sup> *New York Medical Record*, June 26, 1909.

<sup>45</sup> *La cure Solaire de la Tuberculose Pulmonaire Chronique*.

<sup>46</sup> *Crane, St. Louis Medical Review*, July 7, 1906.

<sup>47</sup> *Ross and Thomson, Brit. Med. Jour.*, March 25, 1911.



*Young and Williams* <sup>48</sup> show that outdoor treatment of puerperal infections lessens the mortality nearly twenty per cent. They think that sunlight is the factor, and that it increases hæmoglobin, though little or no light reaches the bodies of the patients, and if it did in any great amount it would destroy hæmoglobin.

Beyond these few facts we have positively no explanation for the wonderful effect on cold climate types, by the simple act of breathing cold air, and having it play on the face and head. Perhaps the cerebral cells are prevented from overheating and are kept at their optimum temperature. One Southern sanitarium has had very good results in nervous cases by the simple expedient of ventilating with cooled air, and the most successful sanitariums are in cool climates. It is evident of course that cold air is injurious to ethnic types adapted to hot air. It is a treatment for white men, and the blonder the more efficacious.

The experiments on the critical temperature, described in a prior chapter, which show that the body temperature varies with that of the air, explain why consumptives are worse in a heat above the critical point. Their fever is increased. Similarly cold air may counteract any tendency to fever. *Rollier* has shown that the body may even be unclothed for a short time daily in calm winter weather if kept in the sun for warmth, but in summer it is found to be injurious. This, then, is the probable benefit of his winter treatment of brunets, but his failures with blonds are due to the excessive light which he thinks is the curative agent in others.

The use of hot or cold baths is greatly modified by the complexion of the patient. Formerly we reduced fevers by increasing the perspiration, then *Brand* found that in typhoid we could extract the heat sooner by cold baths, but now we are finding that the effect of the cold is very temporary, for it closes superficial arterioles, reduces radiation and perspiration, and creates the necessity for more baths. Hot baths, on the contrary, dilate the arterioles, increase the superficial

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<sup>48</sup> *Boston Medical and Surgical Journal*, March 14, 1912.



circulation, radiation and perspiration, and thus lower the fever more than cold baths and keep it down longer. *Chastang*, of Paris (Caducée), found the same phenomenon in thermic fever, and if, after a hot bath, the patient is placed in a gentle draught of air, the temperature comes down sooner, consciousness returns sooner and there are more cures than with cold baths. This treatment would be dangerous in negroes if the air temperature be over blood heat, because there could be no radiation from his skin, though a strong current of air might make up for this by increasing evaporation. At temperatures between  $98^{\circ}$  and the critical point ( $73-85^{\circ}$ ) the white skin would not radiate sufficiently without the draught of air to carry off the heat by evaporation. In a cool room the radiation might be sufficient without a draught. *Simon Baruch* says that the best antithermic bath is one at  $90^{\circ}$  F., of an hour's duration. Water of low temperature is a vasomotor stimulant.

Color therapy has occupied a large space in popular literature, but little is known about it. There is an enormous amount of medieval nonsense as to the effects of color in disease, and it is transmitted from generation to generation like folk-lore and old wives' tales. The retinal and nervous irritation of the two ends of the spectrum and the absence of any effect of yellow and green, show that much of the alleged results of color are merely due to exclusion of excessive amounts of all frequencies. Mild red and blue light may be less irritating than a glary room and appear to be soothing, though in fact more irritating than if the room were merely shaded or were yellow or green. Green rays seem to be therapeutically inert.

*H. von Tappeiner* discovered that certain fluorescent substances, such as resin, magdala red, erythrosin, fluorescin and acridin, which were more or less inert in the dark, became poisonous in the light. He called this a photodynamic effect but found that in some instances at least it depended on the presence of oxygen. If eosin is injected under the skin, and then exposed to light, it causes extensive necrosis. He tried this therapeutically in skin diseases, by first painting with the



fluorescent substance and exposing it to the sun or an arc light. The results<sup>49</sup> were no better than by the ultra-violet light alone and we have heard little or nothing about the matter since. If iodine is painted on the skin in the dark, it is absorbed and does not discolor, but white light fixes it in the skin.<sup>50</sup>

*Tappeiner's* work led many to think that we could administer such fluorescent substances as quinin, esculin, fluorescin, resorcin, orcin, eosin, fraxin, uranin, rhodamin, petroleum jelly or salicin, and then cure internal neoplasms by the fluorescent light evoked by X-rays. But fluorescent rays are wholly inert in such small amounts, and unfortunately many of these substances do not fluoresce to X-rays at all. The matter was soon dropped, but in recent years there has been an attempt to revise the method. *Regnault* and *Foucault* concluded fifty years ago that the damage done by ultra-violet light in the eyes was mostly due to the fluorescence evoked in the media of the eye, but there is no evidence that this is so.

In some German sanitoriums, light baths are used as counterirritants to cause skin congestion and thus draw blood from congested deeper structures, but the results do not create much enthusiasm.<sup>51</sup> This result is exactly the opposite of what we need in tuberculosis, as *Bier* has shown. There is reason to believe that except in local applications, the baths retard recovery. In the case of tabes, arteriosclerosis, "heart diseases" and "kidney diseases." The treatment smacks of the quackery of the spas.

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<sup>49</sup> Jesionek, *Münchener medizinische Woch.*, May and June, 1904.

<sup>50</sup> Bruntoni, *British Medical Journal*, November 16, 1907.

<sup>51</sup> Jackson, *The Medical World*, January, 1915.



## CHAPTER XII

### NERVOUS EFFECTS OF HIGH FREQUENCY WAVES

The first effect of light on the nervous system is stimulating. To waken babies we merely lighten the room, but to induce them to sleep in the day we must draw the shades. The following letter received from *Miss Clara D. Matthews*, Teacher of Methods, City Training School, Elizabeth, N. J., shows that children react as quickly to changes in light as the bacteria we use in our laboratory experiments.

"About three years ago I had the pleasure of hearing a lecture on the effect of light, given at the Plattsburgh State Normal. The speaker made special reference to children in the school-room and advised teachers as to the treatment of nervous classes. I have followed the suggestions made with very noticeable results in several class-rooms. On very bright days I carefully shaded the windows before the children came in from the playground. The relief to the children was immediately evident and they worked quietly the whole afternoon. As a further test, I left the windows open the next bright day. The children were restless during the entire session. Only a short time ago while visiting classes taught by pupil teachers, I approached a room from which evidence of great disorder could be plainly heard. I entered the room quietly, drew the shades and noted that the children were quiet in a very few minutes. The same children were in the best of order when I returned to the room later in the afternoon. I have been so much impressed with the results of carefully regulating the light that I now instruct all girls in my method classes to try this plan of securing quiet work during the trying spring days."

The stimulation of strong sunlight has been frequently mentioned by literary men of genius, for, with rare excep-



tions, 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 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 unscreened from the pelting rays of the hottest Italian suns. *Byron* was no less a sun-worshiper, who noticed remarkable changes in feeling on sunny days. *Charles Lamb*, though very fond of London, 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. Newcomers in the African Deserts are so stimulated as to feel they had received a new lease of life. *Lady Mary Wortley Montagu* speaks of it, 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." *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 irrespective of the later collapse.

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 and beneficial to the developing ovum, but so far as known to the writer they are the only lower animals which deliberately give light baths to their larvæ.



*Professor Claudio Forni*,<sup>1</sup> 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." It is quite evident that *Forni* was producing various grades of thermic fever, which masked the effects of light alone.

The ether waves set up in the neighborhood of X-ray machines, wireless apparatus and high frequency currents, have been blamed for a great deal of mental and nervous exhaustion in the operators as an after-effect of the stimulation, though *Marconi* has stated that if proper protective screens are used no ill results are seen. The nervousness or hysteria which in time attacks some telephone girls is better explained as due to exhaustion from undue strain of all the mental faculties, but the neurasthenic state of many X-ray operators seems due to the short waves they constantly encounter.<sup>2</sup> The excessive amount of ozone encountered is thought to be harmful and to be the cause of the anæmia now and then developed, but ozone has little or no effect of any kind.

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<sup>1</sup> *Gazette degli ospedali e delle cliniche.*

<sup>2</sup> Dr. M. P. Bellier, *Archives de Medicine Navale*, March, 1909.



There is a similar neurasthenia<sup>3</sup> due to the actinic effects of short rays developed in the neighborhood of all electric appliances. The nervous exhaustion which follows thermic fever, lightning stroke or a heavy electric shock, is so persistent or permanent as to indicate a profound alteration in the nervous tissue, and is probably the same condition as we find in the neurasthenia of long exposure to the short rays of the sun.

The Swedish scientist *Svante Arrhenius* has proved that if a school-room is surrounded by a network of wires through which high frequency currents are passed like a huge solenoid, the children are greatly stimulated mentally and physically.<sup>4</sup> They grow faster as with plants similarly treated, and make more rapid progress with their studies, but their mental quickness shows that it is a dangerous experiment on account of the certainty of exhaustion as an after-effect. They behave somewhat like American children overstimulated from excessive sunshine. Even in London, with all its fogs, it has been found that the irritability and peevishness of babies is often due to the glare from constant association with white surfaces—walls, clothing, bedding, perambulator. American babies are made actually neurasthenic by excessive light, and the glare of school-rooms is responsible for many an attack of "nerves."

Tropical irritability is mostly due to this constant bombardment of the sun, for it is worse in the blonds. In officials of long residence it becomes so noticeable in their letters that it is frequently necessary to relieve them from duty and send them on vacation to darker climates. In Rhodesia, the Company compels all employees to leave every two years to prevent this nervous state. It was this that caused several prominent engineers to leave the Panama work. *Kohlbrugge* states that even elevation in the tropics does not prevent the inevitable neurasthenia—especially between 4,500 and 6,000 feet with an average temperature of 15° to 17° C. The hill stations in India develop neurasthenia in

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<sup>3</sup> F. H. Millener, *American Medicine*, August, 1906.

<sup>4</sup> *Cosmos*, October 14, 1911.



spite of the coolness. Perhaps the increase of ultra-violet rays in the upper atmosphere may make the condition worse. *Gustave Michaud*<sup>5</sup> states that in tropical highlands photographic plates are overexposed in times proper for lower levels. Above 8,000 to 10,000 feet the ultra-violet actually penetrate colored garments and may produce severe sunburns. Some of this effect is due to heat transmitted through the shirt, as happened to our soldiers marching to Peking in 1900.

"Arctic irritability" is a neurasthenic state which develops in explorers after a year or two in the cold, but the exact cause is in doubt. There are a number of conditions which could account for it, without calling on either the excessive light of summer or the darkness of winter. From the neurasthenic conditions of blond residents of our glary Northwest and the interior of Alaska, it seems that light is at least one cause. A member of the Scott south pole expedition, who became insane, was a victim of this condition, exaggerated by fatigue. *Dr. H. G. Blessing*, who accompanied the *Fram* in 1893, said it required three years to produce serious nervous results, and though he blamed the lack of sunshine of winter, it was little worse than in the fiords of Norway.

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 farther 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. The same phenomena have been noticed in the light glare of the interior of Alaska, but not on the cloudy coast. *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, indeed negroes are able to live in the arctics for

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<sup>5</sup> *Popular Science Monthly*, 1905.



a while, and one of them reached the north pole with Peary. 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 arctic mental depressions occur in the dark season. 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.

The sexual system is particularly stimulated with the return of the spring, so that it really amounts to a rutting season in the Eskimo. There is some evidence that a similar excitement is found in temperate climates in the light season. There may be a basis in observed facts for the poet's idea that in the springtime the young man's fancy lightly turns to thoughts of love. Newcomers in the tropics experience a great stimulation of the sexual system, which seems to be followed by exhaustion as it leads to excesses. *Ripley* quotes *Beyfuss* and *Jousset* to the effect that the tropical climate is a sexual stimulant, but does not give the reasons. The possibility of aspermia after long-continued excessive exposure to light must not be forgotten.

We are now in a position to understand that acute condition called heat exhaustion, which is so puzzling to most practitioners. It is called sunstroke by *Leonard Rogers*, I.M.S.,<sup>6</sup> because it is generally due to exposure to the sun, as in marching troops. The patient collapses, has a weak, rapid pulse, normal or subnormal temperature, relaxed, cold, wet skin, and is fully conscious, as a rule, though he may faint away for a short while. It is the picture of shock, and is shock. It is due to light and not heat, for it occurs in a light bath where heat is carefully excluded and it is found in minor degree in those cases of tuberculosis exposed naked to the winter sun at Leysin in the Swiss Alps, as reported by *Rollier*.

Actinic shock is much more common in blonds than bru-

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<sup>6</sup> *Journal Royal Army Medical Corps*, January, 1908.



nets and is rare in negroes who are susceptible to thermic fever and heat cramps. In the Elks parade in Philadelphia, 1906, it afflicted a multitude who were standing in an intolerable glare. Recovery is generally rapid and complete, if the patient is removed to the shade and stimulated. In every respect it is the opposite of thermic fever, which is usually called sunstroke—a term, by the way, which we should abandon. Heat-exhaustion had better be called light-syncope or actinic shock. This is the condition which generally results in India when a man foolishly stands bare-headed in the noonday sun, although thermic fever may also result. If his hair is thin or he is bald he may be stricken in a few moments, as also may be a bald-headed man in a light bath if his head is not covered with towels. The tropical native escapes by means of an elaborate head-dress. White men have avoided it by wearing opaque protection to the head and spine. *Lt.-Col. Andrew Duncan*, I.M.S., was the first to call attention to the fact that light is the factor in the tropics, though he has never made a proper distinction between this condition and thermic fever. He was the first to popularize opaque clothing, though his selection of orange red is not essential, as any opaque fabric will do. *Colonel Maude*, of the Royal Engineers, discovered many years ago that if the spinal cord was also carefully shaded by an opaque cloth, cases of "heat-exhaustion" were still more efficiently prevented. There is no question that light does have a deleterious effect upon the upper part of the cord, and this is a factor in these syncopal tropical cases where the sun has been beating on the back in a long march. The hair in our wild state evidently acted as a shade to the neck, in the same way that the mane of the horse shades his brain.

If there is a simultaneous exposure to both heat and light, as in the summer sunshine, thermic fever, heat cramps and actinic shock might coexist in any degree of severity in the same person. Hence, we find in practice that there is an infinite variety of forms of "sunstroke" with or without any one of the prominent symptoms,—fever, coma, etc. These mixed cases have very greatly puzzled pathologists. More-



over, negroes may drop from thermic fever, where blonds are being overcome by the light.

These results are even more pronounced in excessive exposure to the ultra-violet rays of the quartz mercury lamp, devoid of infra-red and red. *Berthelet* declares them more dangerous than any other short frequencies, as he has seen serious results in man—ophthalmia, with ultimate blindness, burns of the skin and conditions resembling heat exhaustion. In insects we may have every grade of effect up to instant death.

Wild animals are so well protected against light that they rarely suffer from it in their natural habitats. The domestic animals forced by man into undue exposures to the sun very often die of thermic fever though, as far as I know, they never have any condition corresponding to actinic shock. In *Aron's* experiments<sup>7</sup> he was unable to cause it. No attempts have ever been made to produce actinic shock in mammals such as is found in insects exposed to the ultra-violet rays of the uviol lamp.

There is very little known as to the psychic effect of colors, though an enormous amount of nonsense has been written on the subject. Certain combinations are intensely painful to sensitive eyes, in the same way that discords are painful to sensitive ears. Dogs are particularly pained by bugle calls and other harsh sounds. Very high pitched pure tones will set our own nerves a-tingle, and certain pure colors are more or less painful to men, but no generalizations are possible, as the personal equation is perhaps different in each of us.

Green seems to have no psychic effect whatever, and is suggested for "dark rooms" when other colors prove irritating. *Sir James Crichton* said<sup>8</sup> that the rays from red to yellow have a depressing psychic effect and the red an exciting one, though *Piffard* stated the opposite. *Courmont* and *Bayle*, of Lyons, found that the red light used in treating small-pox was so irritating that the patients begged to be put

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<sup>7</sup> *Philippines Journal of Science*, 1910.

<sup>8</sup> Address to Manchester Sanitary Association.



into ordinary light and the nurses could be induced to stay only by furnishing them with blue glasses. The photographic manufacturer, *Lumière*, of Lyons, was compelled to substitute green for red light in the dark room on account of the mental excitement produced. Red is also said to cause terrifying hallucinations and delirium in patients, and *Havelock Ellis* stated that red and yellow are the only colors seen in dreams. The reason for the well-known effect of red on the bull is not understood, nor is there any reason for the selection of red by the demi-monde, except convention, as it does not seem to have any sexual effect.

It has 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. On the other hand, *Minin* reports that he cannot use the ultra-violet rays of his lamp 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. On the whole, the evidence seems to prove that the psychic effects are the opposite of the irritating effects on protoplasm. For instance, red, the most irritating mentally, has little effect or a depressing one on muscular contractions, which are increased in vigor by the rays at the short end.

The effects of suggestion are sometimes confused with the purely psychic effects of colors. Green and yellow suggest the quietness of the fields, blue the immensity of the sky, and red the violence of fire and bloodshed. Scenic artists, by proper combinations, certainly enhance the effects of dramas, but whether this can be called psychic in the sense that red affects a bull is extremely doubtful.



The psychic effects of moonshine are not known. Most of the stories being pure fabrications or the result of mistaking mere coincidences for cause and effect.

Whether or not we actually need this stimulation of a little light to reach our highest mental and physical efficiency is still a moot question. Physiologists are probably of the unanimous opinion that we do need some, but there is curiously little evidence in support of the theory. Indeed, the facts seem to point the other way. Undoubtedly we desire the stimulation of light, but that does not prove we must have it. The thirst for alcohol does not prove its necessity. Many writers even speak of a "light hunger" or "light thirst" found in those long deprived of their accustomed stimulus. 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.

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. The anæmia of tunnel workers was proved to be due to hookworm. 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.

*Arlidge*, an English physician, long ago called attention to the health and long life of miners who spend much of their time in the dark. We have mentioned the fact that coal miners are remarkably free from tuberculosis though rock miners have as much as in any other dusty trade. Cer-



tain indoor trades seem to protect one from tuberculosis and outdoor trades predispose to it, though the opposite results are generally found. Criminals never suffer from it if they are properly treated. It is found that even fresh air out doors is needed only part of the day. Indoor workers should sleep with open windows, but outdoor workers can keep the room rather close.

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 nervously 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 recent reports indicate that New York subway employees are healthier than those on surface cars.

Residence in dark houses is harmless, even for brunets, who are adjusted to more light. There can scarcely be more stable races than those 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 of city dwellers also. Not only do yellow Chinamen thrive 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.<sup>9</sup> The underground population of London and New York is very large, but of course nothing to compare with this. The 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.

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, often

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<sup>9</sup> *Collier's*, January 9, 1904.



with no chimney or fireplace, and, of course, no stove, and into these places are huddled many people. 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.

*Edward Eggleston*,<sup>10</sup> describing the primitive dark houses of our earlier settlers and the frontiersmen, said 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 says 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 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 several 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 shade indeed has been a benefit.

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. 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

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<sup>10</sup> *Century*, April, 1885.



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, 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 kinds 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.



## CHAPTER XIII

### RESULTS OF INSUFFICIENT PIGMENTATION

*Charcot*, in 1859, was the first to show that sunburn was due to ultra-violet light on insufficiently pigmented skins. *Finsen*, *Whitmarch* and numerous others have produced sunburn artificially by cold light. The irritation of ultra-violet is so serious in glacier-burn, that blood vessels leak and there are hemorrhages into the intercellular spaces. The extruded blood pigment gives a curious yellowish brown color to the skin, identical in character with the "black and blue" stain after a bruise. Tanning, on the other hand, is an extra amount of pigment produced by the irritated pigment cells of the skin. It is exceedingly efficacious in excluding ultra-violet rays, so that a well-tanned person can stand exposures which are exceedingly harmful to those with white skins. Similarly, glacier-climbers can prevent burns by staining the exposed skin a dark brown or blackening it with carbon powder. It is needless to remark that the blonder the person the more he suffers from actinic burns of all kinds.

Prolonged irritation of strong sunlight will cause a chronic eczema so different from ordinary forms as to have warranted the names of European Leprosy, Healthy Man's Disease and Biblical Leprosy. *Jack London* suffered dreadfully from it in his South Sea voyage,<sup>1</sup> and reports that none of the physicians consulted seemed to know that it was actinic eczema. It promptly recovers upon removal of the cause. It is worse if the skin is kept wet. This eczema is the main cause of death in young white skinned pigs and other domestic animals in very light countries, like our western plains. It also appears in our southern summers on the

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<sup>1</sup> The Cruise of the Snark, p. 339.



white spots of horses, such as those with white noses. In the tropics all skin diseases are marked and severe on the white spots of imported breeds of domestic stock. *Turner*, of Johannesburg, says that the native African albinos suffer from severe forms of it. The raw-beef appearance of the faces of old cabmen, sailors and others exposed to the weather is partly due to the light, for it is worse in blonds.

The intense redness of blond skins which will not tan, is almost as good a protection as the yellow or brown color of the tanned brunet skin—since all the colors stop the short rays. Consequently the red color of the skins of some domestic animals is fairly efficient where the light is not very strong, as in central or northwest Europe, but it is not possible to acclimatize them in the tropics. White bulldogs, fox terriers and white skinned cattle do not thrive in the tropics, and we have spent much time and money in vain attempts to establish white skinned hogs in our sunny climates. American farmers are under the constant necessity of importing breeders to keep up their deteriorating white skinned stock evolved in northwest Europe.<sup>2</sup> *Professor E. H. Starling*, University of London, was the first to call attention to the fact that the white skinned northern horse will not survive the tropics.

The skin lesions of pellagra are due to the actinic effects of light, for they occur mostly where light reaches the skin and constitute the well known "glove," "boot" or "collar." The skin is like the prepared photographic plate, and only waits the light to show results not possible in the non-pellagrous or healthy skin. Sun exposure makes the eruption worse.<sup>3</sup> It does not appear under finger rings.

White rats fed on buckwheat and kept in the dark remain healthy, but if exposed to light, develop a disease<sup>4</sup> which resembles pellagra.<sup>5</sup> *Virchow* found that the buck-

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<sup>2</sup> See articles by the author in the *U. S. Cavalry Journal*, September, 1911, and May, 1912.

<sup>3</sup> Triller, *La Tribune Medical*, September 22, 1906.

<sup>4</sup> Fagopyrismus.

<sup>5</sup> Raubitschek, *Wien. klin. Woch.*, June 30, 1910.



wheat eruption of cattle appears only on the clear white skin, and not on animals confined in the dark.

The frequency with which lupus appears on the face is surely related to the loss of vitality of the skin from the constant bombardment of light. Similarly a blond skin in the tropics will lose its resistance to pus organisms, from a loss of vitality similar to that seen in X-ray burn. The eruptions of scarlet fever, measles, rubeola, epidemic cerebrospinal meningitis, leprosy and smallpox, appear first on the face and are generally worse in that locality. Perhaps light exposure has something to do with herpes which complicates pneumonia, infectious catarrh, bronchitis and other infections. These phenomena appear in all races, even in the negro, in whom smallpox may be very severe, but the differences according to pigmentation have not been recorded.

Long continued sun exposure of skins insufficiently pigmented not only causes chronic hyperemia, pigmentation, atrophy, keratosis senilis, Paget's disease, etc., but also a condition of cancerosis. It is particularly marked in children, in whom it has been called *xeroderma pigmentosum*—"a malignant disease, usually developing in early life, characterized primarily by freckle-like spots, especially on exposed surfaces, followed by telangiectases, atrophic changes, angiomatous and verrucous lesions, with increased pigmentary spots, and finally after some years by epitheliomatous growths and fatal ending."<sup>6</sup> The sufferers are generally very blond.

The late *Dr. James Nevin Hyde*, of Chicago, Ill., carried this generalization still farther and has shown by an enormous amount of data that light is a cause of skin cancers in adults.<sup>7</sup> *Dr. Wilfred Watkins-Pitchford*, Government Pathologist in Natal, South Africa, independently discovered it.<sup>8</sup> It is impossible to quote all their facts, indeed much of

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<sup>6</sup> Stelwagon.

<sup>7</sup> *American Journal of the Medical Sciences*, January, 1906.

