

**Biological Perspectives on Human Pigmentation (Cambridge Studies in Biological Anthropology):** Ashley H Robins. Cambridge University Press, Cambridge, New York, Melbourne, Sydney. 1991. pp. 253.

This is an excellent compendium summarizing and elucidating available information on human skin, especially its colour or absence thereof. Given the vast expanse of the topic and the abiding human interest as well as involvement in it, it is appropriate that a multidisciplinary perspective has been projected. Beginning from historical studies, the author quickly updates and presents current anatomical/biochemical status of the basics: the melanocyte and melanin, in the first two chapters.

The third chapter deals with effects of UV radiation on pigmentation. Its discussion so early is probably based on the role of light in determining secretion of the pineal hormone melatonin. The chapter also introduces interesting and popular aspects of UV radiation (Types, effects, the ozone layer, altitude, latitude, climate, etc.). Different types of tanning reactions and racial differences in cytological/biological response to UV exposure are no less interesting.

Natural and artificial photoprotection are described, with down-to-earth, dispassionate analyses of sunscreen agents, both physical and chemical, skin darkening chemicals (hormones, psoralens, natural carotenoids, etc.). However, despite popular notions to the contrary, it is apparent that most such agents do not conform to their advertised claims, and in many cases may actually entail risks ranging from photosensitivity disorders to skin cancer if used without moderation.

Melanin, the chief pigment lending 'colour' to skin, of course, gets repeat detailed treatment. Chapter 4 is exclusively devoted to functions of melanin. This is important since only a comprehensive understanding of its possible functions can lead to assignment of biological role to this unique pigment.

Melanin bears out the axiom that Nature knows best. Conclusive recent evidence is cited that melanin is the sunscreen *par excellence* against the ravages of radiation. Clinical, observational and experimental studies clearly establish that skin cancer (due to

radiation injury) is least in Negroids and other pigmented peoples, as opposed to the fairer, light skinned ones. Even among the latter, skin cancer may be 5-8 times more common in those living in areas of high solar radiation. For Caucasoids, every 10° decrease in latitude is shown to double rate of skin cancer. On the other hand, higher susceptibility/incidence of skin cancer in Negroid albinos pinpoints melanin as a major factor in its prevention. The role of stratum corneum (including its thickness) is at best supplementary. Actually, it is the cell layers *beneath* the Stratum Corneum which contain characteristic, numerous and large melanosomes, singly dispersed in the Negroids, which act as the effective UV filters.

The *mechanism* whereby melanin is able to exercise its photoprotective function has been ascribed to its free radical property, due to which the pigment acts as an electron transfer polymer participating in oxidation-reduction reactions and protecting tissues from damaging effects of stable free radicals.

Another important property of melanin is thermoregulation which it exercises in conjunction with sweat glands. Concealment, camouflage (cryptic colouration), the typical example being industrial melanism, warning/display and other non-human functions of melanin have also been touched upon.

The next two chapters are yet another interesting expose of melanin's wide-ranging biological properties, the focus here being on non-cutaneous melanin. Eye colour and vision itself is directly attributable to melanin biosynthesis/deposition in the eye and retina. Retinal pigment is not correlated with race, whereas eye colour may be.

Neuromelanin or brain pigment is found in neurones in various parts of the brain. Neuromelanin has now been shown to exist in nearly all mammalian species but its intensity is greater in primates, reaching a maximum in human. Among other hypotheses, it has been speculated that neuromelanin may represent accumulation of waste products in the neurones.

Decrease or loss of dark pigmentation in the brain region called substantia nigra has been correlated with occurrence of Parkinson's disease. Any studies on relationship between race and Parkinson's disease were inconclusive.

A compound known as methylphenyl-tetrahydro pyridine (MPTP) selectively

destroys pigmented cells of substantia nigra and causes acute Parkinson's disease.

Manganese ion may also induce Parkinsonism by a somewhat similar mechanism. Finally, and somewhat remarkably, cigarette smoking reduces risk of Parkinsonism. Reasons for this are not yet understood.

There is evidence that certain drugs such as phenothiazine, chloroquine, atropine, etc. bind selectively with non-cutaneous melanin and may cause serious side effects including drug-induced Parkinsonism, tardive dyskinesia and retinopathy, to mention a few. Available data are unable to establish ethnic differences in drug responses based on intensity of pigmentation.

Whereas evidence is not sufficient to be conclusive, it does seem that increase of non-cutaneous melanin in such tissues as eye, ear, brain, etc. may be associated with a certain amount of superiority in specific neurological function. Melanin is highlighted as a fundamental organizational molecule in living systems, and neuromelanin as possible physical substrate for higher cerebral functions.

The next chapter a technical one, describes techniques of measurement of skin colour, including the latest developments in the field. Of interest and importance are descriptions and data of skin reflectances made in different populations with respect to age, geography and sex.

The next two chapters deal with disorders respectively of hyper and hypopigmentation resulting variously from genetic, pathological or artificially-induced causes. Diseases such as Addison's Cushing Syndrome, etc. are ascribed to hormonal or metabolic causes.

Developmental/genetic conditions such as freckling and different kinds of spots including the so-called Mongolian spot, and hyper pigmentation induced by specific drugs (e.g. phenothiazine), as also the interrelationship between schizophrenia and phenothiazine therapy have also been discussed.

The most prominent hypopigmentation disorder is, of course, albinism which is steeped in all kinds of folklore and myths. Genetic and biochemical causes and the condition are discussed in the light of modern knowledge and various effects ranging from skin cancer, deafness, brain and vision deficiency which have been apocry-

phally or factually associated with albinism have also been described. An important aside highlights the fallacy of using albino animals for research since they are 'abnormal', to begin with.

Another genetic disorder, phenylketone urea and an acquired hypopigmentation condition, vitiligo are also described along with possible biochemical causes and psychosocial trauma of the sickness. The 3000-year-old Indian Atharva Veda describes vitiligo, and, remarkably mentions a plant containing psoralen as a palliative-anticipating modern (1990's) PUVA therapy [use of photosensitizing psoralen agents in combination with long-wave UV(-A) light]!