<sup>8</sup> "Light, Pigmentation and New Growth, being an essay on the Genesis of Cancer," read at the South African Medical Congress, Durban, Aug. 2, 1909. Printed by Wm. Clowes & Sons, Limited, London.



it would merely duplicate what is elsewhere described in this work. Briefly it might be said that skin cancers are far more common in light skins in light countries than in skins properly pigmented. Negroes rarely have it in America and their rate for all cancers is but 57, while the white rate is 75.<sup>9</sup> The death-rate in the United States is lowest in the black States and highest where the blonds are most numerous.<sup>10</sup>

*Loeffler* long ago noticed that the natives of the tropics rarely have skin cancer, and it is said to be unknown in Tunis. It must be said that among lower races only a small percentage reach the cancer age. Still, the children never get such conditions as the cancerosis which afflicts blond children exposed to intense sunshine. In sailors it is so frequent that *Unna* called it "carcinoma of the sailors' skin," while in miners it is practically unknown. The death-rate from cancer of the head, face, and neck is 3.7 in males and only 1.8 in females, and the afflicted males are mostly outdoor workers—agricultural laborers furnishing nine-tenths. Hyde shows that cold, heat and inclement weather are not factors, for it is seldom found in Russian peasants, Eskimos, Egyptians, stokers, firemen, etc. In some people, it does not appear until old age, but in those having less pigment and more light exposure it comes on sooner, so that *Unna* calls it "presenile epitheliomatosis." He also shows that under the influence of light the melanotic granules permeate the papillary layer and cutis, forming "a black net directly communicating with the pigmented lymph spaces of the prickle layer."<sup>11</sup> Multiple epitheliomata of the skin are found mostly in those who have been exposed to much light. It has been reported that cancer sometimes follows lupus which has been cured by *Finsen's* ultra-violet light, and the cancers due to X-ray are common knowledge.

*Watkins-Pitchford* correlates the exposure of the breasts with the fact that two-fifths of cancers in women are of the

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<sup>9</sup> Census, 1910.

<sup>10</sup> Census, 1900.

<sup>11</sup> Hyde.



mammary glands. For one case in men there are a hundred in women. He also mentions the fact that the small unimpregnated uterus is well protected by the bladder and is rarely cancerous except at the fundus, though cancer of the fundus is also rare in those who have borne children. Organs which are dark red or brown in color (spleen, liver, heart, lungs and kidneys) have less cancer than the unpigmented (bone, larynx, rectum, stomach and uterus), also cancer frequently arises at the juncture of pigmented and unpigmented surfaces. The probable death-rate from cancer in various races is in the following order: Zulus, 1.0; Tamils, 7.7; American Indians, 28.0; Chinese, 49.4; Italians, 52.1; English, 82.8; Dutch, 91.3; Swedes, 102.0.

The nervous effects of excessive light, already described, are more marked the less the pigmentation, and consequently are universal in Europeans in the tropics. During the first few months of 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. It is said that even in Los Angeles the old residents can detect a newly arrived person by his energetic ways. 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 came 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.

There is some evidence that the preliminary stimulation and later exhaustion cause actual delusions, which account



for the mania among American officials in the Philippines to deny that the climate can affect any one. The most notorious case was that of *Civil Service Commissioner Washburn*, who stated <sup>12</sup> that the climate was not harmful if one was moral and sober, and that if he did break down recovery was possible there. Within a few months he himself collapsed and had to go away to get well.

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.

Exhaustion may be so severe that alcohol in moderation is a necessity. I have given the proofs of this assertion in a paper <sup>13</sup> 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 3½ 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

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<sup>12</sup> *American Journal of the Medical Sciences*, 1906.

<sup>13</sup> *New York Medical Record*, December 17, 1904.



among the abstainers was a trifle higher than among the excessive and less than among the moderate drinkers.

We have shown that possibly some of this is due to the fact that the abstainers do not drink enough water. However, 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 burned fuel and thus relieve the natural processes of part of their burden. White residents of Abyssinia find that alcohol is needed at the day's end.<sup>14</sup> The late *Willard Parker* is said to have taught fifty years ago, "Never drink; but if you must drink, do it in hot weather. Never, never in cold."

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 sun 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. 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." The chief surgeon, *Colonel Charles R. Greenleaf*, mentioned the mental, nervous, and physical deterioration after a year

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<sup>14</sup> Duncan Brodie.



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. 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. It is not often mentioned in reports, but the case is tabulated necessarily under some infection or other condition from which the patient would promptly recover at home. Of 313 soldiers invalided home from the Philippines January, 1910, to October 31, 1911, in 91 the cause was a mental or nervous disease.

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. 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. 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 "Punjaub head" I have seen were both in bald men.

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 found in blond neurotics in temperate climates. Some women suffer dreadfully from it and it drives many home. It is the cry of the irritated and damaged nervous system for relief. It is an axiom of physiology that a healthy organism is com-



fortable, and that discomfort invariably means damage by some cause.

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. The most pitiful objects in the Philippines are the neurasthenic American children who have been born or raised there. They have no self-control when subject to disagreeable sensations and can stand no pain whatever. They become frantic in the dentist's chair. *Kohlbrugge*<sup>15</sup> says that physicians have mentioned the same nervousness in the Dutch tropical colonies, and it is in marked contrast to the phlegmatic type normal to the fogs of Holland. Those who state that white children thrive in the tropics have overlooked the appalling neurasthenia. I have many times had these pitiable neurotics pointed out to me as illustrations of the manner in which white children thrive in the Philippines!

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 sun, but then begins the restless age of running about when it is practically impossible to confine them. Hence they are more and more exposed, 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 brunet babies to flourish in the

<sup>15</sup> *Archiv. für Rassen und Gesellschafts Biologie*, November 5, 1910.



Philippines and at the feebleness, exhaustion, woful condition and struggle for life of the brilliant blonds, there being exceptions, of course, depending on inborn vitality and the care given to them.

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. 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.

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. Hypertrophic hearts of athletes may become dilated in a short time. The vasomotor disturbances from a 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. *Lombard*<sup>16</sup> 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. *Grijns*<sup>17</sup> found that the reaction time of white men in the tropics was much less than at home, though the Malay was normal in that respect. *De Manaceine*<sup>18</sup> found that heated rooms reduced our ability to sleep, and this, of course, only accentuates the exhaustion of the tropics

<sup>16</sup> *Journal of Physiology*, 1892.

<sup>17</sup> *Archiv. für Anatomie und Physiologie*, 1902.

<sup>18</sup> "Sleep."



due to other causes. The *New York Medical Journal*<sup>19</sup> very correctly likens tropical exhaustion to the sequela so frequently found after influenza, indeed the two conditions are identical.

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 brunets. We only know that for many ages the blonds flocked to the brunet 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 brunets suffering from nervous diseases. Among the Christians of the cities we gather a general impression that the blonds are, as a class, more nervous and present more cases of nervous disease than the brunets. In our South the blonds are the main sufferers. The nervous, excitable, hysterical condition of these blonds, reverses the natural conditions found in Europe, where the brunet Mediterranean man is notoriously more nervous and excitable than the blond northerner. The brunet 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. The Teutonic peoples of Northwest Europe control the vast majority of the ships of the world. When disaster overtakes a British vessel, nearly every one keeps his head, and if they sink, they sink in silence, but in a French, Spanish, or Italian ship, every one becomes hysterical and the ship is a howling bedlam at once, as we saw in the Bourgogne 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

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<sup>19</sup> February 1, 1902.



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, too, become hysterical under excitement, and a Chinese or Malay crew cannot be depended on in disaster.

It was also a matter of common 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 brunet, 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 brunet; 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 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 brunet.

	Number.	Percentages.		
		Brunet.	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 disadvantage under which the blonds labor from their lack of opaque protection. Of course brunets 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.
Brunets .....	205	65	23	9	3
Mixed types .....	583	64	25	7	4
Blonds .....	306	54	31	10	5

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.	Brunet.	Blond.	Mixed.	Brunet.
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. Since then there has been a progressive improvement with increased knowledge of hygiene.

Blonds and brunets were later studied in the Philippines<sup>20</sup> and though the investigators were unable to see any difference in the morbidity and mortality rates of the two classes, the data published show that there was a vast difference in favor of the brunets. The blonds, including many mixed types, had ten per cent. more cases of illness and days lost, even including accidents and cases having no relation to the climate. Heat exhaustion, neurasthenia, pemphigus, eczema, dermatitis and ulcers were twice as frequent in blonds, tuberculosis almost twice and alcoholism three times. Blonds also had more insanity, malaria, tuberculosis, diseases of the eye and ear, lymphadenitis, ringworm and digestive disturbances. This was only after eighteen months' residence, but the differences are more marked later.

*Macdonald*,<sup>21</sup> in his studies of the effects of pigmentation in Glasgow school children, quotes numerous observations of the relative morbidity of blonds and brunets, but they have no value since the climatic environment is not mentioned and blonds will have the advantage in one place and brunets in another. *Ripley*<sup>22</sup> 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.

Though there are thousands of articles and books on the subject of the effects of different climates and different weath-

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<sup>20</sup> *New York Medical Journal*, October 12-19, 1912.

<sup>21</sup> *Biometrika*, July, 1911.

<sup>22</sup> "Races of Europe."



ers on human conduct and physical health, the only statistical study is that of *Professor E. G. Dexter*, University of Illinois. His work<sup>23</sup> 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 there is a marked increase of abnormal conduct due to irritation in the light seasons and on bright days. 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 is goaded into an irritated state in which he loses control of his emotions and inhibitions and commits abnormal acts. Such a criticism could be leveled 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.

Children behave worst on the days when the humidity is least, and 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. 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. On cloudy and rainy days there is a remarkable improvement in deportment, which is also best on calm days, 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.

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<sup>23</sup> "Weather Influences." Macmillan.



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. 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 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.

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. In prisons, the deportment of the criminals varies as above in a general way, showing the irritation of light, for they are exposed in their labor, as a rule.

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. 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 the wet and cloudy, 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. *Lombroso* and many others have found that insanity and suicide increase in the summer. 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 India 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 ( $45^{\circ}$  to  $70^{\circ}$ ), the extremes of heat and cold giving a few cases, though they give more than their proportional share. Since the publication of *Dexter's* book a large number of articles have been written upon the connection between suicide and sunshine.

In 1903 the suicides among soldiers in the United States were .07 per 1000, but were .16 in the Philippines. There was one homicide at home but eight in the islands. Of the 119 deaths in the Philippines between January, 1910, and October, 1911, twelve were suicides. 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. Although there are no recorded statistics of the complexions of suicides in light countries, the blonds seem to furnish an undue share. It is largely an ethnic matter everywhere, for intruding migrants suffer more than the adjusted autochthones.

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. 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 XIV

### EYE DISEASES DUE TO LIGHT

The eye is more injured by excessive light than any other organ. It is said that the end apparatus of the optic nerve is more easily damaged than proliferating cells, more so indeed than the germ cells. The retina has the sensitiveness of nerve tissue in general, and being necessarily exposed to the direct action of light through the transparent media, it must be protected from excess. *Dr. Geo. M. Gould*, in his works on eye strain, mentions the following fifteen mechanisms for toning down the light to a harmless intensity which permits accurate vision: shadows of the retinal vessels, reflection of light from the blood corpuscles, shadings of the *muscæ volitantes*, retinal pigment extending to the iris, the ever-varying size of the pupil, the skin of the lids and its pigmentation, the eyelashes, winking, binocular vision which shades one part of the retina when a similar portion of the other is illuminated, incessant movement of the eyes, the overarching eyebrow, the hairs of the eyebrow, retraction of the eyeball in the aged, the habitual placing of the border of the upper lid at the upper border of the pupil. To which may be added the squinting of the eyelids until the opening is a mere slit when exposed to intense light, and the pigment formed on the exposed sclerotic in dark races. Gould also mentions the effect of high cheek-bones in shading the eye from below, such as glare from snow, sand or water. In some races the brow and cheek-bone are so prominent as to make the eye appear sunken, as indeed it is, and thus protected from sky and snow glare.

Many of these arrangements vary from race to race according to their necessities. Such profound changes could only arise in one way—the slaughter of the unfit and the



preservation of those with the proper variations. Hence there must be much eye disease interfering with survival of men who migrate to lands too light for their means of protection, or to others too dark for their pigmentation. Adjustment means that the eye is not injured by any radiations it ordinarily receives.

There are two kinds of pigment in the iris. "One, the stroma-pigment, varying greatly in amount in different individuals, lies in the branched cells of the stroma; the other, the retinal pigment, fills up the epithelial cells of the retinal pigment layer and is fairly constant. Stroma pigment is brown in color, and when it is deficient, the iris appears blue or gray, according to the delicacy or coarseness of the stroma-fibers which allow the retinal pigment to shine through."<sup>1</sup> The two forms of pigment have entirely different embryonic origins.

The retinal pigment on the iris seems to be wholly the black variety, but the stroma pigment is composed of the three found in the skin,—black, red and yellow. The various combinations of these, together with the blue appearance of the retinal pigment of the rear surface shining through the blood, give an infinite variety of colors and shades. A deficiency of black and yellow produces the red brown of the rufous people. The yellow may appear separately in specks or give a green color in combination with the blue. The more light to which a race must be exposed, the greater is the amount of black and the less the yellow in the iris, but a pure black is not found. The darkest are brown, as the red is apparently never deficient except in the Xanthous and albino.

The iris changes in color according to the intensity of the light.<sup>2</sup> On emerging from the dark, green-yellow eyes become blue-gray. 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

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<sup>1</sup> A. L. Dykes, *Lancet*, November 29, 1913.

<sup>2</sup> Exner, *Medical Record*, October 22, 1904.



was not known. It appears to be a phenomenon similar to the changes in the chameleon, but unlike that animal it is not for resemblance to the background but to grade the protection according to the degree of light. *Professor Wm. Ridgeway*, of Cambridge University, has stated<sup>3</sup> that *Scott* took only dark-eyed men on his first south polar expedition, because the blue-eyed did badly. On their return to New Zealand their friends were astounded to find that in some the eyes had lightened up very perceptibly. There is no explanation for this curious phenomenon, unless these particular men had passed much of their time in darkness.

The visual purple—a bluish fluid circulating in the retinal cavities—seems to be more directly connected with vision rather than as a protection. It is said to transmit the more harmful rays at the two ends of the spectrum but absorbs those relatively harmless frequencies which cause the greatest sensation of vision—yellow and green. Light bleaches it, if intense enough, the color becoming red, then yellow and then fades entirely, and the wave lengths absorbed seem to have the most effect. Vision is not possible until the purple is restored, which occurs very promptly. The “after color” one sees after looking at the complementary color a few minutes, has a relation to the restoration of the visual purple.

The other pigments in the eye are entirely protective, particularly those in the iris and skin of the lids. They are like dark brown shades for a glary room. Even the sclerotic becomes pigmented at the palpebral fissure in races exposed to excessive light. The pigment in the retina varies with that in the skin, the color revealed by the ophthalmoscope being a reddish brown in the negro and light yellowish red in the blond. This pigment also has an amœboid movement. Under the influence of strong light it envelops the rods and cones, but retracts when more light is needed for vision, as in the migrations of pigment in the iris.

The keenness of all the senses is about on a par in the various races of man, the differences being individual, not

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<sup>3</sup> *Science Progress*, 1910.



racial.<sup>4</sup> The paucity of color words in primitive languages has been shown to be due to poverty of the language not of color sense, as once thought. People saw things long before they talked and the development of color sense probably occurred ages ago in mammals long before even the monkeys were evolved. Acuity of vision likewise is individual, the races being essentially the same on the whole, and the vaunted superiority of primitive people is not found on careful tests. There is no question though, that it is depressed when the light is not appropriate for the man's pigmentation.

In testing the acuity of vision, the test letters must be illuminated more for dark people than for light, since the normal pigment of the former has the same effect in reducing acuity as dark spectacles on the very blond. Theoretically there is a separate range of intensity of light best for each degree of pigmentation, though this range is considerable on account of the various adjustments to permit of vision in weak or strong light. At any rate, a black man has keen vision in a strong light in which a blond is partly blinded from the glare.

The visible spectrum extends from the violet rays of 397 microns to the red of 723 microns, though *Parsons* says<sup>5</sup> that most people do not see any red rays longer than 600 microns, or violet rays shorter than 400. *Helmholtz* gave the red limit of visibility at about 800. We have no way of determining the color range of lower animals, though there is some evidence that they have different ranges than man.

Perhaps no two men have exactly the same power to distinguish colors at the two ends of the spectrum, all being more or less red blind and some blind to the violet. In the mid-lengths perhaps all races are alike, omitting the few individuals in each race who are blind to a few bands. The ability to distinguish shades has been proved to be a mere matter of education and refinement. The uncultured child

<sup>4</sup> Woodworth, *Science*, February 4, 1910.

<sup>5</sup> *Journal American Medical Association*, December 10, 1910.



or savage prefers the glaring pure colors like red, yellow and green, not because they cannot see the subdued tints but because they have not had their attention directed to them. It is said that a baby will pick out red and yellow toys, and the savage selects these colors for adornment. Present day primitive people seem to be a little defective in faint tints of blue and yellow, but so also do many of the higher races. Whether the greater pigment in the retinae of dark races has any effect on the color sense, as often suggested, is quite improbable, except in faint light. It is known that as an object recedes from us, its color becomes indistinguishable, as there must be a certain intensity of the rays to perceive the color.

The transparent media of the eye have the power to absorb considerable of the infra-red and ultra-violet which are not involved in vision and which have an irritating or destructive effect according to their intensity. Though all the media of the rabbit's eye are transparent to wave lengths from 660 to 390 microns, they are more or less opaque to the frequencies beyond these limits. *J. Herbert Parsons*, of London, and many others have determined just what lengths are transmitted and which ones are turned into other forms of energy or "stepped down" to heat rays.<sup>6</sup> The shortest ultra-violet rays being destructive to the naked nerve endings, few if any of them reach the retina in ordinary sunlight, though, of course, if we look directly at the sun, they may penetrate sufficiently to destroy the function of the nerve tissue and possibly the tissue itself. *Verhoeff* and *Bell* think that eclipse blindness is purely a thermic effect.<sup>7</sup>

In the rabbit the cornea is opaque to ultra-violet wave lengths shorter than 295 microns, which are all injurious to it. These high frequencies seem to be stepped down to infra-red and warm up the tissue. The cornea transmits only one-nineteenth of the lethal rays shorter than 305.<sup>8</sup> The aqueous is transparent to all ultra-violet rays like ocean

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<sup>6</sup> *Journal American Medical Association*, December 10, 1910.

<sup>7</sup> *Science*, September 25, 1914.

<sup>8</sup> *Verhoeff* and *Bell*, *ibid.*



water of similar thickness, but like water it absorbs infra-red to a large extent. That is, the ordinary amounts of infra-red which reach the eye from the environment warm up the cornea and aqueous but do not reach the lens or vitreous. Reasoning from the previously mentioned amount of sun's heat which penetrates a few centimeters of lake water, it is evident that if we look directly at the sun, most of these intense infra-red rays will pass through all the media to the retina, heating up all of them by the small amounts absorbed by each. It is not known how much of the heat of red-hot glass or iron reaches the lens, when workmen look at them and though *Parsons* thinks that very little does, there are others who believe that these infra-red are the sole causes of the serious troubles of such overheated eyes. The cornea is so efficient in excluding short rays that light 150 times the intensity needed to produce photophthalmia, affects the lens only superficially, though it may completely destroy the corneal epithelium, corpuscles and endothelium,<sup>9</sup> the cell changes being characteristic of chemical action in general.

The lens is opaque to the rays shorter than 350 microns and partly so to those up to 400; that is, to practically all the ultra-violet of the iron arc which gives out rays as short as 230 microns. If a lens is put on the skin and exposed to sunlight, it prevents sunburn under it. Therefore few ultra-violet rays ordinarily reach the vitreous, which of itself is opaque to an ultra-violet band extending only from 280 to 250 microns with ill defined edges. Ordinarily no ultra-violet ever reaches the retina, even the aphakic eye is efficient without glasses opaque to the short rays. *Verhoeff* and *Bell* have flooded eyes of rabbits, monkeys and man an hour or more with light 150 times as intense as that needed to produce photophthalmia, with no evident permanent injury to the retina, the scotoma disappearing in a few hours.

Man's media have approximately the same powers as those of lower animals, varying with the age, babies absorbing most of the ultra-violet, though there is a transparent band from 300 to 310 which persists for twenty years. After

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<sup>9</sup> *Verhoeff* and *Bell*, *Science*, September 25, 1914.



twenty the band disappears, but the absorption retracts to about 377 and with advancing years to 400 or 420 microns. Debility diminishes absorption up to 375 microns. That is, we become blind to the violet end of the retina with old age and glass-blowers become violet-blind in a few years.

Fluorescence of the lens seems to be elicited by absorbed rays from 350 to 300 microns. That is, those harmful rays which manage to pass through the cornea and aqueous are stepped down to harmless visible frequencies in the lens.

The whole ocular arrangement, including the visual purple, seems able to neutralize the more prevalent colors, such as the blue of the sky and sea and the yellows and greens of vegetation. The two ends of the spectrum are unquestionably irritating. They were so infrequently met that there was no necessity for the evolution of strong defenses against them. A glaring red light in a few minutes or hours therefore causes irritation with more or less conjunctivitis, and possibly iritis and retinitis. The mercury vapor light is quite comfortable at first because of the absence of red, but we are beginning to hear complaints of troubles from the more slowly acting short rays so numerous and powerful in this light. Green seems to have the least effect, and is recommended for the outside of houses, to prevent the irritation of white surfaces in light climates.

Glass which transmits yellow and green but filters out the two ends of the spectrum, is the best protection against excessive light in cases of photophobia, or in normal migrants in light climates. An amber glass permits more visual rays to pass through and does not interfere with vision so much as the dark green, though the latter are the more comfortable. Blue glass merely has the effect of reducing intensity as in smoked glass and may strain the eyes by reducing the visual rays too greatly. The anæsthetic effect of the blue might have serious paralyzing results on the retina in time, if the light is very strong. Unfortunately the manufacturers of glass have not yet been able to make kinds which will transmit only one wave length and exclude all the others, except possibly the true ruby glass.



The amethyst glass which was so popular a few years ago is not nearly so efficient to tone down excessive light as the amber or yellow. It is better than none and better than plain glass which stops only the ultra-violet, but the violet rays seem to add to the irritation rather than subtract. In the tropics it has proved useless and irritating.

*Schott's* success in making a crown glass transparent to rays as short as 280, has led to attempts to make glasses opaque to these. According to *Parsons*, borosilicate crown glass is opaque to those shorter than 295; flint glass, 315; blue glass, 320; smoked glass, 345; and heavy flint to all shorter than 375 or even 400, while many other forms with a greenish yellow tint are said to stop all ultra-violet. They all absorb some of the visible rays. A red glass made by *Elder* and *Valentine* in 1894 excludes all ultra-violet frequencies. A green glass used in Kew Gardens to keep out infra-red, transmits a very short spectrum, being opaque to rays longer than 579 and shorter than 468, but it is hard to see through. An almost colorless glass tinged with didymium is transparent only between 656 and 398. *Parsons* says it is the best for spectacles when we wish to exclude the infra-red and ultra-violet.

All wave lengths between 200 and 2,000 microns are able to cause cell irritation, though the effects of the frequencies near the two ends of the visible spectrum are more easily elicited. Contractions of the rods can be obtained by any length between 226 and 800.<sup>10</sup>

There is now much investigation of the effects of all wave lengths which may enter the eye in too great an intensity for the absorptive powers of the media. With the prolonged use of the *Schott* uviol lamp giving out rays as short as 253 microns, *Parsons* found in rabbits, that in the pupillary area the nuclei of the capsule cells became swollen, the chromatin strained badly, the cytoplasm was vacuolated and other changes occurred, all of which showed the same profound actinic effect as in other tissues. *Hess* showed that the result was due to the shortest rays, for it did not occur if they

<sup>10</sup> Hertel, *Zeitschrift für Augenheilkunde*, November, 1911.



were filtered out. *Schanz* and *Stockhausen*<sup>11</sup> concluded that bright light is a causative factor in senile cataract, but *Verhoeff* and *Bell* do not believe it is due to any rays whatever. Nevertheless it seems more prevalent in light climates than in cloudy ones, and more prevalent in the insufficiently pigmented. A great many observers have concluded that glass-blowers have a special form of cataract, though most cases are the same as in the senile. Whether this is due to the ultra-violet rays which are feeble, or infra-red which are intense, is not yet settled. *Verhoeff* and *Bell*<sup>12</sup> blame the latter, but *Sir Wm. Crookes* seems to think that both are at fault and has tried to devise a spectacle glass which will completely cut off both infra-red and ultra-violet. Cataract should be more common in migrants who are insufficiently pigmented.

The ultra-violet seem to be the chief cause of the intense conjunctivitis of an eye exposed to strong light. This, with swelling of the lids, sometimes afflicts photographers using mercury vapor lamps, while complete protection is obtained by plain glass which excludes the short rays beyond 300 microns. It accompanies snow-blindness and is worse in high altitudes where the ultra-violet are stronger. The hotter certain lamps become the richer in ultra-violet, and since the introduction of these lights ophthalmia has become more frequent.<sup>13</sup>

The effects on the retina of intense light are also mostly due to the ultra-violet rays which manage to pass through the media, and vary all the way from hyperæsthesia (day-blindness) of irritated nerves to hypoæsthesia (night blindness) when only a strong light will affect the exhausted protoplasm. Actual destruction of tissue may occur with neuro-retinitis, followed by atrophy. Examination of retinae exposed to intense light have shown that the cell damage is more marked in eyes from which the lens has been removed.

Not only in the arctics do these cases of "snow-blind-

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<sup>11</sup> Parsons, *Journal American Medical Association*, December 10, 1910.

<sup>12</sup> *Science*, September 25, 1914.

<sup>13</sup> F. Stein, *Berliner klinische Wochenschrift*, May, 1909.



ness" occur, but in lower latitudes also—in those exposed to the snow glare all day, such as drivers and letter carriers. The pains are very distressing. It also affects all who are exposed to glare from any source,—the sea, sands of the shore, foot-lights, white surfaces of fences, houses and roads, and wet asphalt pavements. It afflicts travelers in high altitudes, such as the British soldiers in Thibet. The Russians suffered more or less in Manchuria, but the darker Japanese escaped. White people in the tropics also suffer often in severe form. In temperate climates a mild form appears in the spring. There are no pathological signs in some cases except the xerosis of the bulbar conjunctiva, which, by the way, indicates very serious irritation over long periods. Occasionally there are pigmentary deposits in the retina which are etiologically the same as skin pigments following any irritation. These spots appear in eyes exposed to any intense light (retinitis pigmentosa), and are therefore more marked in the blond than in the brunet.

The retinal damage is invariably worse when ill feeding or confinement has reduced vitality, as in the inmates of workhouses, jails, asylums, and soldiers and sailors in campaigns where food is scarce and exhaustion severe. Scurvy is occasionally complicated with severe forms. It is to be noted that with rare exceptions all these forms of actinic ophthalmia appear in migrants evolved in darker countries; and the less they are pigmented the more they suffer.

Ophthalmia electrica is merely a severe form of snow-blindness, from exposure to the intense flashes of light from short circuited wires or broken circuits. There is a temporary blindness from retinal anæsthesia, and several hours later an intense pain from ciliary congestion. If the exposure has been long or intense we can have almost any degree of destruction of tissue, with subsequent blindness. In minor degree, ophthalmia electrica, with headache, affects workers in factories where naked arc lights throw out much ultraviolet. In times of solar eclipse many people foolishly look at the sun without smoked glasses, and subsequently suffer from local blindness—scotoma helioclpticum—which may be permanent if the exposure has been severe enough.



*Rollins*<sup>14</sup> was the first to report serious and permanent damage to the eye by X-ray, even blindness. This differs in no respects from the actinic exhaustion or even destruction of the vision due to the ultra-violet rays of some lamps as described by *Steinmetz*.<sup>15</sup> Even short exposure to rays of moderate intensity may be disastrous. All the media of the eye may be more or less injured by these rays of artificial lights. The mercury vapor lights are being specially condemned in France for this reason.

*Parsons* states<sup>16</sup> that most lamps do not give out rays at the red end of the spectrum but do emit more or less ultra-violet, the ranges being roughly as follows: A petroleum lamp with an ordinary white glass cylinder gives a spectrum from 600 to 350 microns, osmium and tantalum lamps 630 to 300, welsbach 600 to 329, the arc light with clear globe 600 to 300, without globe 600 to 230, but an opal globe cuts off the shorter ultra-violet down to 330, the mercury vapor with quartz emits short rays to 253 but is poor in red and yellow. It is quite evident, then, that we should avoid these short-ray lamps as much as possible, and light our houses with those which give out more of the yellow rays. A perfect lamp is yet to be invented. The petroleum lamp would be the best were it not for the painful heat, but perhaps the incandescent bulb would do if we could escape the direct glare.

The red vision or erythropsia which troubles some who have been operated on for cataract, seems to be due to a retinal exhaustion from short rays normally stopped by the lens. It is sometimes prevented by glasses, but others deny this. The cause of erythropsia in normal eyes is unknown, but it seems to be mere color fatigue due to same mechanism as produces a subjective color seen after looking at the intense complementary color.

Vernal catarrh has been thought to be partly due to excessive light, but others doubt it. The eye symptoms are

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<sup>14</sup> *Boston Medical and Surgical Journal*, April 2, 1903.

<sup>15</sup> *Scientific American Supplement*, December 17, 1910.

<sup>16</sup> *Journal American Medical Association*, December 10, 1910.



cured by dark glasses. Similarly hay fever has been partly blamed on strong sunlight as a contributory cause, and as a fact blonds do suffer more from it than brunets, and the victims are more or less nervous if not actually neurasthenic. *Ferni* found that among the diseases partly due to sun exposure were coryza, influenza, hay fever and epidemic meningitis. The effect of light in causing sneezing has a relation to hay fever, because some sufferers have reported that they could ward off attacks by wearing smoked glasses. The alleged cures of hay fever by electric light can well be doubted.

Nystagmus is one of the commonest results of the long continued effect of light too intense for the protective mechanisms. It is almost, if not quite, universal among albinos in any climate. The red or partial albinos of the Philippines are also sufferers. The nystagmus of miners seems to be a result of eye-strain, though the irritation of bright light upon emerging from the mines daily may be a contributory cause.

Pterygium is probably due to any irritation of the sclerotic and cornea, chiefly dust, but light may have an influence also, as it is more common in blonds.

*Riggs*<sup>17</sup> has reported rupture of the iris from excessive contractions in the tropics to exclude the light. Corneal astigmatism is an almost universal result of the pressure of the lids on the bulb in an effort to exclude excessive light. It exists in high degree in all albinos who necessarily pass their day existence squinting the eyes to a mere slit. In blonds who have migrated to a land too light for them this malformation of the cornea exists in a degree proportional to their blondness, the intensity of the light and the length of exposure. In America it is well nigh universal in the blond, while in the cloudy areas of Europe it is comparatively rare in all classes.

In blond American children astigmatism appears very early and may so disable them as to necessitate removal from school. This is doubtless due to the greatest ease with

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<sup>17</sup> *Naval Bulletin*, January, 1909.



which the lids can squeeze the child's eyeball out of shape. To be convinced of the pressure one has only to notice children and adults exposed to strong light, say at the seashore, and observe how the blonds squeeze the lids nearly shut and show the strain by their frowning expression. The brunets do this far less and the negroes not at all. All races seem to be able to open their eyes widely in their normal habitat, except those exposed to intense snow glare. I have been particularly struck by the frowning faces and squinting eyes of the blonds in the cities of southern Germany and the evident comfort of the brunet urban types.

There is no longer any doubt that eye-strain of any sort, if long continued and severe enough, will cause nervous exhaustion. *Gould's* study of cases due to refractive errors of minor degree, leave no doubt of the far-reaching effects of the long continued effort of trying to obtain clear vision for near work. Several observers have concluded that some of the neurasthenia among blonds who have migrated to light countries is also a result of the strain of trying to see where the light is too strong. It is at least certain that in light countries these blond intruders are the greatest sufferers from eye-strain, astigmatism, sun pain and neurasthenia. When the blurred vision of gross refractive errors is too great to be overcome, the person does not make the attempt, and thus escapes eye-strain. The sufferers are those who have minor errors which can be overcome by effort. In like manner, albinos give up the effort to see accurately in strong light and have less nervousness than the bright blond who succeeds in seeing after great effort. Albinos in the tropics are said to be blind between 9 A. M. and 4 P. M. That is, they are day-blind, like blond arctic explorers who are wholly disabled in the snow glare from retinal hyperæsthesia, but who can see enough to march at night. Europeans suffer much more from all eye diseases in the tropics than at home, and the blonds more than the brunets. In our over-lighted schoolrooms the blonds suffer from eye injuries where the negro may have difficulty in seeing.

In all animals there are, as in man, numerous mechan-



isms for shading the eye. In the tropics it is rather deep set in lower animals, so that it is shaded by the bony projections on the skull as well as by hair in various situations. The observations of *Casey A. Wood* on the retinae of lower animals, warrants the conclusion that the arrangement of the pigment seems to bear a relation to the intensity of the light of the normal environment. Those on the plains, for instance, which seek their food beneath them, like the dog family, must have plenty of pigment on the lower half of the retinae on account of the glare from the sky, while the upper half receiving little light from the ground has far less. The colors of the retina are also probably related to the light habitually encountered.

If nocturnal animals such as owls are unduly exposed to light in zoological gardens, they suffer from chorioiditis. When our northern horses were taken to Cuba in 1906, it was found that very many suffered from ophthalmia from the glare, and special means were adopted to protect them in the lightest hours of the day. Blindness is not uncommon in northern horses in the tropics. The intensity of ultra-violet rays necessary to produce demonstrable tissue change has been investigated by *Verhoeff* and *Bell*.<sup>18</sup> They find that to cause photophthalmia to the extent of conjunctivitis, accompanied by stippling of the cornea, requires energy measured as  $2 \times 10^6$  erg seconds per square cm. of abiotic radiation of the quartz lamp or magnetite arc. Two and a half times more will destroy corneal epithelium. The effect of repeated exposures is cumulative, unless the intervals are long enough to permit recuperation. This abiotic action is confined to wave lengths shorter than  $305 \mu\mu$ , at which they are evanescent, but with shorter waves they increase with considerable rapidity. Infra-red produced no such changes, indeed to injure the cornea, iris, or lens by heat, "requires a concentration of energy obtainable only under extreme conditions," and "that such rays are in the main absorbed by the media of the eye before reaching the retina," yet they believe glass-blowers' cataract to be due to heat. They produce no data

<sup>18</sup> *Science*, September 25, 1914.



in support of their conclusion that all artificial lights are harmless under the ordinary conditions of use, indeed they base that conclusion on the assumption that the ultra-violet rays are too feeble to do harm. Rays too feeble to produce demonstrable lesions quickly, may destroy the vision in time, as in glass-blowers' cataract. Much of the outcry against some lamps is no doubt exaggeration, but *Verhoeff* and *Bell* are dangerously wrong in the opposite extreme. Besides, a lamp absolutely harmless to a negro will blind a blond in time. They did not keep up the applications of light long enough to elicit demonstrable lesions.



## CHAPTER XV

### ORIGIN AND DISTRIBUTION OF BLONDNESS AND NIGRESCENCE

The word Aryan has been much misused and for a long time was under a scientific cloud. When philologists first discovered that there was a kinship between all the languages spoken by Icelanders, Celts, Teutons, Slavs, Romans, Greeks, Armenians, Persians, and Hindoos, it was assumed that these peoples were blood relatives and constituted a great Aryan Race. When it was finally proved that the modern types were ethnically distinct, and that language was no proof of racial relationship, the pendulum of scientific opinion swung to the unwarranted extreme of denying that there was or ever had been an Aryan people. Then it was learned that no race can survive if it migrates very far, and that the peoples, who carried the Aryan language from Arya and forced their speech on conquered countries, have perished long ago. The present Aryan-speaking peoples must then be largely the descendants of the conquered residents of the countries invaded.

The trend of thought is now toward the conclusion that there was a numerically small Aryan race differentiated from the Eurafrican stock, and that it evolved the primitive Aryan language. Opinions still differ as to what the early Aryans looked like, but an increasing number of ethnologists, and probably the great majority, think that it was a tall, brainy, blond race whose descendants still exist unchanged in type in the cradle of the race whose climate has not markedly changed since neolithic times. This would make southern Norway the primitive Arya, and the words Aryan and Blond almost synonyms.

Primitive men were probably brunet, but we have no



direct proof. The present anthropoids are very dark to protect them from tropical light and heat, and as the ancestors of man required a similar climate they too must have been well pigmented. That this pigment was still needed after these creatures were evolved into human form is indicated by the fact that newly born blond babies often, if not generally, have very dark or black hair, which is soon replaced by yellow.

We can safely deny that the first men were black, for that would imply a tropical and light climate which 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, and thus caused an evolution of the large human brain. The tropical climate preserves simian types, and does not modify them into human forms. The monkeys disappeared from places where they were evolved into man. This is all explained in greater detail in the article by the writer ("The Evolution of the Small Brain of Civilized Man," *Amer. Jour. 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, respectively.

Cave-dwellers were probably brunet, for the best evidence available has led anthropologists to the opinion that the earliest men in Europe were brunet. 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. The Eskimos and probably the earliest cave-dwellers in central and southern Europe in the glacial period, were exposed when out of doors to a summer glare which made brunetness a necessity. They are in the same condition as modern city dwellers, who are cave-men to a large extent, some even inhabiting cellars, and the city dweller is notoriously brunet.

Ripley<sup>1</sup> says: "There is a factor of the environment

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<sup>1</sup> Racial Geography of Europe.



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.

Not only do mountains furnish the requisite clouds in which blonds can live, but the elevation increases the cold, so that the higher we go up mountain sides, the more nearly the species of plant and animal approach the arctic forms living at the extreme border of life of any kind. Hence, in the mountains all over the world we find types of men who are survivors of migrants from northern lowlands. They may not have yellow hair, but blue eyes are found in northern Spain, northern Italy, Switzerland, Albania, in the dark valleys of the northern slopes of the Atlas mountains of North Africa, but not the southern, among the Kurds of Asia Minor, and in our southern Appalachian system. The Amorites of Palestine were figured as light types on Egyptian monuments, but the exact amount of pigmentation is not known. *Ellsworth Huntington* has mentioned<sup>2</sup> the light (not blond) types living in the northern highlands of Syria (Druzes). He thinks they are remnants of Crusaders who mingled with the natives. The yellow-haired type has never survived in this part of the world. These remnants have brown hair and blue eyes, but they survive because the climate is cool and somewhat cloudy.

It is remarkable what a short horizontal distance may separate two environments, one suitable for blonds and the other for brunets. For instance, the prevailing wet southwesterly winds are cooled off by the Scandinavian uplands which are therefore cloudy and suitable for blonds, but on the sunnier coast there is a strong brunet element. To the northeast of the mountains the climate is more sunny, as the winds are drier, and the Lapps require much pigment as

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<sup>2</sup> Palestine and its Transformation.



a protection from snow glare. The blonds flourish in the cloudy mountains of Tennessee and yet on the sunny base plains the negroes flourish, and neither type can permanently survive in the habitat of the other. There are light types in the northern Syrian Mountains, but negroid ones near the Dead Sea. This blond mountain type cannot survive higher elevations beyond the protection of the forest. Hence plateau types, as in Thibet, are heavily pigmented. The blond in highlands south of about  $45^{\circ}$  is therefore confined to a zone, as he can go neither up nor down, north or south. Brunets can survive in mountains, of course, and as a fact the Alpine type is so named because it was forced into the upper infertile regions by Aryans who took the best land. The same phenomenon happened in the British Islands, the Scotch Highlanders and Welsh being notoriously brunet.

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 brunets, the type which then occupied all of Europe and which is not much different from the present Mediterranean races. The descendants of these 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 brunet 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 brunet 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. They 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 modern descendants are in every part of Great Britain, and are quite numerous along the Scandinavian coast.

*Ripley* says 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 learned 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 broad-heads. 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. It might have been on the continent before Scandinavia was habitable, but that would be too early, as the type seems to have been a rather recent evolution.

Unfortunately England does not possess the proper conditions for this blond type and anthropologists are asserting that the better adjusted earlier brunet 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.



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 those which spread to the south of Europe in primitive times.

From the original home the blond has spread like waves all over Europe, submerging all brunet types wherever he went. Blond Gaelic-speaking Scandinavians settled in Scotland 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 the foundation of the modern state. The Roman occupation of England stopped the current temporarily, but on the withdrawal of the garrisons, the influx was renewed by the same race which spoke Teutonic dialects.

The earliest language traceable in Great Britain was non-Aryan and it has been considered to be Iberian, probably that of the brunet 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 essentially of the same blond stock, or at least the leaders were; but there is no doubt also that these immigrants were mixed with many brunet broad-heads, for Denmark and North France had been for a long time occupied by these Asiatic invaders, who had been con-



quered by the Aryan type, and compelled to learn Teutonic languages just as those in Great Britain and France had learned Celtic, or Gaelic, speech.

*Gael* means "fair" or "blond," and so does *gallus*, and these earliest blond invaders of France and England looked on themselves as "white men," who conquered brunets. 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 prehistory, conquering the brunets 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. *Fein*, *feinn*, or *fian* also meant "champion" or bodyguard of the king—hence the modern fenians or national guards. It is logical that "white" and "champion" should go together. There are many words 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 brunet broad-heads or round barrow race—a language related to the Finno-Hungarian remnants still spoken on the continent.

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 heads were markedly long, and their speech Celtic. 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, there is a slight suspicion that England is as Celtic as Ireland—ethnically, not linguistically, of course.

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 far older than the earliest Celtic invader. 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 high culture which we presume the Aryan Celts possessed not many centuries prior to the Roman conquest.

In Russia the blonds are in the northwest, brunetness increasing in all other directions. Speaking of the Scythians, Herodotus said that the Budini, since identified with Slavs, were a "large nation and had blue eyes and red hair." Slav place-names have been traced as far west as Utrecht, showing wide migration, and the language indicates that the original Slavs all "dwelt together in a comparatively narrow space." The word "slav" is thought to come from "slava," glory, or "slova," word, indicating "intelligently speaking" men, as compared with the conquered. Others think slav meant "illustrious or renowned," but the derivative "slave" has been thought to have been given in contempt by western Teutons to the ignoble Asiatic races who learned to speak the language of their Slav conquerors. *Penka* thought the word derived from "Klu," meaning subjection.

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. The first inhabitants were apparently long-headed brunets who were of the primitive European race which existed all over the continent. Later the whole land was occupied by brunet 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 Aryans. Very early the blond Baltic type asserted 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. The analogy is even closer yet, for the primitive Russians were themselves immigrants from the cradle of this part of the human race, because Russia was probably under water at the time man was evolving from a lower type.

*Professor Zograf*, the eminent anthropologist of Moscow, has proved that the original Slav was a blond longhead. *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 farther 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.

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 Scandinavian, who solidified a government which has existed to the present. But this government is, and always has been, an Aryan aristocracy ruling brunet Asiatic people, just as ancient Greek democracies were Aryan aristocracies ruling brunet 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 the opposite of that in Russia generally, for a very large number of the Finns are pure Aryan, blond long-heads. 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 it up in favor of a lower one.

Many of the Asiatic peoples have refused to learn Aryan tongues and we find them still speaking the languages they brought with them—Tchuds (Lapps, Finns, Esthonians, and Livonians) in northwest Russia, Permians in east Russia, Samoyeds in north Russia, Huns in central Europe and Basques in the west. 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. All the languages of the 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 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, and these in turn by Teutonic.

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 submerged by Aryans whose higher and more complex brains have evolved higher languages.

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 overlords. Many of the army officers are blond Aryans and the soldiers are brunet 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 policy to absorb Manchuria, Mongolia and Corea 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 recent check is only temporary.

In popular literature, and occasionally also in scientific, 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 brunet, and even now the word Celt rather brings to mind this type and the word Slav always does. By reason of linguistic remains, *Charles De Kay*<sup>3</sup> 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. 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 wars between them and later Celtic invaders. The Asiatics certainly never reached Iceland, which has always been Aryan. Icelandic is said to be the most primitive Aryan tongue, and

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<sup>3</sup> *Century*, 1889.



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.

The earliest Aryan invaders of central Europe are believed to have been the Reihengräber or "rowgraves," from the peculiar custom of burial in long rows. They may not have antedated 1000 B.C. They were surely blond long-heads and 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. The Goths were the earliest Teutons and were not heard of until 300-200 B.C. They came from Scandinavia and their language was almost the same as the ancient Scandinavian and German. They evidently migrated back and forth across the Baltic.<sup>4</sup>

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*. There are common words for *water*, *river*, but 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 near the Baltic surely fits this slender evidence, though it is to be confessed that no mountains and few trees are difficulties south of the Baltic.

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,

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<sup>4</sup> Gronberger, *Science*, August 21, 1914.



"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 brunets, forced into this brumous latitude to evolve blondness, evolve more brain and create 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 the Aryan 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 workmanship of their stone tools, in the period before they learned of the existence of metals, 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." They learned of the existence of iron in the second or third century A.D. All other anthropologists apparently agree with this conclusion, for as early as 1874 there was substantial agreement that the first men of Scandinavia were in the later stone age and that no paleolithic remains exist.



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 environment 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 farther south in the Rokitno swamps about Pinsk and along the Pripet, but modern historians have accepted the Scandinavian origin of the Germans.<sup>5</sup>

Innumerable variations are constantly appearing in every species, but the rate at which a new species arises by the selection of the fittest variations, is generally very slow except in the critical periods when a rapid change of environment causes a rapid selection. Evolutionists have changed their opinions on this matter quite markedly in recent years. When the Dutch botanist *De Vries* published his mutation theory there was a stampede in the direction of believing that evolution occurred by leaps instead of slowly by the tiny changes explained by *Darwin*. It is now claimed <sup>6</sup> that the plants used by *de Vries* were really hybrids and that the sudden changes he noted and believed to be gigantic variations or mutations were merely old characters reasserting themselves. Though *de Vries* denies this, the drift is now back to the old theory of gradual change by tiny increments, but the possibility and probability of the sudden appearance of mutations is not denied.

The rate of the evolution of blondness and nigrescence must likewise have been slow, though there were unquestionably critical periods in which it was relatively rapid. Even

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<sup>5</sup> Richard's History of German Civilization.

<sup>6</sup> E. C. Jeffrey, *Science*, April 3, 1914.



granting that a beginning of blondness had occurred to the south of the Baltic in post glacial times, the neolithic migration to the darkness and coldness of Norway must have hastened the process.

It could not have taken many millenniums to have produced the ability to evolve Aryan speech, which *A. Schleicher* has pronounced "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."<sup>7</sup> Their laws were undeveloped and the property almost communal, but the marriage relations showed a high mental level. Their isolation made it impossible to learn of the high civilizations which had been built up to the south of them. That is, they were highly evolved shortly after migration to Scandinavia. There seems to be a tendency to place that movement about ten or twelve thousand years ago, coincidently with the first invasion of Europe by the Asiatic broad-heads. This was ample time for the evolution of blondness.

*Professor A. Keith*, Curator of the Museum of the Royal College of Surgeons, has recently stated that there are evidences that Europe has always been Aryan and that the "pre-Aryan" languages drowned out by the classic flood were really only prior dialects. There was a common family of dialects throughout Europe and primitive Aryan was merely the one carried into Scandinavia, where it was highly evolved by this more intelligent band. This is merely another way of saying that the Baltic type is a variety of the long-headed primitive race of Europe, which trekked north long after speech was evolved, and that their language prevailed.

Within recent years there has been a tendency to consider the Aryan emigrations as rather recent. Sanskrit students have said that there is nothing authentic in India prior to the Christian era. The Aryan invaders may have arrived there only a short time before. They soon forgot their origin as they had no literature. They were ignorant of writing and transmitted their knowledge orally. They only

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<sup>7</sup> Hilderbrand's *Jahrbücher für Nationaleconomie*.



reached the highlands of Persia in the sixth or seventh century B.C. There is nothing authentic in Greek history prior to the sixth or seventh century B.C., and the old estimate of the Dorian invasion as 1200 B.C. is now known to be excessive. *Sapir* puts the time of the primitive Aryan language as late as 1500 B.C.<sup>8</sup>

Similarly there is a tendency to consider the peopling of Scandinavia as much more recent than ten or twelve thousand years ago. The culture of these first invaders of Scandinavia was too high for such a remote period. If this surmise is correct, the evolution of the yellow-haired type of man may have required a time measured by centuries rather than millenniums. At least we can agree with *Keith* that it was the last type of man to arise in Europe. The tendency is to lengthen the eolithic and paleolithic periods to one million years and shorten the other stages. The evolution of culture is in a geometrical ratio, each period being a fraction of the preceding. This is due to the fact that each invention acts like a multiplier as it adds to all preceding inventions.<sup>9</sup> The neolithic period can therefore be counted in a few thousand years, and blondness seems to have been evolved in this time.

The unification of a mixed population which migrates to a new environment may occur in a century or two, as will be mentioned more fully in the discussion of the results of migration. For instance, the elimination of the blonds from the creoles of Louisiana and the survival of only the dark, has made those people quite uniformly brunet. This is not an evolution of a new type from a prior one by the survival of the fittest variations, but the preservation of a type evolved elsewhere. The evolution of blondness was due to the survival of the blondest variations in a pure-bred people of uniform complexion—and these variations were of minor grade not necessarily the mutations of *de Vries*.

The evolution of nigrescence in primitive men who migrated south must have occurred very early in paleolithic

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<sup>8</sup> *Popular Science Monthly*, July, 1911.

<sup>9</sup> *American Journal of Insanity*, July, 1901, Evolution of Brain.



times—a remote period measured in hundreds of millenniums, before language was evolved. But the rate at which it occurred may have been relatively rapid. At least it kept pace with the slow movement southward, since present day experience shows that the migrants would have perished in a few generations if not sufficiently protected by pigment. The evolution of brain was checked by this movement, for the struggle for existence was eased up where wild foods were available the year round and little forethought required for survival. Hence the negro's ancestors must have left the north very early, as their mental state is primitive. Men lived in Egypt in the earliest paleolithic times and probably all over Africa, so that the black skin may have been extremely ancient.

The negro baby is rarely as dark as its parents, but more of a reddish brown, showing that blackness is an evolution from brown migrants from the north. *Davenport* says that the new-born negro baby quickly darkens on exposure to light. *Dr. G. A. Turner*, of Johannesburg, has reported that the black negroes occupy a zone and that the tribes lighten up as they recede from that place to the south, showing that a reverse involution occurred in those who migrated south.

The rate of migration of primitive man must have been slow enough to have permitted time for favorable variations to arise. It was a mere oozing along the surface—one family never wandering far from its birthplace. Each of the present anthropoids is confined to a very restricted habitat, though the numerous related species are evidently evolved by variations of migrants. The same phenomenon evidently occurred with primitive men; that is, at any one time there must have been different types in different places of Europe. In a subsequent epoch, say 100,000 years later, each locality must have evolved entirely different types from the prior inhabitants or immigrants. They were so different from each other that anthropologists are experiencing great difficulty in finding any relationship at all.

Anthropologists are almost unanimously of opinion that



the American continent was peopled by neolithic boatmen from northeastern Asia only a few thousand years ago. *Dr. Ales Hrdlicka*, of the United States National Museum, has proved from linguistics and physical resemblances that certain mongols are akin to American stocks. Some of our northwest Indians are indistinguishable from Japanese and other natives of northeastern Asia. In the time they have been in America, they have evolved suitable complexions, each type being adjusted to its environment. A few thousand years can therefore account for the evolution of blondness.

*Havelock Ellis*<sup>10</sup> says that in quite a number of races the women are distinctly lighter than the 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* think it may be due to the propagation of the original condition of the blond invaders who were mostly bachelors and who married brunet women of the conquered country.

There are innumerable mixed types which seem to be 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

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<sup>10</sup> "Man and Woman."



the brunet 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 whom it inherits its characters never lived in the blond producing climates.

There is one other form of brunetness 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, 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 as the sallow or swarthy. Originally 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 colder light countries.

The instability of the nervous system in southern Europe has been mentioned as one of the causes which make such people inferior sailors. There is a further possibility that another selection has caused the preeminent seafaring abilities of the Baltic type. They may have been subjected to so much pressure from the mainland, that survival was possible only to those who could escape by water. That is, only the boatmen peopled Scandinavia. 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 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 to destroy.

Japan is similar to 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 seaman-ship. Each race instinctively 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.<sup>11</sup>

But look at the Russian peasant,—not his Aryan conquerors. He is an Asiatic who has been a land-lubber since the beginning, neither he nor his ancestors back to 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. 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.<sup>12</sup>

The original Slavs were called "Wends" by their Teu-

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<sup>11</sup> This paragraph and the following were written before the late Russo-Japanese War.

<sup>12</sup> Dr. E. J. Dillon, *The Contemporary Review*.



tonic neighbors, and the word has been thought to come from the root *voda* (*wandu* in Lithuanian) meaning water—that is, they were people dwelling about the water,<sup>13</sup> 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 brunet or Asiatic type does not.

The Aryans who subjugated Greece proved that they were seafaring people by nature, for they immediately became “skillful shipbuilders and navigators.” They destroyed Phœnician trade, and their factories and colonies were planted from Odessa to Marseilles (Clodd). It is believed that the *Iliad* and *Odyssey* are merely amplifications of Phœnician sailors’ log-books, idealized into an epic by Aryan conquerors. 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 battles royal, 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 by way of Iceland.

*Dr. J. Macmillan Brown*, University of New Zealand, has made the remarkable assertion<sup>14</sup> that there is some evidence of the presence of blonds and long-heads in America in ancient times. In *The Lone Hand* (1911) he connects them with the neolithic people who carried the megalithic culture across northern Asia, and throughout the Pacific as far as Easter Island. Some had golden hair, as shown in the pottery vases.

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<sup>13</sup> *Encyclopædia Britannica*.

<sup>14</sup> *Journal of Race Development*, July, 1911.



*W. Bateson*, in discussing the coloration of *Lepidoptera*,<sup>15</sup> mentions several species in which dark types appeared about the middle of the last century when large cities began to be very numerous, and have continued to increase in number. He says: "Taking the evidence as a whole, we may say that it fairly suggests the existence of some connection between modern urban developments and the appearance and rise of the melanic varieties." The same phenomenon is seen in the case of man; that is, city populations are more brunet than the surrounding country, and the congested parts of the city are darker than the suburbs. The causes are not definitely known. Of course the blond northmen have more intelligence as a whole than the dark types south of them, and can afford suburban homes, but there is something in city life which eliminates the blondest and preserves the dark, causing in time a brunet urban type by this selection, a type which cannot live in the country or suburbs.

*F. C. Shrubbsall* states that in London<sup>16</sup> the "adult hospital patients as a whole are slightly fairer than the population within the sphere of attraction of each hospital, that with each successive generation of city life the fair element sends an undue proportion of its members to the hospitals, that child patients are markedly fairer than the children in the districts around the hospitals and that diminution of stature and increase of brunet traits are almost certainly progressive with increased heredity of an urban environment." The blond traits are associated with acute rheumatism, heart disease, tonsillitis and osteoarthritis and the brunet with nervous diseases, tuberculosis and malignant disease. These conditions may refer to the tallness of the blond element. *David MacDonald* finds in Glasgow that in the various gradations between the extreme dark and extreme fair types, the closer the type approximates to fair, the less recuperative power it has and the less resistance it offers to scarlet fever, diphtheria, measles and whooping cough.<sup>17</sup>

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<sup>15</sup> *Problems of Genetics*, p. 135, Yale Univ. Press, 1913.

<sup>16</sup> *British Medical Journal*, December 24 and 31, 1904.

<sup>17</sup> *Biometrika*, July, 1911.



Both of the above authors quote a wealth of material of a similar nature as to other cities, and *Dykes* found that brunet London children had more resistance to diphtheria and scarlet fever than the blond.<sup>18</sup> The neurasthenia of city blonds has also been noted. The causes of blond morbidity in cities is probably the greater glare and heat of the city summers, for which considerable pigment is needed. In the surrounding shady rural districts where a blond population is more fit, the reverse phenomenon may occur, but there are no known statistics to show it.

Urban brunetness is not an evolution from a prior blond type, but is the result of destruction of the blondest races from the country and preservation of the brunet races. Big cities are too recent to have had time to have evolved a type fit for them, though it must be confessed that the Ghetto Jews of Europe, by survival of the fittest, seem to be as perfectly adjusted to a crowded urban life as it is possible to be.

*Maurice Fishberg*<sup>19</sup> finds that the Jews tend to resemble the races among whom they live. That is, they are long-headed in the Mediterranean basin, broad-headed in eastern Asia, tall among tall races, short among the short, but there is this curious exception—they are always darker than the people among whom they live. The proportion of blonds, brunets and mixed types among them is nearly constant. Inter-marriage is constantly introducing other types, but the blonds are being as constantly eliminated by urban residence.

The urban type is of frail physique, utterly lacking the stamina needed for severe and prolonged muscular exertion, but possessed of other nervous and muscular qualities which render it immune to the damage inflicted on tall, muscular blonds in like surroundings. Baltimore, Maryland, is very brunet, largely from its Jewish element, but the surrounding country has many decaying blond types who are preserved far longer than their relatives who drifted into the city.

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<sup>18</sup> *Lancet*, November 29, 1913.

<sup>19</sup> *Memoirs Anthropological and Ethnological Societies*, 1905.



In those parts of Europe "where the Alpine race forms an appreciable element in the population," the cities are more long-headed than the surrounding rural populations. This was discovered by *Lapouge* in France, but it is called Ammon's law from *Dr. Ammon*, of Carlsruhe, who later worked it out in great detail. In southern Italy there is a reverse phenomenon—the cities are more broad-headed. The cause of this phenomenon is unknown, as it has never been studied in relation to pigmentation, but it seems to indicate that the brunet Alpine type is more fitted to city life in the south than in the north. It seems to thrive in American cities in the same latitudes it does in Europe.

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. 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 negrito type and that he is not yet adjusted to the climate but will in time. For the present he is making the evolution a slow one, because 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 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. As a rule every light hot 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.

The ability to tan or take on coloring matter as a protective armor against light is surely a matter of selection, for it is quite certain that in the conditions under which blondness arose there were short periods of time when there was much light—as in the short hot glacial summers of pre-history—and then those blonds who could tan were far better fitted to the environment than those who could not, and surely these tanned men survived. 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 through—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. The bronzed skin of the cachectic white man who has long been in the tropics is likewise a pathological phenomenon.

The *freckled skin* which is so common in youth before the darkening due to age, is 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 brunetness. 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 a darker country.

Nothing is known of the reasons for the remarkable pigmentations accompanying pregnancy, chlorosis and other blood conditions, 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. 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.

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. The name Russian is said to be derived from 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 rufous tendency all around the Mediterranean. It is more noted on the north side than the south and is quite common on the east, 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 rare among them, except in northern Europe, and these can be accounted for by cross-breeding. *Ripley* states that this red type was chosen in the early centuries for the pictures of Christ. Rufousness appears so often among the Teutonic types in Scotland, Scandinavia, Finland, Lithuania, and Germany that *Topinard* thought it a mere variety of yellow-haired blondness, but it is quite common in Russia, Spain and Italy among brunets, and the biblical Esau shows that the red hairy type has been in the Mediterranean basin at least 2,600 years.

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. Women's hair turns 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 red of the mammoth's hair thus indicates sun exposure, and those species which lived in wooded countries were probably black.

An investigation of redheadedness in the English village of Burbage by a noted eugenicist, *Major Hurst*, brought out the fact that it never appeared as a new trait, but always as an inheritance, which may have skipped one or more generations by the operation of Mendel's law. It seems therefore to be a partial albinism in which the black and yellow pigments are missing or defective. Extreme xanthism also seems to be a partial albinism, due to defect of the red and black pigments. As far as known both these forms of defect, as well as total albinism, are transmitted strictly according to Mendel's laws, in the same way as other defects, such as deaf-mutism and polydactylism.

*Dr. G. A. Turner*, of Johannesburg, South Africa, in describing the albinos, which seem to be more common among negroes than whites, mentions cases of what he calls xanthism, which also is a Mendelian inheritance. The skin is a rich red, hair a dirty clay color, the down on the temples red-golden, eyebrows and lashes dark dull-brown and iris brown, sometimes a very light brown. Nystagmus is present occasionally. These seem to be identical with the red types I have seen among Malays, and are unquestionably due to defect of the black pigment, leaving only the red and perhaps some of the yellow—a partial albinism.

The investigators of the Galton Eugenics Laboratory, in their monograph on albinism in man, apparently group the lightest grades of xanthism with albinism, and state that even in the complete albino there may be a yellow tinge to the hair. They consider it a graded character, for the pigmentation may increase with age. The pigment in the hair is said to exist both as granules between the fibrillæ and as a dye diffused throughout the fibrillæ, the granules being defective in albinism. Though they find that separate grades are hereditary, like pigmentation in general, they cannot find it transmitted as a Mendelian character, though nearly all



other investigators consider all defects of pigmentation as Mendelian.

Melanism is a term for the occurrence of black varieties among mink, otter, marten and other animals, especially the common red fox. In the latter species, these silver or black foxes seem to be proportionally more numerous in periods of food abundance, as many as one-fifth being then so colored.<sup>20</sup> It seems to be a Mendelian character due to dominance of the black pigment and suppression of the red and yellow. Its use is unknown, but perhaps it is pathological like albinism.

Among East Indians there are many dark types in which both yellow and red pigments seem to be missing—they are truly black men. Perhaps the condition is normal to tropical races, though, as a rule, the presence of red or yellow, or both, gives an infinite variety of shades which defy classification. Some races seem to be defective in red and others in yellow, but the black always exists in some degree except in the albino rufous, xanthous or the mixture of the latter two—a type for which we have no name.

The reason for the senile blanching of the hair of the head and body is wholly unknown. We have not even a suspicion. *Metchnikoff* has shown it to be due to the removal of the pigment by the phagocytes, but he does not show why they 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.

*Dr. Adolphe Bloch* has discussed the origin and evolution of the blond races,<sup>21</sup> and his article contains numerous quotations from ancient literature which leave no doubt that the blond type was indigenous to Europe and constituted the Aryan race which was directly descended from quaternary man.

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<sup>20</sup> Cox, *Science*, July 17, 1914.

<sup>21</sup> Translation in *Smithsonian Report* for 1912, pp. 609-630.



## CHAPTER XVI

### EXTINCTION FOLLOWING RAPID MIGRATION

There seems to be no dissent from the opinion that the cradle, or cradles, of the race were small areas. Specialized types, like the present anthropoids, always have very limited ranges. Therefore the earth has been peopled by migrants who moved so slowly that there was time for the evolution of new types adjusted to the new environments. History itself is a record of the events following these perpetual movements which seem to be growing in intensity, rather than diminishing. It is evident then that there must have been a great mortality of migrants who were unfit for their new climates and a survival of variations which happened to be more nearly adjusted. If a movement was rapid and carried a people to a place where there were no variations fit to survive, extinction was inevitable. Modern means of transportation are so rapid and cheap, that more men than ever are being carried to places where they are hopelessly unfit, and the results are now seen in every country of the world—high morbidity of the intruded unfit type. We must repeat over and over again that evolution is invariably accomplished by slaughter of the unadjusted and the limitation of breeding to the fit variations. Each subrace of man indicates a frightful mortality in the making.

According to *Dr. Arno Poebel*, of Johns Hopkins University, a translation of the creation story written in Sumerian on ancient Babylonian tablets from Nippur, says: "After [the gods] Enlil, Enki, and [goddess] Ninharsagga had created the black-headed [thus the Babylonians designated humankind] they called into being in a fine fashion the animals, the four-legged, of the field." The date is about 3000 B.C., and the reference to clay moulding shows that



the origin of the story could not have antedated the neolithic period. It is quite certain therefore that the blond type of man was unknown at that time or he would have been mentioned as the dominant type in accordance with the invariable rule. In the earliest Semitic languages the words "black" and "hair" are synonyms.

The civilized world thus got along very well without the blond type for some thousands of years. The first sure knowledge we have of it in massive numbers was only a few centuries before Christ. Individuals may have begun the southern drift several centuries earlier, since *Anderson* says <sup>1</sup> that pictures in the Egyptian pyramids show "white men of the north, with blue eyes." *Dr. A. von le Coq* has found pictures of blond types in Turkestan, dating from about the time of Christ,<sup>2</sup> and *Bloch* says there were Turkish-speaking blonds in China at the same time. The Esau type of man existed several centuries earlier in Palestine.

Prior to this time some combination of unknown forces cooped up the blue-eyed race in the far north in some limited area where it was subjected to a terrible struggle for existence—so strenuous that only the most vigorous and most intelligent could survive. When it evolved a great brain it overcame adversities and lessened the death-rate. The birth-rate does not change and therefore an increasing density of population caused expansion in all directions. The type moved out, conquering less intelligent and smaller people, until it hacked its way to the Mediterranean and Asia. It was a terrible struggle, if we may judge from the historic migrations of the Goths, who in the fifth century A.D. moved across Belgium, Luxembourg, Alsace and Lorraine and "ravaged France with fire and sword." The Eastern Goths, after passing the Danube, overran Greece and Italy, "every step marked by copious bloodshed." A brother tribe, the Vandals, left a trail of destruction.

The seventh chapter of the last edition of Malthus' wonderful work on the "Principles of Population," contains

<sup>1</sup> Extinct Civilizations.

<sup>2</sup> Exploration Archeologique a Tourfan, Paris.



an account of the numerous ancient outpourings of the surplus population of these prolific people living south of the Baltic, and the frightful slaughter of them by the peoples of the lands they coveted. Fifteen centuries have not changed the conditions or the race. They must get food and the means of importing it or emigrate.

When the Dorians invaded Greece, they found a great pre-Aryan or Mycenæan civilization which they destroyed, and when they reached the walls of Tiryns and Mycenæ they 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 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 northern vigorous barbarians destroyed.

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 Alpine type did not get over the Pyrenees in any considerable numbers, nor farther south than the middle of Italy, as the archæologists 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. 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. Perhaps but one tribe of this southern stock evolved the Semitic language and one of the northern the Aryan.

The languages of the world are so different from each



other as to indicate dispersion before the origin of speech, for man must have existed a long time without a real language. Certain resemblances between Aryan, Semitic and Hamitic seem to indicate common origin, but they have been separated so long that they have evolved 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.

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 highlands—a tribe which was very backward, being barbarous 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 Jewish, which now refers solely to that wonderful 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 great 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. *Dr. Maurice Fishberg*<sup>3</sup> 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. *Ripley* states that the Hebrews were anciently long-

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<sup>3</sup> *Science*, March 20, 1903.



headed western types, as were the ancient Phœnicians and Egyptians. Later they proselyted among the Asiatic broad-heads, and to such an extent that the present Jewish people are in large part descendants of Asiatic converts. Semites are mostly Mohammedan and Christian. 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.

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 civilizations. 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 tableland now, through climatic changes. The early Asiatics, then, had high civilizations in Mesopotamia (Akkádia) 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. *Maspero*, *Flinders Petrie*, and others seem to agree that the first warriors, priests, and architects of Egypt were of the "white race," but recent examinations of skeletons are said to reveal Asiatic features.

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, 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 probably 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.

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 movement 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. They are tincturing all this vast territory with long-headedness just as prior Semites have done for 4,000 or 5,000 years. Now the point so interesting for us is the fact that this eastern stream does not take the type out of its zone, like the southern drift in Europe. Consequently they survive like the Alpine type from Asia. At the present day the Med-



iterranean type is exceedingly well marked throughout southern Asia, India, and even farther. *Ripley* mentioned the affiliation of Hindus and Mediterraneans. It is possible to select a Hindu, Persian, Oriental Jew, Parsee, Armenian, Greek, Italian, Spaniard and Portuguese, dress them alike and defy an ethnologist to differentiate them. This zone is parallel to the Alpine zone of Asiatics farther north.

In the sixteenth century the Portuguese carried shiploads of slaves from India to Cebu, Philippine Islands, and sold them to the Spaniards who established them on farms. This area contains people of the Mediterranean type, so different from the Malay, that they must be descendants of these slaves. I have seen a very dark American officer of the Mediterranean type, who was identically the same as these Filipinos, only a little lighter in complexion.

The Semitic languages of the migrants in southern Asia and adjacent islands have been drowned out by later floods of Aryan or Asiatic tongues, but the alphabets carried in historic times have survived in scores of forms all the way to Mindanao. The Tagalos of Luzon used a modification of these alphabets until it was suffocated by the Roman form brought in by the Spaniards.

The blond northman, conquered his way into ancient Greece, and became the ruling or upper 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 brunet. 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 Phœnician trait it is be-



lieved to be Semitic. It has been called Iberian or Mediterranean. The faces of the men as revealed in Greek statuary are typical Germans, and most of them had wavy or curly 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 were "white men," and Hellas, the white man's country, 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*<sup>4</sup> 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. *Albania* may also be a name given when blond northmen lived in the country.

*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. 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.

Without a single exception these blue-eyed migrants have died out in the southern lowlands. 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

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<sup>4</sup> "Races of Great Britain."



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 a few centuries or thereabouts to destroy its blonds, and more quickly in the city than country.

Socrates (born 469 B.C.) is described as follows: "His presence was mean and his countenance grotesque. Short of stature, thick necked and somewhat corpulent, with prominent eyes, with nose upturned and nostrils outspread, with large mouth and coarse lips, he seemed the embodiment of sensuality and stupidity." He was executed for gross immorality. *Professor J. J. Stevenson*<sup>5</sup> says that Socrates was "a careless sloven, neglectful of family obligations, casting slurs on his burdened wife, unattractive of face and figure, a loungee at street corners, etc." 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 produced such types even though they were men of genius?

The Greeks died out in Egypt and their wonderful sciences were lost. 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.

Brunet natives reasserted 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. Philip and Alexander, who were northern men and descend-

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<sup>5</sup> *Popular Science Monthly*, December, 1910.



ants, no doubt, of later arrivals from Germany, had no difficulty in conquering them all, for they were practically helpless from degeneration and partial extermination. 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.

Long before the beginning of the Christian era few Homeric Greeks were left, and the Romans described these few effeminate in words of the greatest contempt. But the real Greek—the brunet 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 more than three 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, but 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 whose son 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. Recently discovered sculptured portraits of Cleopatra show that she was of the Mediterranean type differing but little from present day Greeks.

Italy presents the same picture, beginning at a later date. 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 being the brunet 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 Alex-



ander and his successors, even turning against the home land and fighting the Germans. 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*<sup>6</sup> 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 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* article<sup>7</sup> show conclusively that the big northern type was the ideal soldier in ancient Rome and continued to be the ideal long afterward, and they also prove that the ancient soldiers who conquered Rome and built up its civilization could not stand the climate and had probably disappeared 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.

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. From what we know of the appearance

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<sup>6</sup> *Fortnightly Review*.

<sup>7</sup> *Allgemeine medicinische Central-Zeitung*, 1893.



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 not even a memory.

The death of the ruling and conquering Aryan type in ancient Rome is shown by the statement of *Draper*<sup>8</sup> that "in the earlier ages the Roman 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, at the end strikes the nail on the head as to the cause of the ruin: "Whoever inquires 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.

The low class of Italians of to-day are savages according to *Lombroso*. They live in conditions which other savages resent. They are short, brunet with long heads, and many have large negroid projecting faces. Many are not at all

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<sup>8</sup> "The Intellectual Development of Europe."



unlike a type which we imagine to have been the occupants of Europe in paleolithic times and which oozed into Italy as soon as they could escape from the northern home. They were subjected to a selection of the most fitted—that is, the most brunet—until they reached a pigmentation suited to the degree of light to which they were exposed. 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 brunets 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 brunet who are descendants of more primitive immigrants. There is a strong negro infusion on the northern shore of the Mediterranean, which accounts for much of what *Lombroso* saw.

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. Mural paintings on Etruscan tombs depict white men in positions of authority over dark ones, thus proving a northern pre-Latin immigration.

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. In the time of Cæsar the northeastern part of France and the lowlands of the Rhine valley were occupied by the Belgæ, who were blonds with blue eyes and yellow hair. The brunets 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. The Goths, Vandals and Franks were blond Aryan Teutons who later invaded France, and this type has ever since been flowing into the land from the Baltic breeding



ground, individually or in military masses in search of land, food or trade to get food.

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 always been going on 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 autochthonous cave men. The death of the intruders perpetually makes room for new invasions. It can never be depopulated as so many foolish writers predict, indeed the population increased three and a half millions from 1872 to 1911. It has less surplus population than its neighbors. If there are too few births, immigration restores the balance; if too many, there is an increased death-rate or more emigrate. 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 brunet, and the Gauls in all probability have scarcely left a trace in the south.

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 Spaniards, who were converted in large numbers to Judaism, and when the Semitic Arab and the



Berber brought in Mohammedanism they embraced that too and were much happier and more contented than 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. 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 words became equivalent to Mohammedan. *Saracen*, the name the Arabs gave themselves, means "men of the Desert."

We would presume that the farther 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 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 farther 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."<sup>9</sup>

The historic medieval waves of blond Teutons, in a southern or southwestern direction, need not delay us long. Rome had kept back these 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.

The Roman barriers weakened about the time that this type of men flooded England, and when "the mythical Hengist 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 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, where a few survive. Their brothers

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<sup>9</sup> Press reports.



who flowed east to Russia at the same period have left plenty of strong descendants who are now typical Longbeards.

*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, like that of a glacier. The men disappear like the ice, but their thoughts and civilizations remain like the boulders and gravels of a terminal moraine.

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, was said to be a Swede, his grandfather having been a Swedish army officer, but his father served in the Russian army. *Skobelev* also was of northern origin. It is 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.

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 brunet. All folk lore points the same



way, for princesses, fairies, and angels are invariably pictured as brilliant blonds, the brunet 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 and Rome.

*Dumont* and many others have mentioned the fact that blonds were the rulers of brunets all the way from the Peloponnesus to Ireland. Irish traditions still refer to a blond race which conquered brunet earlier arrivals. In Scandinavia, too, the brunets 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. Brunets who have percolated into Scandinavia may possibly survive millenniums before evolving blondness like the first invaders.

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 brunet. 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.<sup>10</sup> Somewhat later, he was generally believed to have been brunet, but this change of opinion corresponded, I believe, with the invasion

<sup>10</sup> Draper's "Intellectual History of Europe," p. 361.



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 brunet 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 its most persistent enemy. It is merely the symptom of that mental attitude of the brunets 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 brunet in the early centuries of the Church when she was doubtless looked on merely as a fortunate Jewess.<sup>11</sup> 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 blond. But Mary Magdalene shows her lowly origin by being pictured as brunet. 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 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 brunets.

The Devil and all his Imps are almost always pictured as brunets, 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 brunet, 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

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<sup>11</sup> Draper's "Intellectual History of Europe," p. 361.



*villeins* being the lowest laborers, slaves, or serfs, and they were presumably conquered brunets. We 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 pictured dark.

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 brunets, while in the highest and best the proportion of blonds is markedly greater even in our brunet cities where there is such a large number of high-type brunets. In the schools of New York City, the better the neighborhood the higher the percentage of blonds, and the light types also increase in percentage in the higher grades because the brunets drop out earlier.

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 brunets. "The thrall or churl is invariably a dark type, the opposite of the flaxen-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 interesting point as to central Europe lies in the fact that the conquering blond always seized the fertile, rich countries and drove the vanquished brunets 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 and soldier.

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 in Media and Persia, where they had waxed strong enough to conquer Turanian and Semite 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.

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 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 that 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 British Aryans who came in by the back-door. Perhaps the first Aryans enlisted into their armies at Bactria immense numbers of



brunet 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.

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. *Draper* said that the doctrines of the Druids recalled in many particulars those of the Rig-Veda—both originated in Scandinavia in a common source.

All the 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*<sup>12</sup> says the latter in Persia were all Turanians who could not then accept an Aryan religion, and they actually killed Zoroaster. The present Aryan race in India—the British—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.

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 branches

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<sup>12</sup> "Extinct Civilizations."



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.

There are said to be ruins of big buildings in Borneo which may have a Ceylonese origin, but whether the Aryans ever went farther 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* believes the Aryans did come. The sailor instinct may have led Aryans to the Pacific Islands, as previously explained.

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 article<sup>13</sup> 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 farther, 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 as-

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<sup>13</sup> *Philadelphia Medical Journal*, April 7, 1900.



serted 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 build it up die out from climatic unfitness. Lower races never have and never will keep up a high civilization thrust on them. The brain which evolved it must sustain it.

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 thousand 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 survival 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.

Extinction of blonds in light countries may be delayed many generations if there is a constant breeze to assist in carrying away surplus heat. These instances have given rise to doubt as to the universality of the law of adaptation. For instance, there are poverty-stricken white people called "Conks" in southern Florida, the Bahamas, Barbadoes and Bourbon, who are largely descendants of Tories who migrated there after the Revolution to continue under British rule. They are frightfully degenerate, at least in Hope Town, Abaco, Bahamas, according to a report of a scientific expedition of the Baltimore Geographical Society,<sup>14</sup> which the investigators thought was due to inbreeding. The half-breeds were worse off still, but the negroes were the best in spite of inbreeding. There are similar instances in Jamaica and other islands in the New World. *Professor J. Macmillan*

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<sup>14</sup> *Science*, October 2, 1903.



*Brown*, of the University of New Zealand, reports blue-eyed, yellow-haired Europeans of the fifth generation in the Island of Kissa, descendants of Dutch soldiers. They, too, show weakness of constitution, erroneously blamed on inbreeding. They have forgotten Dutch and speak the native language, though three-fourths are of pure Dutch descent.

*J. H. F. Kohlbrugge*<sup>15</sup> states that the fair people of *Kisser* (Kissa?), are of mixed blood, and that the "blond" Europeans of Pitcairn are half-breeds of Tahiti women. He thinks that long survival is dependent on race mixture. He says that "other whites have been living on Saba Island (Dutch West Indies), and have not mixed with the natives, but are degenerating in a remarkable manner. During the eighteenth and nineteenth centuries many French aristocratic families resided in Guadaloupe and Martinique, but as soon as immigration stopped they died out or degenerated. A number of Dutch farmers settled in Surinam with their families about the middle of the last century; of these, only a few have survived and are fertile without race mixture. The same can be said of the German families settled on the coast of Queensland, but the period has been too short to form a definite opinion. Dark-haired Europeans have fared far better. For the last two centuries several Portuguese-Jewish families have been living in Surinam, and Spaniards have successfully persisted in high-lying plains, not, however, without race-mixture." Italians seem to stand Queensland the best, and the Portuguese the tropical north of Australia. He also says that the fair inhabitants of Pitcairn, Kisser and Saba are of a low intellectual level.

It is almost a biological axiom that half-breeds between widely separated races cannot persist because of physical unfitness to the climate of either parent. They are actually people without a place on earth suited to their physique, men 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 dam-

<sup>15</sup> *Archiv. für Rassen und Gesellschafts Biologie*, vol. vii, No. 5, 1910.



aged 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. 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 woful 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 expected.

*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."<sup>16</sup>

A medical officer informed me that mestizo children died of malaria in far greater numbers proportionately than

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<sup>16</sup> Burot and Legrand's Hygiene.



full-blooded 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. *Ripley* gives many illustrations of the weakness of hybrids. *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, while the half-breed is physically adapted to neither, indeed is unfitted to any set of conditions it can find anywhere. Nevertheless, 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.

The distribution of blonds in highlands, as already described, shows that elevation postpones extinction of migrants for many centuries if it is shady, cold, and, as *Mackintosh* has discovered, the soil is dry. If to elevation we add artificial protection from the sun, extinction seems to be prevented. For instance, the Abyssinian mountaineers within 9° of the equator are said to be of Hebraic origin, and the high-class women, who rarely leave their houses, and even then cover their faces, are said to be sometimes quite white. The men are brown, largely from sunburn, though there is a negroid element shown by the curly black hair. Careful housing is also preserving the Spanish types in the plateau of Bogota at an elevation of 6,000 feet, almost directly under the equatorial sun. In the mountains of Sinaloa, of Mexico, there are numerous blue-eyed, light-haired men whose occupation of mining no doubt helps to preserve them. The alleged blonds in such places as the uplands of Algeria, who are said to be descended from Tamahu in



unbroken descent for 3000 years, are really very dark. The same may be said of the "blond" Eskimo found by *Stefansson*.

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 it is the same. Indeed, it is foolish to suppose that a climate which evolved the blackness of the natives 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*<sup>17</sup> 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 disorders, and neurasthenia. *Colquhoun*<sup>18</sup> mentions the decay of native Australians, their anæmia, nervousness, and exhaustion.

The mountains of South Africa may be cool enough for blonds for a while, but from the brownness of the natives 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 brunets, and even they are known to be dying out, leaving the land to the adjusted brown or black native Indian types everywhere.

The less the distance the blond migrates from the present center of blondness in southern Norway, the longer he survives. The type seems permanent in the cloudy, cold, northern parts of Scotland, and, perhaps, of northern Ireland and northwest Russia, but *Munro* states that they are not holding their own in England, where the brunets are more resistant and have longer lives. *Havelock Ellis* states that there is a progressive diminution of fair people on the Continent. *De Quatrefages* found it to be a fact in Normandy, *Schaafhausen* in Germany, and *Shimmer* in Austria.

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<sup>17</sup> February 2, 1901.

<sup>18</sup> "The Mastery of the Pacific."



The climate of Japan is unlike that of any other place on earth. It has modified the various races which have immigrated into it until they are unfit to live permanently anywhere else. Though they flourish better than Europeans in all our climates, they have utterly failed to colonize in a very cold or very hot one. In this respect they resemble the Irish, who are disappearing in America, as described later. On the other hand, the Aleutian Islanders, though rather recent arrivals from Asia, have not changed, as the climate is practically the same as that which evolved the type.



## CHAPTER XVII

### EXTINCTION OF MIGRANTS IN AMERICA

Mexico is much farther south than Spain, and the complexion of the native Mexican of the lowlands is 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 Aztecs as well as the other allied races 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 a long time, 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 <sup>1</sup> that the measurements of the natives of Tetelcingo agree with those of the ancient Aztec and Nahuatl skeletons from various parts of the valley of Mexico.

Of the present 20,000,000 Mexicans, 40 per cent. are said to be pure-blood native Indians, speaking the languages they used when Cortez arrived. Fifty per cent. of the population 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, though some of the old religions have survived in purity. 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 Romero* <sup>2</sup> 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 be-

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<sup>1</sup> *Harper's Magazine*, December, 1902.

<sup>2</sup> "Modern Mexico."



hind 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 hardly, 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 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."

The swarthy Spaniard is adjusted to a climate like Maryland, but 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. The contemporary history of Mexico and Central America is explained by the disappearance of the Mediterranean type which formerly ruled them.

The same deterioration is a feature of the 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.

Between 25 and 30 degrees of latitude we have the Pe-



ninsula 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 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 toward 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 eventually die out. 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 brunet 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 farther south. In this zone also the blonds cannot survive, except in the mountains, but as it is the zone of southern Spain, southern Italy, Japan and Greece, we find that the olive and dark brunets are perfectly adjusted and flourish. The Mediterranean races tend to flock to our south, and to California below 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 brunet central Europe. They flourish in the Adirondacks and Green Mountains, where some of our ablest men have been born.



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.

*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 brunets 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 brunets already noticeable in this part of America. The southern army in the Civil War was markedly more brunet than the northern.

The Southern Hemisphere, except the tip of Patagonia, is north of 45 degrees, and therefore unfit for blonds. The survival of German colonies is not conceivable in the tropical parts of South America, but the type is as vigorous in Argentine and Chili as in similar latitudes of North America, though permanency is not possible. *Savage Landor* reports a dreadful degeneracy among the Portuguese in tropical Brazil. Though they are heavily pigmented, they are not sufficiently so. The Indian is nearly black. The Portuguese can stand the tropical climates of Australia far better than blonds, but eventual decay can be predicted.

*Dr. Theodore N. Gill*, of the Smithsonian Institution, is reported to have stated that our blond types are becoming less plentiful. *Professor Otis Mason* also stated 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."

*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. We seem to be repeating the evolutionary history of southern Europe and northern Africa.

The Alpine type in Europe, by the process of selection, seems fitted to its present location, but it is vastly different from the Asiatic, from which it descended. Indeed, there is a perfect gradation of forms from the light brunets of western France to near yellow of eastern Russia, where they cannot be differentiated from mongols, as some have oblique eyes, high cheek bones, olive skin, and coarse, black, straight hair. There is no reason except our internal migrations why similar changes could not occur in America for types not too far from their zone. Indeed, in the short time the American Indians have been here they have differentiated greatly to fit them to survive from the arctic to the tropics, but they were all pigmented to begin with.

The mortality of a mixed American population must increase with the sunshine. This is shown by the urban rates in the United States, which average about 20 in the Southeast, 18-19 in the Middle States, 16-17 in New England, 14-15 south of the Lakes, 12-13 in the Eastern Plains, 9-10 in the Western Plains, and are nearly the lowest in the northwestern corner. Bartholomew's Atlas shows that the sunshine varies in approximately this manner. The lowest rates are in the southwest, where the Mexicans are so numerous. Our army statistics also show that the sick rates vary from place to place with the sunshine. The rates in the civil populations in the arid regions, Nevada, Wyoming, Colorado, Idaho, Oklahoma and the cities of the California valleys, are much greater than in the Northwest or farther east.

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. He 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.

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. 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. The worst districts in Ireland are the Connemara Mountains, 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.

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. A study of the students of a small New England college patronized by old colonial families showed a remarkable uniformity of hair color—medium to dark brown. The yellow-haired have almost all perished. The New Englander is not disappearing as some think, but the blondest surely are.

The degeneration of blonds along our whole northern border, particularly in the West, is in marked contrast to the healthy conditions of the brunet French Canadians, whose color approaches that of the "white Indians" native to the Northeast. These industrious, dark Canadians are now flowing south, and are already in possession of much of our northern border. In New England they are crowding out other types. On the other hand, the blonds furnish many, if not the most, of the vagabonds and ne'er-do-wells around the towns of northern New York.

*Francis Parkman*, in his works on the old régime in Canada, mentions a book, "*Nouveaux Voyages*," written by a *Lieutenant le Houtan* about 1700. In it is a description of the women sent over by Louis XIV as wives for the soldiers who were colonizing New France. "Few of them were brunet." They evidently came from northern France, but the hot and sunny more southerly climate of the St. Lawrence has killed off the blondest of their descendants. The deterioration is far more rapid in western Canada, and was more rapid still in the Louisiana French, where no blonds are left at all, and where no one even suspects that they had blond ancestors. For several years I made observations of the yellow-haired men I have met in America, and with very few exceptions they are either of very recent stock or come from the mountains.

In a book, "*The American People*," *A. Maurice Low* shows that historical American families, who were largely blue-eyed, by the way, do not perpetuate themselves. There is not in public life a single representative of the names on



the Declaration of Independence or of men noted in the Revolution, or who sat in the Constitutional Convention, though a few trace descent to collateral lines. Similarly, the early leaders in finance and commerce are not represented to-day in those spheres. The cause is not sterility or race suicide, as *Low* thinks, but climatic unfitness, because in Europe the adjusted great families remain great a much longer time. Direct descendants of America's early great men are commonplace, as a rule, if not actually below the average, both mentally and physically, and although the colonial stock, as elsewhere shown, still furnishes our intellectual leaders, they come from the middle classes, and few are really great.

The blond Greeks disappeared after a wonderful intellectual career, and it is undoubtedly true that the older blond stocks in America are disappearing except where kept alive by new blood, and the farther south the quicker the decay. They are being elbowed out by newer arrivals of the northern types—not of those from the south of Europe. *Woodrow Wilson* is the grandson of an immigrant from Great Britain, and the late *Governor Johnson*, of Minnesota, who was booked for the presidency, was the son of a Scandinavian. German names are increasing in number in "Who's Who in America," but the old Dutch are being swamped.

We can now also understand why there is such a flood of brunets 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. Russians are pressing on Austrians and Germans, the latter on the French, but the Italians, Armenians, Greeks, Huns, Servians, and Bulgarians flock to America to live in the 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.



The negro slave was healthy because cared for like an ox, but became sickly in freedom. The death-rate has increased from 24 per 1000 in Charleston, S. C., in 1822 to about 45, some say 50 in some cities, and it is now more than double the white rate, whereas in slavery it was less. 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 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. 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.

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 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 from the Continent into England, which has never suffered in the least from its slight lack of adjustment for blonds. Every decade brings more to America from northwest Europe than the total immigration of New England prior to the Revolution, but the negro is not recruited this way.

There is one part of the United States which has almost the same dark, cold conditions of our original Aryan home near the Baltic—the northwestern corner and southwestern Alaska. There are cool to cold winters, short cool summers, plenty of rain, and the sun appears on an average of one day each week, some places having but fifty sunny 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. There is a remarkable similarity in this climate to that of Ireland, where blonds have flourished for thousands of years.

The people are extremely comfortable in these fogs and rains, due to the relief from the painful glare of the sun found in other parts of the United States. Indeed old residents 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.

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 them. Unfortunately it is not cold enough, and they may not survive permanently, but they will surely last longer than in New England.

The pleasing dream of the low types flocking here that America is a "melting pot" destined to make an alloy of all races, has no scientific basis and is sheer nonsense. The hybrids could not breed true to type anyhow, and if they could it is evident that even if they were adapted to one place they would not be to any other. Types unfit for the environment must disappear, and as elsewhere explained, though we might develop as diverse types as in Europe, there cannot possibly be an American type fit for every place



## CHAPTER XVIII

### CAUSES OF EXTINCTION OF MIGRANTS

The nervous exhaustion due to prolonged exposure to excessive light and heat may be transmitted to offspring which in turn may be still more damaged by the same factors, until a condition is reached where the organism is so enfeebled as to be an easy victim of any lethal agent which the normal ancestor would have resisted. That is, neurasthenia may be a method of eliminating unfit migrants. Surgeon-General *Sir R. Havelock Charles*, Indian Medical Service, has shown that it is a decided factor in the decay of northern types in India.<sup>1</sup> He also says that though there have been numerous ancient streams of "white" races into India their extinction was unquestionably due to climate neurasthenia. Foreign races in southern Asia, such as the Chinese, maintain themselves by constant importations. "The European struggles during the first, dwindles and degenerates during the second, and becomes extinct, as such, during the third or fourth generation."

Numerous other writers have mentioned the prevalence of neurasthenia in all decaying migrants, particularly Europeans in tropical climates. Yet it does occur in cold places such as in Peking where the sky is cloudless and the sunshine intense.<sup>2</sup> Ziegel found it to result from long residence in Los Angeles.<sup>3</sup> It is extremely prevalent among whites in Florida, and it is so common in Colorado as to have occasioned frequent notice in the literature.<sup>4</sup> There is an

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<sup>1</sup> Transactions of the Society of Tropical Medicine and Hygiene, November, 1913.

<sup>2</sup> Shattuck, *Boston Medical and Surgical Journal*, July 18, 1907.

<sup>3</sup> *New York Medical Journal*, December 15, 1906.

<sup>4</sup> Byles, *Medical News*, November 26, 1904.



alarming amount of serious sickness in the hill stations of India, though the temperature is cool,<sup>5</sup> and there is no question that neurasthenia is a marked factor, as in other highlands. Porto Rico seems to have about the same effect in causing neurasthenia among Americans as the tropics in general,<sup>6</sup> and the result differs but little in the long run from that of Colorado.

Throughout America the very blond, particularly the rufous and xanthous, suffer from all grades of nervousness up to disabling neurasthenia. This is pathological, for we have shown that in a normal dark habitat they are as phlegmatic as the rest of the population.<sup>7</sup> In women it frequently prevents employment, and is a very serious matter, though often treated flippantly by humorists. Some employers instinctively hire brunets in preference to the blonds.

On account of the harm done to nervous patients by sunny, high altitudes, *Leonard Williams* has strongly advocated sending them to low level or relaxing climates, where the rains and clouds also protect them from light.<sup>8</sup> Our northwest coast is an ideal location for sanatoriums for nervous invalids,<sup>9</sup> and so is Norway.<sup>10</sup> Indeed, Norway is becoming quite a health resort the year round, for the winters are not as severe as the world believes, and seem to be more upbuilding even than the summers.<sup>11</sup>

The rufous are possessed of a rather unstable nervous system only in light countries, for *Hurst*<sup>12</sup> finds them as phlegmatic in England as the surrounding population. Nevertheless, they rarely become great men and leaders, and their irritability in light countries is a grade of neurasthenia. They may be possessed of brilliant minds, but, as

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<sup>5</sup> Giles, *Climate and Health in Hot Countries*.

<sup>6</sup> King, *Journal American Medical Association*, May 19, 1906.

<sup>7</sup> Neurasthenic States Caused by Excessive Light, *N. Y. Med. Rec.*, December, 1905.

<sup>8</sup> *Edinburgh Medical Journal*, March, 1905.

<sup>9</sup> House, *Medical Sentinel*, March, 1906.

<sup>10</sup> Austin, *Boston Medical and Surgical Journal*, July 8, 1909.

<sup>11</sup> A. Megelssen, *To Norway for Health*.

<sup>12</sup> *Ibid.*



in the albino, there is likely to be defect of some sort. *Dr. Bertha C. Downing* has made the curious observation<sup>13</sup> that congenital idiots in America are generally blond, as though extreme xanthism were a defect of development. The defect of mental growth might be part of the process of extinction of the unfit, for she found in a large private school for wealthy children, blonds were in a decided majority, and were either precocious or below par mentally.

It is evident that these nervous effects would bring on insanity most often in the class least adjusted to a place. The bright blonds, for instance, furnish more than their share of the insane in the asylums of New York State.<sup>14</sup> The New York State Commission in Lunacy has reported that insanity is extremely frequent in mechanics engaged in outdoor employments and relatively rare in mechanics engaged in indoor occupations. Taken in connection with the prevalence of blonds, there is ample justification for blaming the excessive light of this climate. We have already explained the greater prevalence of suicide and crime on sunny days and in the sunny season. There are no data as to whether the excess at these periods is in blonds or brunets, but we can safely predict that the lighter types will be found to predominate. The Jews have less insanity than the Gentile population and the Jews are always the better pigmented.

Climatic neurasthenia is quite common among New York policemen, who frequently are disabled thereby. It is often the reason for pauperism or chronic thievery. Among convicts in Dannemora Prison, in New York State, where "third termers" are sent mostly for crimes against property, the blonds are far more numerous than in the general population.<sup>15</sup> In the northwestern parts of Europe, where the blonds are better fitted to the climate, the brunets furnish an undue number of criminals. That is, the main reason for social parasitism is unfitness for the environment. Both

<sup>13</sup> *N. Y. Med. Rec.*, August 21, 1909.

<sup>14</sup> Complexions of the Insane, *New York Medical Journal*, December 23, 1905.

<sup>15</sup> "Who Are the Unfit?" *New York Medical Record*, 1909.



criminals and prostitutes are notoriously lacking in mental development, and being too feeble for hard, muscular labor, their neurasthenia is only increased by the effort to do steady work.

In striking contrast to all this is the prevailing brunetness of those convicted of crimes of violence. In Europe, assaults and murders are at a minimum in the blond northwest corner, but increase toward the Mediterranean. Among the most brunet races, murder is a fine art. In America, the immigrant brunet races continue these habits, which could almost be called normal. The convicts show no evidence of degeneration, as their acts are racial.

Suicide has been shown to be a result of nervous breakdown, and is more common in America where light exposure is excessive. Blonds therefore should be the greater sufferers, since the Europeans in the Philippines have higher rates than the natives. *Ripley* has found the rate to be higher in the invading race generally, and the farther from the place of origin or the more recent the migration the higher the rate. It is greatest in parts of France where the Teutonic and Mediterranean types predominate, least among the Alpine race. In Italy the Alpine type suffers most, but in England the Teutonic.

Blue eyes are found in about 90 or 95 per cent. of the aged paupers in the asylums of New York City. As New York can be called a brunet city, it is evident that these blonds have been seriously damaged by the climate. Some are foreign born who outlive their children and grandchildren. The pitiful side of the matter is the utter helplessness of many a neurasthenic descendant of the blond old stock. The "down and outs" who obtain temporary shelter in the New York City Municipal Lodging House are mostly native sons, whose average residence in the city was thirty-two years and four months. Only nine per cent. had been in the country less than three years.

*Dr. S. Carlsen*, of Spring Grove, Minn., has published in a Norwegian medical journal <sup>16</sup> an account of the "Influence

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<sup>16</sup> Tidsskrit for den Norske Laegeforening, No. 10, 1909.



of Climate Upon North European Emigrants, Particularly Norwegians, in America." In Minnesota and the Dakotas they decay in spite of good hygienic conditions, good food, large, airy and warm houses, and temperate life. The children are poorly developed and anæmic, suffer from catarrhs and dental caries, and 80 per cent. are nervous. "If we do see a sound, healthy woman with healthy cheeks and strong physique, we may be sure that she is a newcomer from a country district at home." The Norwegians who settled in Texas about the same time have completely disappeared, not by amalgamation, but by inability of the offspring to develop properly in an unfit climate.<sup>17</sup>

Norwegian mountaineers settled in our Northwest soon lose buoyancy and elasticity of gait. The hair becomes dry, alopecia develops, digestive troubles and constipation are common, female disorders prevail, and both sexes suffer frequently from nervous disorders. In the second generation decayed teeth are common, and tuberculosis and rheumatism are appallingly frequent.<sup>18</sup> The nervous conditions in northwest Canada are still worse.<sup>19</sup> In contrast is the healthy condition of Norwegians who migrate to the Orkneys and Shetlands, where *Beddoe* found the dark types to be the most frequent victims of nervous disorders.

The greater susceptibility of the young to adverse climatic factors causes defective development of the teeth, which are prone to early decay and thus still further add to the damage by interfering with mastication and by harboring foci of pus germs, which constantly poison the body. In all the descriptions of decaying migrant types, defective teeth are almost invariably given prominent mention. There is no question but that this hastens the extinction of the unfit.

The light of our western and southwestern country is the cause of that wonderful exhilaration we experience in the West. "I wouldn't live in Colorado if they gave me the

<sup>17</sup> The Physical Decay of Northern Europeans in Our Northwest, *New York Medical Record*, December 18, 1909.

<sup>18</sup> Janson, *Northwestern Medicine*, January, 1903.

<sup>19</sup> Heustice, *Canadian Medical Journal*, February, 1907.



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." Neurasthenia invariably results and physicians are sending their nervous patients to lower altitudes. *Dr. V. E. Watkins* found that the sufferers were largely if not entirely blonds.

*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 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 generally 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

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<sup>20</sup> *New York Medical Journal*, December 30, 1905.



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."

"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 at high altitudes, 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 Indian 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. *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.

For many years physicians have been calling attention to the neurasthenia of the eastern part of the United States. Commentors almost invariably blamed the rush and push of our life, but as a matter of fact such conditions are just as bad in European cities, where neurasthenia is rare. Besides, work rarely hurts any one. Within recent years the climatic causes have been grasped.<sup>21</sup> The conditions found among infants and children remind one of those found in white children reared in the tropics.<sup>22</sup> The middle class girl is "a bundle of nerves incased in a fragile frame," one in twenty

<sup>21</sup> Dr. J. Madison Taylor, *New York Medical Journal*, July 6, 1912.

<sup>22</sup> *Boston Medical and Surgical Journal*, November 10, 1904.



giving up school because of failing health. In both sexes, great brilliancy of intellect may be developed, even genius as in the decaying ancient Greeks, but these neurotics do not produce the solid results of the more stable minds of Europe.

American nervousness explains the history of our athletics. Our sports require quickness, and we excel in all demanding an enormous expenditure of energy in a short time. Europeans hold the records in all events requiring more endurance. Moreover a short residence in America stimulates the foreign stock so that they accomplish wonders, but the longer the residence the less athletic. An analysis of the American Olympic Victors of 1906 and 1910,<sup>23</sup> shows that they were largely foreign born or of stock arriving since 1840. Few were of colonial families. The native born were practically all from north of Mason's and Dixon's line. That is, the stock decays and the farther south the sooner.

Alcoholism is now recognized as a symptom of a profoundly exhausted nervous system, and it is probably the determining cause of most if not all of the pauperism in the asylums of New York City. Austin O'Malley<sup>24</sup> investigated thirty-four Irish families who migrated to the latitude of Maryland after the famine of 1847, and who have woefully decayed. They have produced a large number of chronic drunkards, epileptics, neurasthenics, insane and consumptives. The families which settled in Canada at the same time have done far better, and as the blonds here suffer the most it is evidently a climatic matter. There is ample ground for believing that the Bacchanals of Ancient Greece and Rome were what might be called the climatic alcoholism of the decaying Aryan invaders, and were not indulged in by the brunet autochthones. The former excessive alcoholism of the British in India was of the same origin, and exists yet in other tropical countries where the danger has not been so well understood. In Boston, in 1900, there were sixty-eight deaths from this cause, of whom forty-four had Irish born

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<sup>23</sup> *North American Review*, 1907, and *New York Medical Record*, April 27, 1912.

<sup>24</sup> *American Medicine*, November, 1908.



mothers. It is evidently one means of eliminating the physically unfit.

The tuberculous are universally neurasthenic, and in advanced cases it even affects their mentality to such an extent as to warp all their opinions. All this has been imputed to the toxæmia, but we must now reopen the question and find out whether the neurasthenia did not exist first and lessen the normal resistance. The connection between the two has led many an observer to class tuberculosis with the diseases of nervous origin. It at least seems that tuberculosis is nature's main weapon for the removal of migrants who are markedly unfit for their new environment and therefore the most neurasthenic.

Pathologists are quite unanimous in opinion that practically every civilized man has latent tuberculosis which stands ready to spread and kill as soon as resistance is lowered from any cause. Children are born free of the affection, but begin to acquire it in a year or two, from the germs they pick up in dust and dirt. These bacilli are probably avirulent, being weakened by light and drying, but are able to establish themselves in the lymphatic glands of the neck and around the bronchi. In these entrenched positions they play the rôle of constantly vaccinating us, so that we produce antibodies which immunize us against virulent invaders. There is no sure evidence that an adult is ever newly infected. If active tuberculosis develops, there is always a history from which we conclude that the infection had existed for a very long time, and that it spread because the patient had been reduced in health by underfeeding, fatigue, exposures to climatic adversities, or some infection like malaria, measles, whooping cough and typhoid fever—the latter in particular being followed by tuberculosis far more frequently than the medical profession suspects.<sup>25</sup>

A child which has not yet had time to evolve immunity from auto-vaccination, is susceptible to massive doses of viru-

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<sup>25</sup> Tuberculosis following Typhoid Fever. *American Medicine*, January, 1914.



lent bacilli from a nurse, and will succumb to disseminated tuberculosis. This also sometimes happens in an adult after or during a typhoid fever which has completely destroyed his normal immunity. Very soon the child develops enough immunity to confine later invaders to small areas of activity and from that time on, the extension of the lesions is the result of a very slow fight against the body resistances. Localized tuberculosis always means the existence of some immunity.

It is quite evident then that the constant bombardment of adverse factors of an environment, against which we have inadequate defenses, must damage migrants, and that those most out of adjustment to the new environment must suffer the greatest reduction of their normal resistance to tuberculosis. The earliest reference to this phenomenon was made by *Hippocrates*, though he did not recognize the reason for it. He said that "the form of body peculiar to subjects of phthisical complaints was the smooth, the whitish, that resembling the lentil; the reddish, the blue-eyed, the leucophlegmatic, and that with the scapulæ having the appearance of wings." No such types are found in modern Greece, hence it is evident that in the fifth century B.C., there were still some decaying remnants of the blond northern invaders whom we have called the Aryan or Homeric Greeks, and that tuberculosis was eliminating those injured by excessive light, heat and other adversities. In the central plateau of France,<sup>26</sup> the blonds lose ground through an excessive mortality from certain diseases, chiefly tuberculosis, but the brunets are increasing in numbers.

We can now see why it is that tall men who migrate to lands of small stature, should suffer more from tuberculosis than the short migrants. I have frequently noticed this among Americans in the Philippines, but no statistics have ever been collected on the subject. Similarly the stout and muscular men would occasionally astound us by developing tuberculosis, particularly athletes who exposed themselves to the sun. The native or adjusted physique is frail, as we have

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<sup>26</sup> Bouchereau, *Anthropologie*, Paris, 1900.



explained, and the small, frail, American brunets did not furnish many cases of tuberculosis.

Blonds are particularly harmed in all light climates where the heat is also above the critical temperature for long periods of time. Of forty-four European types who developed consumption in the Philippines, twelve were "pure blonds," fourteen were "blond," nine were mixed types and only nine brunet. All of these men were out of adjustment, and as a result the disease is exceedingly rapid. The Third Annual Report of the Phipps Institute of Philadelphia shows that of 725 consumptives, 371 had light eyes, and this in a city population notoriously brunet, where also the higher classes of population, which are largely blond, do not apply for treatment. In a report from the Agnes Memorial Sanatorium of Denver, an institution frequented by the better class, there were 152 "blonds" to 44 "brunets."

The Hebrews of New York City and Boston have lower tuberculosis rates than any other racial element of the population, yet they show the universal phenomenon of elimination of the lightest, many of whom are perfectly adjusted to the darker and cooler cities of northern Europe. The race is notoriously dark, with only a few blonds, yet *Rosenberg*, of the Montefiore Home, reports that there were 417 light types to 733 dark, the "light" class including all variations from the prevailing brunetness of the race. Moreover, the few real blonds among them are said to be rapid, hemorrhagic and incurable, while those of ordinary complexion are slow, mild and curable. *Maurice Fishberg* says <sup>27</sup> that all over the world the Jewish death-rate from tuberculosis is from one-half to one-fourth that of the surrounding gentile population.

On the other hand, we must recall *Shrubsall's* report <sup>28</sup> of the greater tuberculosis mortality of the brunets in those places in northern Europe where the blonds are the adjusted types. This phenomenon is more marked the blonder the population and therefore the greater the unfitness of brunets,

<sup>27</sup> *New York Medical Record*, December 26, 1908.

<sup>28</sup> *British Medical Journal*, December 24, 1904.



such as Holland, Scandinavia and northern Germany. These dark migrants in the north are very curable in the Swiss Sanitoriums, particularly at Davos, where the well-to-do gravitate from Germany. Similarly the dark Mediterranean type furnishes the highest percentage of cures in southern California, but in the rainy northwest coast no case has been known to recover if it is so far advanced as to excrete bacilli in the sputum. *Beddoe* found the brunets in England slightly more tuberculous than the blond, but it was due to the preponderance of cases from the brunet cities.

In all parts of the United States the blonds are the unadjusted and their proneness to tuberculosis has raised the impression that a person with the tuberculosis habit is "tall, delicately built, with oval face, clear skin, blue eyes, etc." <sup>29</sup> I tried to put this matter to the test of statistics, but found that no sanitoriums kept accurate records, that there were also no records of the complexions of the healthy populations for guidance, and that a sanatorium population was drawn from many localities. Nevertheless, enough was collected to prove conclusively <sup>30</sup> that blonds do furnish more than their share of cases in all parts of America, and are more difficult to cure. This phenomenon is more marked in our South where we also have the highest tuberculosis rates in the country.

The Twelfth Census<sup>31</sup> shows that the tuberculosis death-rates of the various races in the United States are approximately proportional to their blondness. Even in our southwest, the climates lauded for cure and prevention, the "old" families are beginning to melt away from tuberculosis. The infection brought in by "lungers" cannot be blamed for this, as the adults are immune to new infection, and the sputum so carelessly spread about is promptly sterilized by the sunshine. The Indians on the other hand have not developed immunity in childhood, and they are suffering a high death-rate from the disease which is new to them.<sup>32</sup> Similarly

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<sup>29</sup> Beeson, *Journal American Medical Association*, March 16, 1907.

<sup>30</sup> *New York Medical Journal*, September 12, 1908.

<sup>31</sup> Vol. III.

<sup>32</sup> Brewer, *Medical Record*, April 20, 1907.



Laplanders, Kirghiz and our own Indians, die of tuberculosis when they take up city life and meet the infection for the first time.

The climate of Ireland differs markedly from that of any place in the United States, except our extreme northwest coast; indeed there is no place in Europe which shows such contrasts to America. It has no extremes of heat, cold, light, darkness or dryness, and it is exceedingly humid the year round. There has never been any selection of those fit for the above extremes, and as a result some types of Irishmen who were evolved as the fittest for Ireland are proving the unfittest for America. According to the 12th Census, the general death-rate and the death-rates from tuberculosis and alcoholism, for all over fifteen years of age in the registration area, are higher for those having Irish-born mothers than for any other division of the white population.

The *Bulletin of the Boston Health Department*, May, 1912, shows that the same high rates prevail in that city, and later investigation in New York City by the health authorities show that the conditions there are truly alarming. In Boston, 70 per cent. of the excess from the ages of fifteen to nineteen is due to tuberculosis, though this percentage progressively lessens with age. In New York City in 1906, the Irish death-rate from tuberculosis of the lungs was 476 per 100,000, or almost exactly double the rate for all classes. In Boston the other causes of excess deaths of the Irish were pneumonia, heart disease, nephritis, cancer, apoplexy and alcoholism. The small brunet Irishmen seem to do far better, but there are no figures to prove it, only the statements of several observers who have noticed the greater susceptibility of the blond types to tuberculosis.

The other people from the northwestern corner of Europe are adjusted to more heat and cold than the Irish, and are better fitted for the climates of the northeastern part of the United States. The Scotch seem to be an exception, for their tuberculosis rate is nearly as high as the Irish. Those having less than the average are Swedes, English, Canadians and Germans, but as these are generally possessed



of more means, their relative immunity may be due to economic causes since tuberculosis increases with poverty. Part of the high rate of the Scotch is also due to the fact that mountain people are injured in the plains. The Swiss had the highest tuberculosis death-rate in New York City in 1906, though it came down in later years. Bohemians and Austro-Hungarians also had high rates. Italians have only a slightly higher rate than the average, in spite of their notorious poverty and unhygienic and unsanitary habits. On the other hand, the Finns in New York City have as high a rate as the Irish, which is probably because their native climate is so much cooler than New York. The low rate of the Germans is partly due to the Jews classed among them.

While the Baltic types are only slightly above or below the average as to tuberculosis in our northeastern section, they suffer dreadfully in our sunny west. From some places in a large area, with Chicago as a center, they have practically disappeared from tuberculosis, where they were once very numerous. Lithuanians have furnished an undue number of consumptives in Chicago.

In New York City, the tuberculosis mortality for each nationality varies little from year to year. It is not temporary and accidental, but a permanent vital phenomenon, constantly eliminating the unfit among the newcomers. The survivors should show marked differences in a few generations in the way of lessened mortality. For instance, in 1906, with the sole exception of the French, the death-rate from tuberculosis in each race was greater among the foreign-born, than among those born of foreign parents. The difference in average age of the two classes is not sufficient to account for the difference in mortality, indeed it ought to act the other way, for the foreign-born are more largely of an advanced age when tuberculosis is less common. The average death-rate for all was 239, but in the native-born 207, and in native-born of native parents only 157—almost as low as the rate of those born of Russian and Polish parents, mostly Hebrews—135.

The Irish who multiplied so greatly in the first and



second generation now seem to be diminishing. In the decade ending 1910, their numbers decreased 22,500 in New York City alone, though all the other nationalities from northwest Europe very greatly increased.

It must be remembered that in Colonial days, when our ancestors lived practically outdoors all the time because the log huts were so open to the weather, tuberculosis was so rare as to be almost unknown. Men raised large families, each member of which married to raise large families in turn, but when they became prosperous and built more imposing houses which were overheated and unventilated, tuberculosis began its ravages, and when they moved to the city there was a veritable slaughter. This old stock now survives by moving out to the suburbs and has not yet evolved the Hebraic immunity, for it would promptly perish if submitted to the crowding of the ghetto. *Baxter* found that brunet soldiers in our Civil War, who campaigned in our South, had less disease and were stronger, and that the tall and blond suffered unduly from tuberculosis. This, then, is the process which is making our lowland southerners a race of brunets of medium or short stature,—a fact already noted in the confederate army in the Civil War.

Phthisiographers once lauded climate as an essential in treatment, but the numerous failures in "good" climates and successes in "bad," caused some to change to the equally erroneous opposite extreme that no particular climate is needed for any case. In spite of this, a few still talk of the ideal climate with a maximum of sunshine. *Dr. J. E. Stubbart* mentioned the fact that in his wanderings for the ideal climate, he landed in a place in China where the sun shone five minutes in twenty-eight days—and intimated that he recovered.<sup>33</sup> In fact not a few are now advising patients to avoid sunny places. We have explained all this in a prior chapter.

Each climate on earth is ideal for the type adjusted to it by ages of survival of the fittest, and is harmful for every other type. *Sir Wm. Bennett* noticed that certain cases do

<sup>33</sup> *Boston Medical and Surgical Journal*, August 1, 1907.



best by returning to their birthplace,<sup>34</sup> excepting the crowded slums of course. We find the city best for urban types, but deadly for others. The *Journal of Outdoor Life*<sup>35</sup> evidently noticed this fact but concluded from it that cases are often cured and frequently arrested in the region in which they developed. This is not true unless there is adjustment, for the cases developing among Europeans in the tropics must be sent north instantly as a short delay may be fatal.

Even natives cannot stand all the adversities of their own climate. Healthy Malays must hide in the heat of the day, and if criminals are given hard labor out in the sun at that time, quite a high percentage develop tuberculosis which rapidly progresses. Yet Malays properly treated outdoors in the shade are as curable as Norwegians are in Norway. Outdoor life can do more harm than good if the type is unfit for it. Our eastern climates kill tubercular negroes, but they get well if properly treated outdoors in our southwest, but a tuberculous European promptly dies outdoors in central Africa.

The following are the death-rates per 1,000 of children under a week old in Boston, classed by the nativity of the mother.

	1911	1910
United States .....	37	39
Ireland .....	38	34
Canada .....	35	50
Russia and Poland .....	25	18
Italy .....	13	22

No better proof than this is needed to show the fitness for urban life of the Mediterranean race and Hebrews, and lack of ability to survive of the northmen. The damage seems to be cumulative, for these babies are evidently born unfit.

An important part of medical ethnology is the study of the manner in which, by long-continued natural selection, a

<sup>34</sup> *Practitioner*, June, 1910.

<sup>35</sup> July, 1907.



type will develop more or less immunity to certain diseases. *Dr. G. Archdall Reid* has been the leading worker in this field, and in his books on "Alcoholism" and "Heredity" he gives a profusion of illustrations which conclusively prove that the longer races are acquainted with a disease the less harmful it becomes. Measles, for instance, is exceedingly fatal to lower races which have never before been infected, but it has eliminated from civilized people nearly all those who cannot promptly develop antibodies to kill off the invading organisms. Only a very small percentage of the infected die of it in civilization. The same reasoning is supposed to account for the mildness of mumps, whooping-cough and chicken-pox. On the other hand, the severity of scarlet-fever and small-pox is explained on the assumption that they have been more recently evolved by differentiation from harmless organisms or from those which have taken on parasitic habits in lower animals and subsequently transferred their activities to man, such as the plague bacillus. Both gonorrhea and syphilis seem to be getting mild in civilized races, and gonorrhea is already a negligible complaint among the Japanese. Indeed, in the great majority of healthy young Europeans, too, gonorrhea is a short, self-limited disease, though in the non-resistant its ravages are terrible. Our genito-urinary specialists could give us exceedingly valuable ethnic data as to the types of men who have gonorrhea difficult to cure.

Tuberculosis also is a severe infection among savage races which have never been infected before, but it is universally present in civilized races because all who could not develop antibodies to keep it in check have been killed off. There is considerable ground for the opinion that this evolution has occurred in the short time man has been living in houses, before which, populations were too sparse for the infection to be carried from person to person, and the outdoor life would have cured them if the bacillus were present. The organism probably developed in cattle first, and thence gave rise to the human form. It became a scourge only after populations became dense and lived in overcrowded



houses, and the mortality culminated with the dreadfully unsanitary conditions existing when the modern industrial era began in the eighteenth century, since when the slaughter of the most susceptible has so cleaned up the race that the annual mortality has been reduced to less than two per 1,000 in northern Europe. It still causes one death in every seven to ten according to locality, but as nearly every one shows post-mortem signs of having overcome a temporary activation of his lesions, we can assert that in about 80 or 90 per cent. of civilized humanity the infection is harmless. Moreover, these cures take place without special treatment, which never occurs with negroes and American Indians, in whom it is said to be invariably fatal, unless given special sanitarium treatment.

There is a suspicion that we gradually evolve an immunity against whooping-cough in the same way as we do that against tuberculosis, by the frequent inhalation of small numbers of attenuated bacilli, which gradually produce enough antibodies to render us immune. That is probably why the disease is so fatal to the young, the mortality being 25 per cent. in those less than a year old, and very fatal in the early months of life. The mortality quickly diminishes with age and in time we are wholly immune though we may lose that immunity, as in the case of tuberculosis. The varying mortality from whooping-cough from race to race is probably due to the different periods during which they have had contact with the disease.

*Reid* thinks that alcohol, like the infections, eliminates the susceptible, so that the longer a race is acquainted with it, the less drunkenness they have. He mentions the ancient orgies of the Greeks and Romans, but this may have been a racial elimination of those unfit for the climate. Besides, the northmen now said to be so susceptible have known of mead as long as the Mediterraneans have known wine. In the case of distilled liquors, it seems to be true, that we must acquire a racial immunity through the destruction of those who cannot stand alcohol in this form. Races newly acquainted with it seem to be the greatest sufferers.



Tropical races have evolved a tolerant immunity to malaria, and will harbor the germs for years without signs of harm until their resistance is broken down by an extra infection. Malays, for instance, when attacked by dengue, may develop a fatal malaria almost at once, thus giving rise to the idea that dengue is sometimes of a fatal fulminant form. Malay troops have shown by blood tests that 20 to 50 per cent. harbored the parasites of malaria. In certain African districts practically all the natives had the organisms. After a fatiguing campaign it was quite common for Malay soldiers to develop malaria, though they had encountered no mosquitoes. These facts show why it is that one who migrates from a non-malarious country may promptly die of malaria, contracted from apparently healthy tropical natives. *Sir Ronald Ross* thinks that this is the way the blond Homeric Greeks were exterminated, and the more immune brunet autochthones survived, but if so they would have disappeared sooner than they did.

All wild animals are fairly alive with parasites or commensal organism. Similarly the lower races of man are swarming with all kinds of animal and vegetable parasites, largely intestinal. We have no reason to doubt that such conditions have existed since prehistory and that more or less tolerant immunity has resulted. Although some of these, such as the hookworm and filaria, do much harm, the immense majority of the infected persons are fairly efficient and harbor the parasites through a long life. But if a non-immune migrant comes from a territory where one of these parasites does not flourish, he may promptly die if infected.

In the case of leprosy, the process of establishing a tolerant immunity seems well under way in endemic territory, for the disease is of slow growth and many spontaneously recover. Yet there are such slight differences between these and the races which have not had recent contact with the disease as to raise doubt. Certainly the bacillus has lost virulence if it ever had any, and man must have been acquainted with it a very long time. It really may have been



more virulent in Biblical times and it is slower in tropical natives than Europeans.

The literature of demography and epidemiology contains an enormous number of facts, which merely show the local prevalence or geographical distribution of diseases. Little or none of this material can be used to show that any diseases have succeeded in causing racial immunity other than the few we have mentioned. For instance, we know of no race immune to the plague bacillus, which seems to have been a more or less normal inhabitant of certain Central Asian rodents, and only rarely makes excursions throughout the world, never remaining long enough to create an immune race. Similarly yellow fever has never succeeded in creating even a tolerant immunity in any race. The suggestion is now made that it is normal to certain monkeys, and occasionally escapes to man by way of the *stegomia* mosquito to start an excursion wherever that insect exists.<sup>37</sup> *Sir Patrick Manson* long ago suggested that such a natural reservoir for the organism would eventually be found in a lower animal. Hence we cannot establish an immunity to it.

Whenever man learns how to avoid an infection he immediately stops the evolution of immunity. We were undoubtedly in the process of evolving a resistance to small-pox, in the same way that cattle had done before us. But this process of killing the most susceptible, is too expensive in human life and we have substituted the modified small-pox or cow-pox which kills no one. Hence we will never evolve an immunity to small-pox in the way we have become nearly immune to measles. Modern sanitation also is freeing us of all kinds of pathogenic organisms, so that we do not even acquire the individual immunity which the lower races seem able to develop. Hence clean people are as susceptible to certain pus organisms as savages are to measles. Conditions of filth in which lower races seem to thrive are quickly fatal to those who have been reared in cleanliness. If these filth immunes migrate here, we must force them to live in a way which will not harm us.

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<sup>37</sup> Balfour, *Lancet*, April 25, 1914.



The following table of the admission rates per 1,000 soldiers of the American army shows that the greater the lack of adjustment to a climate, the greater the morbidity.

## ADMISSION RATE PER 1,000.

	Disease only
Whites in Philippines, 1909 .....	1,159
Negroes in Philippines, 1909 .....	1,127
Whites in Philippines, 1910 .....	1,048
Whites in United States, 1910 .....	866
Whites in Hawaii, 1909 .....	839
Filipinos in Philippines, 1900 .....	747
Whites in Hawaii, 1910 .....	729
Negroes in United States, 1910 .....	623
Whites in Alaska, 1910 .....	320
Whites in Alaska, 1909 .....	281

Health Commissioner *Darlington* some years ago stated that the unsuitable climate of New York City kept the death-rate higher than in Europe where the city populations were more nearly adjusted by selection. American sanitarians may never reach foreign standards until centuries of survival of the fittest have left an appropriate type in each locality as in Europe. With our present mobility of population this is not possible.

The eugenic movement concerns itself almost entirely with mental traits, wholly disregarding adaptation to environment. Medical ethnology shows the absurdity of developing a race of intellectual giants, if they are to die out through physical unfitness to the environment. In the case of migrants it is even more absurd, as the decay of our intellectual families proves. Nor can we tell what physique will be best in the future even if we could create any desired physique by proper matings. The types fit for colonial farm life are slaughtered in the cities of to-day, and are hard pressed in the suburbs. No one knows what our life will be two hundred years hence, but we can be reasonably sure that some types apparently fit for survival now, will be at a great



disadvantage in the dense populations of the future with the intricate mechanisms which science is creating to bring in food and carry away excreta. The Spartans proved the futility of developing a type fit for soldiers. They destroyed all feeble infants with the idea of creating a hardy race, but they all died out at the same time as the other Greeks who gave no thought to eugenics. Indeed the whole eugenic movement is unscientific, except that part which seeks to prevent the propagation of defectives. We know that certain defects are transmissible and the welfare of society demands that such parasitic people be barred from procreation. But the creation of new types cannot be accomplished by anything short of excluding the vast majority of the race from having posterity, and it is well we cannot do this. We might create a type which would promptly die of unfitness to the climate. Besides, if we could create people fit for New England, they could not populate Arizona. The types carrying on advancing civilization and creating modern cities, are unable to live among the dense populations they create. In describing the brunetness of cities we have mentioned the diseases which seem to be extinguishing the blonds who are mostly the designers of cities and their mechanical equipments for sanitation.

This is probably the best place to refer to the fact that the amazing reduction of the death-rate among Europeans in the tropics is partly due to the avoidance of infections and partly to more accurate prognosis which has led to the universal practice of sending away those who cannot recover except in a cool dark climate. If they die after being sent away, their deaths do not figure in the tropical returns. In the southern part of the United States, modern sanitation has so greatly reduced the death-rate that insurance companies are removing the restrictions on policy-holders residing there. Formerly the rates were prohibitive for those living within 30° of the equator. Nevertheless, in spite of sanitation, the neurasthenic states persist in developing. Those who periodically leave for vacations in the north, only postpone the inevitable.



## CHAPTER XIX

### ETHNIC PSYCHOLOGY

By means of the intelligence evolved for survival, man began to build up a civilization which was based on the co-operation of his fellows, so that more could survive than by individual efforts. This completely changed the character of the struggle for existence. Survival now depended upon the possession of ability to do some one special thing, and men bartered off their services or products for necessities made by some one else more gifted in those lines. Society arose as an orchestration of specialists, each doing some good to the organism in return for other favors upon which life itself depended. Industry has now become so diversified that survival is possible for every one, even though possessed of only sufficient intelligence to do one thing well,—say polishing shoes. That is, civilization has replaced the evolution of larger brains by the evolution of specialized variations. Ancient skulls in any one place at any one period look as though they were made in the same mould, but modern skulls vary enormously, the higher the civilization the greater the variations. Primitive races were kept uniform because all men in one locality had to be able to do the same things or die. Small variations perished which are now preserved with the large. The average size of modern skulls is therefore less than many a paleolithic savage. *Broca* found stone age skulls to average 1606 cu. cm. for men and 1581 for women, but skulls of the eleventh and twelfth centuries were 1426 and eighteenth were 1462. Prehistoric Europeans were therefore very intelligent.

It is generally assumed that as northern Europe was not possessed of writing in pre-Roman times, it was in a low state of civilization. As a matter of fact a very high culture existed for several thousand years prior to the Christian era. Trade brought in wares from the Mediterranean basin and



Asia. After the Aryans began to spread over it, the culture was still higher, and the mortuary remains recently unearthed show that the blond Celtic rulers of Britain lived in real luxury at the very time the blond Greek Aryans had died out. The north always lagged behind the south for reasons already mentioned.

*Dettweiler* stated in the *Journal of Heredity* of November, 1914, that European culture is indigenous, and that its beginnings date back to the remote paleolithic period. Agriculture existed fully fifty thousand years ago with a relatively high degree of culture, and the art was well developed by the time of the primitive Aryans, who were said to be a settled population with a considerable civilization fully ten thousand years ago. This culture existed, of course, among the ancestors of the Aryans, before the evolution of blondness. Their migrations began later in the middle or perhaps early part of the neolithic, which in this northern country was comparatively recent.

*Angelo Mosso* has shown in "The Dawn of Mediterranean Civilization," that a high culture existed there also fully seven thousand years ago, even before the immigration of the Alpine type from Asia, and that it was built up by the primitive long-headed people who existed all over Europe, which he and *Sergi* call the Mediterranean race. In north Africa and southern Europe it had no Asiatic traits whatever. In Crete, as elsewhere, one civilization was literally built upon the ruins of a prior one, and the excavations show an increasing primitiveness as we go down layer by layer. What is far more interesting are the statements made by *Mosso* and many others that a written language with a real alphabet, not mere pictographs, existed several thousand years ago, and was the basis of the Phœnician. Indeed a dozen of the letters are definitely traced by *Piette* and others.<sup>1</sup>

It required a long time for the first pictograph to develop into a real letter or symbol of a sound, but the process

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<sup>1</sup> George Grant MacCurdy, *Recent Discoveries Bearing on the Antiquity of Man in Europe*.



is evident and the symbols were used throughout Europe. The Phœnicians developed them far more and when the blond type of man came down from the north, it took him only a few centuries, perhaps a few decades, to develop the Phœnician forms into what we now use. East of the Mediterranean, they were developed into semitic alphabets which spread eastward through southern Asia.

The big brained paleolithic northman accomplished other wonders in the way of domesticating plants and animals, inventing textiles and pottery, all of which characterize his next or neolithic stage, during which, in turn, man took the first steps in metallurgy. We have improved on all these processes, but their bases are practically the same as worked out by our remote ancestors.

It is doubtful whether modern man could duplicate the achievements of paleolithic Europeans. In spite of the density of population which increases with civilization, there are not very many more big brains than in the sparse population of those early times. Of course the variations are bigger than ever, but they are not numerous. A community of farmers would take just as long or longer to discover iron smelting as primitive man required.

Variations in brain weight seems to be a great factor in determining a modern man's employments, and must have done so in ancient times too. For instance, *Dr. H. Matiegka* of the Bohemian Institute of Pathological Anatomy, reports the following:<sup>2</sup>

		Average Brain-weight.
Group	I. Day-laborers .....	1,410.0
"	II. Laborers .....	1,433.5
"	III. Porters, watchmen, etc. ....	1,435.7
"	IV. Mechanics, trades-workers, etc. ....	1,449.6
"	V. Business-men, teachers, clerks, professional musicians, photographers, etc. ....	1,468.5
"	VI. Men of higher mental abilities, presupposing a collegiate education, such as scholars, physicians, etc.....	1,500.0

<sup>2</sup> Ueber das Hirngewicht, die Schädelkapazität und die Kopfform, sowie deren Beziehungen zur psychischen Thätigkeit des Menschen, *Sitzb. d. kön böhm. Ges. d. Wiss.*, II. Classe, Article XX, 1902.



Of course we can educate a fool or neglect a genius, and that is why *Gustave le Bon* says:<sup>3</sup> "Culture merely implies the possession of a certain amount of memory, but to acquire it no judgment, reflection, initiative, or invention are necessary. Persons of very restricted intelligence are often met with among those who have passed examinations, while it is quite as common to find persons of a very slight degree of culture who are highly intelligent. . . . All the professions contain a very small number of notable intelligences. Still it appears probable, in virtue of the laws of heredity, that what are known as the superior classes contain the greater number, and it is doubtless therein that their superiority lies. Saint-Simon said, that if France were to lose its 50 leading men of science, 50 leading artists, 50 leading manufacturers and 50 leading agriculturists, it would be decapitated; but if all its officials were lost, it would sustain very little harm." That is, the higher variations are a very small proportion of a modern population. Few men ever think; they merely repeat and copy. The preservation of low variations has caused this state of affairs.

*Havelock Ellis*<sup>4</sup> showed that men of great intelligence generally arise from families already noted for ability; that is, the "old families" and "good families" constituting the aristocracy. Rarely does a genius come from the teeming mass of average men who have done nothing to build up British civilization. *Chas. W. Soper* (April, 1901) has shown that the same rule applies to France and Italy.

When primitive men migrated from the environment which was evolving large brains, and came to less rigorous southern climates where food grew the year round and forethought was not so essential for survival, there was a check to the evolution of larger brains. A new grade of intelligence was now evolved fit for that particular environment and unfit for the ancestral one. We are justified, then, in assuming that the modern small-brained lower races are descendants of very early migrants who departed from the

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<sup>3</sup> *Psychology of Peoples*.

<sup>4</sup> *Popular Science Monthly*, February, 1901.



cradle of the race before the brain had reached its greatest size. Even in these low races we see the same variations in ability as we see in the higher, but the average size of the brain increases from the equator to the northwestern corner of Europe. *Dr. Joseph Simms* concluded<sup>5</sup> that the colder and more forbidding and unfriendly the country the larger the average brains of the natives—Lapps, 102 cubic inches; Swedes, 100; Anglo-Saxons, 96; Finns, 95; Anglo-Americans, 94; Germans, 92; Celts, 88; Malays(?), 86; Chinese, 85; Tombs of Gizeh, 84; Embalmed Semitic, 82; Egyptians, 80; Fellah, 79; Bengalese, 78. Hottentots are said to average 75; negroes, 61 to 69; and Malays may be as low as 57. The pithecanthropus is 45 and the highest ape 34½.

There is much overlapping, of course, but the higher races have more variations of all kinds.<sup>6</sup> This is also shown in some remarkable statistics of Germans and Japanese, collected by *Taguchi*, of the University of Tokio, and published by *Spitzka*.<sup>7</sup> The lower the race the less are the variations, as a rule.

The size of the brain varies with the size of the body, the smallest races having the smallest brains.<sup>8</sup> *L. Manuvrier* found that the size of the body modified the brain so greatly that Patagonians, Polynesians and Indians had larger variations and average than modern Parisians. *Groll* and *Rudolph Wagner* found the eminent men had more richly convoluted brains, and *Edward A. Spitzka* showed that great intelligence was also dependent upon an increase of the white tissue which connects up the various parts of the brain to better cooperation.

Other factors being equal, intelligence depends upon the size of the brain. The apparent exceptions to this rule are men who have been noted for some specialized ability in a limited sphere, and we could scarcely call them great

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<sup>5</sup> *Popular Science Monthly*, December, 1898.

<sup>6</sup> Woodworth, *Science*, February 4, 1910.

<sup>7</sup> *Science*, September 18, 1903.

<sup>8</sup> *Revue Scientifique*, June 3, 1882.



in general intelligence. Indeed, outside of their very limited fields, such men are notoriously stupid and lacking in judgment. By the inclusion of these small-brained specialists, *Karl Pearson* concluded<sup>9</sup> that there was no relation between ability and size or shape of the skull. *Raymond Pearl*<sup>10</sup> also studied the matter, and agrees with Pearson. Nevertheless, it is safe to say that on the whole a race's intelligence is proportional to its average brain weight, and we do know that the civilization a type builds up of its own initiative is proportional to its intelligence. Negroes could never have evolved the civilization of Greece, and wherever they have had a civilization left in their charge, it has decayed, as in Hayti.

Conversely, all old and modern civilizations in lands of lower races have been built up by brainier invaders from the north, who have died out in time through climatic unfitness, and left their culture to decay in the hands of the survivors of the conquered races, as in Egypt, India, Persia, Mesopotamia, Greece and Rome. For instance, the Hittites were represented with upturned shoes, which is explained as a survival of a snow-shoe worn in their former snow-clad mountain home north of Syria or in the Iranian uplands. As they are figured with fingerless gloves, we can rest assured they came from a cold country which caused their more rapid evolution of brain. The Greeks are said to owe their start to the civilization of the Hittites. The Akkads, also, were northern Turanian mountaineers, who attained a high development in the Euphrates valley about 5000 to 6000 B.C. "In their previous homes, before they reached the Euphrates valley," they "must have passed through a long process of primitive civilization, so as to become much more humanized and cultured than the nomadic tribes of Arabia and Syria." Semitic types drifted in later, and became a part of Babylonian populations by 4000 B.C.

All works on the Aryan, particularly *Jhering's* "The Evolution of the Aryan," contain a wealth of data showing that the race arose in a cold northern country, and that after

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<sup>9</sup> *Nature*, April 10, 1902.

<sup>10</sup> *Journal of Comparative Neurology and Psychology*, Nov. 3, 1906.



their migration many customs lost practical use, but were continued as religious ceremonies or games or mere custom. The vestal virgins, for instance, are explained as the survival of the habit of having a few unmarried women to keep up the fire, the men being too busy in the chase and the mothers being occupied with the children. That is, the blue-eyed type which has developed the most brain has evidently been under selection in the north the longest. They built up ancient civilizations after migration and the type is now carrying culture forward.

Illiteracy, for instance, is not necessarily due to lack of opportunity to learn, as in our colonial days, when we were struggling for life. It is due to national or racial lack of intelligence. The more blue-eyed northern types there are in a nation, the more schools are provided for its children and the more care taken to teach them how to survive. Low races are too stupid to learn unless forced to it by higher ones in control of them. This is shown in the illiteracy among immigrants over fourteen years of age.<sup>11</sup> That is, illiteracy diminishes as the size of brain increases.

Norwegian, Dane, Swede .....	0.2
Scotch .....	0.5
English .....	0.7
Irish .....	1
Bohemian .....	2
Dutch and Flemish .....	2
German .....	3
Italian (north) .....	6
French .....	7
Magyar .....	11
Spanish .....	16
Slovak .....	21
Greek .....	22
Armenian .....	23
Jew .....	24
Pole, Russian, Ruthenian .....	37
Italian (south) .....	49

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<sup>11</sup> Report of the Commissioner of Immigration, 1911.



*Buckle*, in his wonderful "History of Civilization in England," shows by a profusion of data that Spain owes every modern advance to immigrants from the north, often imported under contract for the purpose of building up an army, navy, industries or schools. *Schmidt*, in a remarkable book called "Race of Mongrel," shows that all of Italy's medieval and modern renaissance has been due to northern blood, which he called Teutonic or Germanic. In art, war, statesmanship, theology, science and commerce, the great leaders have been descendants of northmen to a very large extent. Pope Pius X was a blue-eyed Baltic type. In every part of the tropical world we see the same phenomenon of a high civilization introduced and held up by men from northwestern Europe.

Practically all great ideas and mechanical inventions come from northwestern Europeans or from descendants of such types who have recently emigrated. *Finlay*, the Cuban discoverer of the way yellow fever is carried, was really Scotch, and *Marconi*, though an Italian, had a Scotch mother. Races evolved within 40° or 45° of the equator have rarely added anything to the advancement of modern civilization, though they did in pre-Aryan days.

The Nobel prizes are largely awarded to men in or from the blond corner of Europe. Up to 1912 they were as follows: Germany, 15; France, 10; England, 7; Holland, Russia, Italy and Switzerland, each 4; Sweden, 3; Denmark, Spain and the United States, each 2. Of those in the United States, Michelson is German and Carrel is French. It would be interesting to know how much the blue-eyed type predominates.

In France there is an increase of intellectuals in the northern or blond area; in fact, it seems a rule the world over that the blond areas of a country have the most men of talent. In Great Britain it seems that the number of contributions to civilization per million population increases with the blondness. Scotland, though largely blond, followed the rule in its backwardness, but as soon as organization stopped internal strife, a flood of ideas poured out.



*Buckle* mentions this growth in great detail. *Buchanan* first described the theory of government, *Napier* revolutionized mathematics, *Adam Smith* founded economics in his "Wealth of Nations." At the present time the Scotch seem to be controlling the destinies of the British Empire. All this is curiously like the history of the Homeric Greek culture which so suddenly flared up when these migrants found leisure and a foundation of a prior culture to work on. In the case of the Scotch, the culture was brought in. Perhaps the blond race mentioned by *J. Macmillan Brown*<sup>12</sup> as existing in ancient Mexico and Peru may have had something to do with creating those high cultures.

In discussing the spread of the Aryans we have shown how they became the rulers and leaders of more brunet populations, and formed the aristocracy. This intellectual leadership still exists. In a popular and picturesque article,<sup>13</sup> *E. T. Brewster* correctly says: "In fact, it appears to be a general social law throughout western Europe, and probably in America as well, that in any single nation the more prosperous communities have the lighter average color. The richer half of Great Britain is the western side and the region around Liverpool; here also is the lighter-colored hair. The Highlands of Scotland and Wales are notoriously both dark and poor. Leinster is the most thickly settled of the provinces of Ireland, and there is the most "Anglo-Saxon" blood. Northern France, northern Germany, and northern Italy have each in turn the larger proportion of blue-eyed inhabitants and the greatest and most famous cities. Even as between Sardinia and Corsica, the island with the more inhabitants to the square mile has them also of the lighter complexion. The royal families of western Europe, "the nobility and gentry" of England, run to six-foot blonds. Everywhere it has gone, this vigorous race has taken the best—or made it. Indeed, certain anthropologists have laid it down as a fundamental law of sociology throughout Europe,

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<sup>12</sup> *Journal of Race Development*, 1910.

<sup>13</sup> *Designer*, February, 1911.



that of two communities otherwise alike, whichever pays the larger taxes, or owns the more automobiles, or contains the larger number of citizens with names in the biographical dictionaries, or the larger proportion of men who do not follow their fathers' trades, or who have married wives from outside their own towns, or who have in any way exhibited special enterprise or ability—this community has also less black pigment in its hair and eyes. The public still insists that the villain of the melodrama shall wear a black mustache. The caitiff knight of romance and the wicked dwarf, and the fiend are swarthy. Avenging valor is a Gibsonesque blond. Throughout our literature dark skin and low stature spell wickedness."

*John Munro*, the English anthropologist, found that British men of talent belong mainly to the blond type. The extremely blond or xanthous does not produce many, but, perhaps, in proportion to their numbers, they are as numerous as among the less blond. *Lombroso* said that the darkest Mediterranean type in Sardinia and Calabria produces few men of genius.

*Havelock Ellis* investigated the complexions of famous people of England,<sup>14</sup> judging the amount of pigment from the eye colors in the National Portrait Gallery. The blond type was the one on which England's fame rests in great part. "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 toward fairness, but by later Tudor times there was a tendency toward 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 trend to brunetness in these families, probably from the tendency of the blond men to marry brunet women.

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

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<sup>14</sup> *Monthly Review*.



each group by the number of brunets. 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.

*Ellis* might have gone a step farther and pointed out the fact that the submissiveness to authority so characteristic of the dark races 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* said:<sup>15</sup> "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

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<sup>15</sup> *The Hibbert Journal*, London and Oxford.



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 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 brunet medieval Bohemian peasant probably cared as little about the matter as he does to-day. It does not mean that all blonds are Protestants or all brunets Catholics, but the preponderance is in that direction, as a rule, to which the blond Flemish of the lowlands are notable exceptions.

*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.

The climate of the United States being suitable for the brunet types of Europe, who are the people for and by whom Catholicism was evolved, these men are flocking here a million or more annually, and flourishing in vastly greater numbers than the Aryan. This explains why it is that the Roman Church, which in 1790 had but 44,500 communicants in the United States, had over 12,000,000 in 1904, an increase of about 270 fold, while the Protestants in-



creased 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 brunetness of its communicants, but it is merely a result of the fact that our country is better suited to people from Catholic Europe than it is to the original settlers.

*Gustave Michaud* showed that in America the blondest areas produce the most men of genius per 100,000 births.<sup>16</sup> *Dr. F. A. Woods*, of the Massachusetts Institute of Technology,<sup>17</sup> has studied the names in "Who's Who in America," and finds that they are nearly all from northwest Europe, the English and Scotch being "distinctly in possession of the leading positions, at least from the standpoint of being widely known." In proportion to numbers, an "Anglo-Saxon" is from three to ten times more likely to achieve a position of national distinction. In New York City, nineteen English names appear 168 times, eight Scotch names fifty-seven times, fifteen Irish thirty-seven times, and eight German or Jewish eleven times. The stocks coming in since 1830 are distinctly inferior, and getting worse and worse. The exceptions among them are written up in magazine articles because they are unusual. It seems also that the greater the numbers of immigrants of any race the fewer are those who become noted for achievement. The English arrivals since 1607 are counted in hundreds of thousands, the rest in millions. Moreover, *Woods* thinks that present-day leaders are largely from the colonial stock of New England, which Benjamin Franklin estimated to be derived from less than 22,000 immigrants. The millions coming from the south and east of Europe have not added anything indispensable to our civilization.

Mere accumulation of wealth does not necessarily indicate

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<sup>16</sup> *Century Magazine*, 1904.

<sup>17</sup> *Popular Science Monthly*, 1914.



intellectual greatness, and few are noted in "Who's Who" merely because they became rich. Nevertheless, it is to be noted that the great fortunes in America have been founded by northern types, either foreigners like Carnegie and the first Astor and Drexel, or not far removed from the old country like Rockefeller, Harriman and Vanderbilt. It is not a paradox, by the way, that though the colonial stock still furnishes our prominent men, the families of the political leaders of the revolution are not related to those of the leaders now.

In spite of our enormous brown-eyed population, it is amazing how few of them are among the intellectual leaders or creators, and how greatly they figure among artists and artisans—the copyists. The creative artists or great masters, be it in painting, oratory, histrionics, or what not, include a large number of northern types, no matter whether they were born in Italy, the Netherlands or Scotland. Indeed, from a study of portraits in the Louvre in Paris, and the National Art Gallery of London, I gained an impression that the northern type predominated among creators, the southern among imitators. Among biographies of great men like John Hunter, it is the commonest thing to see mention of light or blue eyes, and light hair. Indeed, *Charles Kassel*<sup>18</sup> has found that genius is generally associated with tall stature and blue or gray eyes, though the hair is generally brown and rarely yellow or red. No brown-eyed man has ever attained the presidency of the United States. Only one, and he one of our poorest,<sup>19</sup> had dark eyes, and they were gray. The others had light blue or light gray eyes. Only one bishop of the Methodist Church South had brown eyes, and he was the least forceful of them all. It is no mere coincidence that the blond mountaineers of Kentucky, Tennessee and West Virginia should have sided with the North in 1861. There was a racial factor at work.

The professional soldiers in the armies and navies of

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<sup>18</sup> *Popular Science Monthly*, September, 1912.

<sup>19</sup> Franklin Pierce.



Europe and America are appreciably blonder than their respective civil populations, particularly among the officers. To a certain extent this is due to the fact that the blond cannot adjust himself to confining industrial vocations. He must be in the open. Another factor is the larger physique of the northmen, which now, as in Roman times, sends them into the army. It also sends them into the police ranks, just as a poor physique sends men into tailoring and shoemaking. There is another factor, nevertheless, and that is the intellectual one, which makes leaders and rulers of these contentious northmen. Even in our Southern army in the Civil War, the officers were distinctly blonder than the soldiers, though as a whole each class was more brunet than in the Northern. The royal and noble families of Europe are descended from the ancient or medieval blond fighters from the north. At the present time not a single reigning family belongs to the nation over which it is the executive head. The Hapsburgs and Hohenzollerns are Swiss. The royal families of Great Britain, Denmark, Greece and Albania are German; Belgium, Saxon; Spain, Bourbon; and Italy's royal house is from Savoy. They are largely of northern types. The Sultan of Turkey has pale blue eyes and yellow beard. It is said, though the authorities are not mentioned, that Alexander, Cæsar and Napoleon had blue or gray eyes.

Most of Poland's great leaders, such as Kosciusko, have been blonds. Louis Kossuth, the Hungarian patriot, was blue-eyed, his father being a lawyer of "noble lineage and patriotic antecedents." *Ripley* mentions several who have noted the general tendency to blondness and tallness of all the military classes of Russia and Poland. The successful soldiers and diplomats in the Afro-Italian colonies were from the north of Italy. There is a large percentage of very blond officers in both the German and French armies. Joffre has blue eyes. For thousands of years the fighting descendants of northmen have been welding the inhabitants of Europe into independent nations, which have always been fiercely battling for expansion at the expense of neighbors.



Their wars have changed political boundaries, but have left no permanent change in the ethnic composition of a people except when intruders have moved along parallels of latitude.

The nations of Europe are ethnically the same, and in each the Baltic type is on top. Those having the most of this type of man are the first class powers of Great Britain, France, Germany and Russia. Scandinavia and the low countries are too small in area, but their natives are constantly migrating into the big nations, restocking them with blonds as in pre-history. The northwest may be considered the breeding ground for world rulers. The present war is only repeating history, but it seems to be making new history by ending migration in military masses. Hereafter, if a Baltic man wants to migrate into France or Great Britain, he must do so individually. It seems that there are more Aryans among the allied British, French and Russians than in the Austrian and German Empires combined.

Every little while the exodus of migrants from northwest Europe raises apprehension as to draining the homeland of their men of brains, but the worry is baseless. The birth-rate is big enough to supply as many more as the world needs. In former centuries these men killed themselves off in civil wars at home; now they die out after migration. The supply is endless.

In all the elements which are indicative of civilization, the northwestern corner of Europe and lands peopled by migrants from that spot, take the leadership. That is, railroads per square mile, percentage of population in school, percentage able to read and write, per capita mail delivered, per capita commerce and wealth are greatest in the northwestern corner of Europe, northeastern corner of the United States, and the southern extremities of South America, Africa and Australia.

In the work "Expansion of Races" it is shown that by reason of the large number of brain variations of great size which occur in the populations of northwest Europe, that part of the world is controlling much of the rest and is destined to control all. The ownership of much of the ma-



terial wealth of the world is already concentrated there. The foreign investments of the British and French are counted in so many billions as to be beyond our conception. Great financial transactions cannot be consummated without consulting Paris and London. By reason of greater ability, these peoples are also able to make products with which to purchase subsistence. They stay at home and import food, instead of emigrating in search of it like their ancestors. The density of the English population is now so great that most of the food is imported, some of it from the opposite side of the world. To insure the safety of these importations, the farms supplying the food and the ships carrying it must be protected and placed under the control of the nations most interested. Hence it naturally follows that the world is falling piecemeal into the political control of northwest Europe, or of peoples from there, and the English language is displacing all the others not only because it is the most highly evolved, but also because it is the tongue of the predominant empire. The more primitive German tongue and alphabet cannot compete successfully.

All of Africa is owned or controlled by European nations. In recent years the French absorbed Morocco, Italy has taken over Tripoli, and the British are preparing to incorporate Egypt into their empire. Southeastern Asia is a province of northwest Europe. Persia is now ruled from London and Petrograd. The Mexicans are learning that they must not behave in a manner obnoxious to the United States, which is really controlling the destinies of the people across its southern border. In southern Europe the same phenomenon is going on. The Balkan States have found to their sorrow that they are ultimately under northern control, though they themselves have all expanded southward at the expense of the Turk. Greece has been under northern control ever since a Dane was made its king. A temporary setback has not changed the fixed policy of Russia to expand at the expense of China and possibly Korea. Austria has been welded into a rather loosely connected empire by its Baltic types, but unfortunately it is too far south for them



to survive and it already shows signs of dissolution—repeating the history of Greece and Rome. Its heterogeneous Asiatic types, who call themselves Slavs because they speak a Slavic tongue, have not the genius for organization. We are therefore safe in predicting the southern expansion of the German Empire rather than to the east and west. Austria itself looks to the south. It took Bosnia and Herzegovina, made an effort to get Serbia, and always coveted northern Italy. Indeed, the constant southern drift of humanity in Europe, so well described by *Ripley*, constantly carries men into lands of less intelligent but more brunet people where the blondest decay and disappear.

There is no basis for the fear that the lower races, by reason of their low standard of living and low wages, will displace the factories of northwestern Europe. The unintelligent workman is always overpaid for the amount he accomplishes. It is said that for this reason it costs 35 per cent. more to build a ship in Japan than in Scotland. The Japanese are finding themselves unable to keep up railroads, telephones and telegraphs to the level of European standards, and the same can be said of all races which have absorbed a civilization higher than the one built up by their own intelligence. The manufactures of northwestern Europeans with which they buy food will increase rather than diminish, for the imitators will always be behind the times sufficiently to fail in competition with better goods. That enormous trade which is constantly increasing the density of populations of northwestern Europe and its wealth therefore increases steadily. Each nation involved is expanding more and more. German trade is attracting most attention, but it cannot kill off the British. The French are storing up wealth at such a rate that they might be called the capitalists of the continent, averaging about \$1,500 per capita, but the British seem to lead in foreign investments.

Moral and ethical codes are dependent upon racial intelligence. Survival is possible in lower cultures only by reason of self-defensive acts which are decidedly injurious to public welfare in the higher where the community protects



us. Egypt, ancient or modern, was never orderly and prosperous unless under northern control. When the French withdrew there was anarchy until the British took up the burden and suppressed crime with a firm hand. After Lord Cromer's withdrawal the natives were given a larger share of their own government. Crime at once began to increase, and in 1914 caused considerable uneasiness. British law has pacified the greater part of the earth's surface which had always been drenched with blood. The disturbances in tropical America can be settled only by northern control.

The medical lesson of ethnic psychology is clear. In every country the death-rate increases with poverty, because the poor are unable to obtain the necessities of existence, and they lose resistance to infections. One of the causes of poverty is the inefficiency resulting from the lack of vigor induced by an unfit environment, as previously explained. There is still another factor which has a profound influence in causing disease and death—lack of sufficient intelligence. This is usually an individual matter, for there are all grades of intelligence in every race. In a mixed population it is to a great extent an ethnic phenomenon, and races with the smallest brains and least intelligence must have the highest morbidity and mortality rates, as shown by the negroes in America. Smallpox alone would kill them all in a few generations, were it not for the vaccination which a white government forces upon them. Few negroes have intelligence enough to seek vaccination voluntarily. Their habitations are generally the worst in every city, and cause untold trouble to sanitary authorities. They have sense enough to survive in a wild African environment, but must be kept alive in civilization.

Modern sanitation which permits people to live safely in dense masses is largely, if not entirely, a product of scientific ideas evolved by the big brains of northwestern Europe. The following table of death-rates of various European countries, copied from our census mortality statistics (1907) shows this fact. As a rule, the higher the per cent. of blue-eyed people in a country the lower the death-rate, and the



lower must be the birth-rate unless the surplus is starved, forced out or killed in war.

Norway .....	14.5	Finland .....	18.6
Denmark .....	14.8	France .....	19.6
Sweden .....	15.5	Prussia .....	19.6
Netherlands .....	16.0	Italy .....	21.9
England .....	16.0	Servia .....	22.4
Scotland .....	16.9	Bulgaria .....	22.7
Belgium .....	17.0	Roumania .....	25.5
Ireland .....	17.6	Spain .....	26.1
Switzerland .....	17.7		

These facts now show why certain diseases endemic to territories inhabited by lower races, are being exterminated. The natives do not have sufficient intelligence and the work must be done by types evolved in northern Europe. Cuba is no longer a constant menace to the lives of American citizens. If it allows plague to threaten us, another intervention will be necessary. In time the whole country south of us and the northern parts of South America must be cleaned up for our own salvation. Northmen rendered it possible to build the Panama Canal, eliminated malaria from Suez, and small-pox from Porto Rico. They are slowly but surely conquering malaria, plague, cholera, yellow fever and every other disease which formally devastated the world. These men are doing all this because they have at last obtained control of enough of the world to force sanitation upon the natives whose ignorance has been keeping certain diseases in existence. To abandon the Filipinos would sentence them to death by epidemics they are unable to control, and no one dreams of doing it. The healthy southern parts of South America are under the control of migrants from northern Europe, but the rest of that continent is sickly because its rulers are from southern Europe. Medical ethnology then proves that the safety of the world depends upon control by the types of northwest Europe, headed by Great Britain.

It is quite natural that in the present war in Europe, the



nations should group themselves the way they have. It is merely a continuation of the old struggle between Slav, Teuton and Celt, for the control of more of the world, which has been going on ever since the first Aryans moved out of Arya, the only difference being the fact that Teutons have percolated into all three sections in historic times and are now on top in each. Each group by reason of its great birth-rate is in distress for food and must expand. The western group control the sea and probably always will. The only result possible is the redistribution of the parts of the world controlled by each group. It is perhaps the necessary step toward the amalgamation of all three groups into one organism to control the whole world to the immense benefit of mankind. Should this be the ultimate result, the loss of life will be a small price to pay. The number killed is a very small percentage of the population anyhow, and the gaps in the population will be quickly filled because the birth-rate always increases after a war. These organized murders, in the long run, have no effect whatever on density of population. It is to be noted that there is scarcely a soldier in the ranks who knows what the war is all about, and it is doubtful if many of the officers and statesmen see in it anything except an effort to increase the power of their own nation. All assert that they are fighting for national preservation, yet each is obeying natural law. The political and military features do not concern this biological discussion of the result of Aryan migrations, but it might be remarked that the union of nations has gone to a point where one cannot declare war without involving all the rest. A nation is really forbidden to go to war without consulting the others. The united nations of the world is already in sight.



## CHAPTER XX

### PRACTICAL APPLICATIONS OF MEDICAL ETHNOLOGY

The practical side of medical ethnology is self-evident, for it not only explains the "racial" differences in morbidity and mortality, particularly in America where many types are so far out of adjustment that they cannot possibly survive permanently, but it also gives a hint as to the proper management of individual cases. *Dr. J. S. Mackintosh*, Fellow of the Royal Anthropological Institute, and a practicing physician of London, has been the pioneer in putting the matter to practical use in treating the sick.<sup>1</sup> He is particularly identified with the discovery that the Baltic type cannot stand a damp soil or confinement of any sort. Brunets predominate in such wet places as the fens of the great clay district of the Sussex Weald in England, and the marshes west of the Zuider Zee in Holland. Perhaps there is some relation in this to the prevalence of rheumatism and catarrhs of blonds in wet districts. Treatment demands removal to dry places. *Mackintosh* also found that claustrophobia or fear of closed spaces is almost always found in blonds, and seems to be a subconscious longing for the normal open air life. Urban types have the opposite psychosis, agorophobia or dread of the open.

*Mackintosh* has traced neurasthenia in blond city children to lack of pigmentation, even in cloudy London. It is amazing that so few American physicians have noted the far greater prevalence of the condition in the cities of the New World. He shows also that factory life introduced by the industrial era is so wholly unsuited for blonds that they are being gradually replaced by brunet operatives. A dark em-

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<sup>1</sup> *School Hygiene*, 1911, *Clinical Journal*, 1911, and numerous papers in the *British Medical Journal*, 1910 to 1913, and *Journal of Eugenics*.



ployee will thrive in an apartment store or sweat shop where the conditions break down the blonds sooner or later. He says that a patient whose physical type differs widely from that which characterizes the families of many generations of local residence not infrequently suffers from general ill health which cannot be improved by anything short of a return to an environment normal to him, acclimatization being impossible.

In all works on tropical hygiene we find among the practical rules references 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 traveled into every land and sea, it was possible to become acclimated. The data already presented show that acclimatization is impossible if one goes far from his zone. "Intrusive conquest or colonization has left little or no trace," and there is no difficulty in understanding the facts presented by *Dumont*,<sup>2</sup> *de Lapouge*,<sup>3</sup> *Leclerc*, *Isaac Taylor*, *Wm. Ripley*, and others who have shown that acclimatization does not occur.

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 heatstrokes, 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.

In discussing the tuberculosis of migrants we have shown that there is no ideal climate for all cases, but that the ideal for prevention or cure in any one person is that which evolved the type as the fittest. A migrant must be injured in any

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<sup>2</sup> "Dépopulation et Civilisation."

<sup>3</sup> "La Vie et la Mort des Nations."



climate which has already killed off that type. This applies to other diseases. All climates are ideal for the types they evolved, and there is no ideal for all cases of any particular disease.

There is also no ideal residence, school or hospital for all, but there is an ideal for each and it differs from race to race. As already explained, a room light or hot enough for negroes will injure and eventually kill Europeans. Houses comfortable to brunets are intensely glaring and painful for blonds. We have taken our ideas for school rooms from the dark northwestern corner of Europe, and it is safe to say that they are all overlighted in America. The rule to have the window area equal to one-fourth to one-sixth the floor may be safe where the sky is always overcast, but it causes neurasthenia in America to all except the very swarthy.

The practical rule for every person who lives in a climate different from his ancestral one, is to try to approximate his home life as nearly as possible to that for which he is physically fitted, and avoid the adverse factors as much as the search for bread and butter permits. If he cannot dodge known harms he must expect to be injured. We do not run away from battle because we know that bullets may kill us, but we do not drag the wife and babies in with us. Men nowadays run the same risks of injury in their business of providing as their ancestors did in the chase, but the families stay in safety somewhere else.

Birds migrate north to escape harmful factors as well as to find food and a place to rear their young, and they go south only when the cold air makes it impossible to find food. Many Italians are doing the same in their yearly migrations in search of work, not only to near countries, but to America as well. It is a custom replacing the old migration in search of a home near the food supply. Something of the same custom has been instinctively followed by those Americans who go to cool places in the hot season. Many a family keeps itself in existence by these summer migrations, for the children are then raised to a more vigorous manhood, by which time they can stand adversities fatal to the immature.



Our cold winters do not seem to be harmful except to hot climate types.

The invention of bicycles and automobiles, and the movement to the suburbs are now preserving northern types which were being slaughtered in the congested cities of the last generation, and their places are being taken by types from central and southern Europe and Africa. Though we may thus lengthen the lives of the unfit, we cannot preserve the type permanently unless we are able to create an environment which does no harm whatever. If this is impossible, we may merely postpone extinction and make the process imperceptible.

The more a person differs in physique from that which we know is fit for the place of residence, the more sure we are that he is being injured by the environment. As a rule, the blonder the complexion the more necessary to keep in the shade. In regard to cold, the rule is made evident by the distribution of blond types in Europe,—the hotter a climate, the less suitable. The blond is not found where the summers are long or hot, and the tuberculous blond promptly dies if we send him to such places, but improves in the cold. As a rule, the cooler a sanatorium, the greater its success with this type.

A stocky or fat person with tuberculosis will be comfortable and improve in a cold climate which is intensely disagreeable if not actually harmful to one who is slender and thin. This alone will account for many of the strange differences in our success at any one place with patients whom we considered alike. They were equally curable, but the climate happened to be beneficial to the adapted one and injurious to the unadapted.

The great case death-rate from pneumonia in high altitudes and the immense benefit of sending the patient to the sea-level, shows that air-pressure must have an enormous influence. Consumptives frequently die of hemorrhage upon arrival in the mountains, and most do badly if they go above 2,000 feet. This accounts also for the fact that mountain types do badly in the lowlands and should be sent to high



altitudes when sick. Whether it is the coldness or low pressure or cloudiness of our mountain sanitoriums which is the beneficial factor in tuberculosis is still a moot question. Reasoning from the fact that sanitoriums at sea-level in cool cloudy northern climates are equally successful, or perhaps more so in the same class of cases as recover in our mountain resorts, we can safely say that the benefit in all who do improve is as much due to relief from the serious damage of excessive heat and light, as to any specific benefit of other factors. Perhaps the hospitals of elevated regions might avoid the necessity of sending pneumonias to lower altitudes by constructing rooms in which a sea-level air pressure could be maintained. The whole subject of the pneumatic cabinet should be reinvestigated to see if the results of increased or diminished pressure have any ethnic bearings.

Much of the discontent with physiotherapy is due to the fact that we have applied the same measures to all ethnic types. We fail with balneo-therapeutic measures in one type which are highly successful in another. Light exposures which are stimulating to the brunet will exhaust the blond to the point of collapse. The blonder the consumptive, the more likely will light cause hemorrhages.

In ventilating the sick room, the air temperature must be kept below the critical point for the race under treatment. We have mentioned *Baruch's* experience that in Americans the temperature must not be above 60° F.

In the 18th century *John Fothergill* found that "free air" was best for "putrid sore throat" (diphtheria) and *Lettsom*, of London, carried his typhus patients "out into the cold fresh air and wondered at the long neglect of this method."<sup>4</sup> Modern medical ethnology shows that while such management is best for those adjusted to the local climate—and that includes the vast majority of any European population—it will not hold with migrants in America. In the author's personal experience, American typhoids do badly in the open air in hot weather under canvas shelters, and must be put indoors in cool rooms. In the Civil War great success fol-

<sup>4</sup> Bruce, *Lancet*, November 1, 1913.



lowed the mere transfer of cases from the hot south to the cold north. The writer knows of a very brunet man who is in excellent health in the outdoor sunny climates of our southwest where he has mining interests, but his wife who is a bright blond, suffers from the neurasthenic conditions so prevalent in that type in light countries. In a more cloudy climate where she is at her best, he suffers.

In selecting a climate for an invalid or convalescent, plains people should not be sent to the mountains nor mountaineers to the plains, dark types to dark climates or blonds to the sunniest, thin, slender ones to excessive cold, nor fat and bulky ones to very hot, northern races to southern climates, nor tropical peoples to high latitudes. Those needing change will find the good negatived if they travel in a bad climate, but mere residence in northwest Europe for a while may do a world of good to one who has been damaged by our tropical summers. Indeed the annual summer exodus to Europe is attaining the proportions of a flood simply because people are finding out the good it does to return to our ancestral climatic homes. I have known one blond American neurasthenic to recover by simple residence in northern Ireland and another by removal to Seattle.

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 brunets 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. 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. 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. 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 now never see a tree. This is the plan now being executed in all progressive cities and it is money well spent.

Northern types in the tropics must be specially careful as to hygiene. *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, 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. 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. *Baly* found that red excluded the ultra-violet best.<sup>5</sup> *Sambon* invented a cloth yellow on outside and red within, and it is excellent in the tropics. The combination of dark underclothing and white outer garments for the day imitates animals which have white hair and black skin, such as the Arab horse of the lowlands. It reflects most of the heat and light and allows few actinic rays to penetrate. 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.

For evenings, opacity and reflection of heat are immaterial. 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

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<sup>5</sup> *Arch. Röntgen Ray*, January, 1911.



and it explains that wonderful tendency to wear black evening clothes which we see in so many hot countries. 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. The thick blue flannel shirt 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. The khaki flannel shirt seems to be as opaque as the blue and has proved successful.

The hat must be of wide brim and thick enough to exclude all the rays, for those penetrating the skull are the most dangerous. 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. 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 khaki color—big, thick, and of light weight. The most dangerous thing to wear in the sun is a 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.

At one time it was not a soldierly act for a British officer



to take to cover in battle, but it became soldierly in the Boer war. 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 it would prevent much sickness.

The Spaniards who lived in the Philippines did not appreciate the dangers of light because they were brunets and they made but little provision in their homes to escape the dangers. Blond Teutons in India, on the other hand, see the necessity for this protection and build great covered porches around their houses for this express purpose. 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 blond women exposed to the glare of the shell windows. They are immersed in a stimulating and exhausting "light bath." 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. Dark rays are 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. The wooden barracks I personally inspected in Singapore, though built in the simplest and cheapest way, were cooler, darker, and better than any we put up in Luzon. The civilians are worse than the military, for the private house 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 to burn down the expensive buildings recently erected, extreme as this assertion appears. This sentence written ten years ago has been amply confirmed.

The glare from white houses is very harmful. I have seen marked suffering 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.

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 though they could have secured the shade. 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."<sup>6</sup>

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 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

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<sup>6</sup> Burot and Legrand, "The Hygiene of the Soldier in the Tropics."



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."<sup>7</sup>

The siesta is an opportunity to hide like the white ant. 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. It has often been said that natives protect themselves from the sun's rays more carefully than Europeans. 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 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 overnight. 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 50 to 75 per cent. sick it shows the necessity of new regulations on the subject. 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 maneuvers. In the hot weather nothing whatever is done, and every one who can possibly escape to the hills does so.

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 Hongkong, practically in the same latitude as Havana, but

<sup>7</sup> Dr. Richard Stump, *Allgemeine medicinische Central-Zeitung*.



with three 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 sixteen 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 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. Our northern habits unfit us for tropical life. The British made the same blunders in India for over a century.

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, where white men do not last even if they escape the infections.

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. As the majority of the hill stations have a climate the same as Chickamauga Park, a twelve years' tour of duty is not any more harmful



in such stations than twelve 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 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. Ten years after the above was written we began the harvest of deaths from the accumulated damages.

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 were sent home disabled by tropical 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.

The French tour of duty in their best colonies is 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.

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 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 British 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 one 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.

"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 reduced to two thousand. It was formerly thought that all this harm came from the soil in the way of malaria. It was mostly due to exposure to the sun which reduced resistance to all infections. Even the Filipino is liable to this breakdown. Convicts worked in the heat of the day have a dreadful sick and death rate, tuberculosis being rapidly fatal. I know of one instance where 50 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 were 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 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.

Then we do ourselves harm with the cold baths we take. 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, which dilate the blood vessels of the skin and help evaporation and radiation.

Social duties are the main causes of the breakdown of women. *Dr. W. J. Simpson*<sup>8</sup> mentions the exceptionally bad health of British women in India and blames the darkened rooms in which they live. The real reason is found in the excessive exposure to the sun in social functions that should be done at night or better omitted altogether, for our women break down much sooner. 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

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<sup>8</sup> *Journal of Tropical Medicine*, April 15, 1900.



P.M., and up at daybreak. Then the necessary siesta in the afternoon will be appreciated.

In selecting recruits for tropical service exclusively, it would be best to limit them to slender brunets, 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 brunet, the rule should be—in cases of doubt as to a man's fitness—if he is a blond, reject him. Blonds who contemplate a long residence in the tropics in civil employ, or in business, should hesitate unless very vigorous; dark brunets need not worry over it but may run the risk if it pays well enough. 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 hot climate did not stand tropical service as well as the less damaged men of the North.

*Drs. Burot and Legrand*<sup>9</sup> 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. *Dr. James Cantlie*,<sup>10</sup> in an article on tropical hygiene, shows the need of fresh meat to counteract the exhaustions, for he

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<sup>9</sup> "Hygiene."

<sup>10</sup> *Journal of Tropical Medicine*, April 15, 1903.



thinks the lack of "nitrogen" is a prime factor in tropical exhaustions. Physicians are almost unanimous in declaring that the old doctrine that we should eat very lightly of animal food in the tropics is pernicious. The natives are 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 exhaustion, possibly needs more meat than he does at home for an equal amount of physical labor. There is considerable evidence that both beriberi and tuberculosis attack by preference those in a condition of nitrogen starvation.

A large musculature so beneficial in colder climates, is both useless and pernicious in a white man in the tropics, for it is a parasite absorbing nutriment, and requires care, grooming and time to keep it in health. To do all this the owner must expose himself unnecessarily to the sun. A German physician (*Walffert*) 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. So a poor musculature is not a contraindication 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. Calisthenics and outdoor sports are bad if for the sole purpose of increasing the musculature. Athletic contests should be abolished in the tropics. Those who indulge in them furnish more breakdowns than those who are more moderate. It is not true that those who live outdoors are better off for it. In an address in England, printed recently in *Climate*, *Dr. Charles F. Harford* says: "I have known more men returning from a tropical climate with a breakdown of the nervous system than women."



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, yet some old visitors have died before they could get away. Civil service candidates should be limited to those under thirty.

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, pay the market price, and as a consequence are more cheaply managed than government business, as a rule. Congress should 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. *Professor Ripley* says,<sup>11</sup> "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, as incitement of it."

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 compelled them to lay upon their policy-holders in the tropics. The Dutch life assurance companies have found that the expectation of life of the Dutch in Java is not markedly reduced in the well sanitated towns, though *Kohlbrugge* says that scientists and officials are mostly worn out at 50.

It is also to be hoped that this investigation will take us a step nearer the solution of that problem which is now confronting the American people as well as European nations—

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<sup>11</sup> *Popular Science Monthly*, May, 1896.



*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.



ARTICLE XXV OF THE CONSTITUTION

The Congress shall have the power to lay and collect taxes on imports, on exports, and on the whole duty thereon, but all duties of tonnage shall be uniform.

No tax or duty shall be laid on articles exported from any State, except for the purpose of collecting a duty on such articles.

The Congress shall have the power to regulate commerce with foreign nations, and among the several States, and with the Indian Tribes.

No State shall enter into any treaty, alliance, or confederation, nor shall it grant letters of marque and reprisal, nor shall it coin money, nor shall it emit bills of credit.

No State shall be obliged to furnish troops or ships of war, or to furnish any other military or naval force, or to furnish any other aid or assistance, in time of war or actual invasion.

No State shall, without the consent of the Congress, lay any duty on imports or exports, except for the purpose of collecting a duty on such articles.

No State shall, without the consent of the Congress, coin money, or emit bills of credit, or make any thing but gold and silver coin a tender in payment of debts.



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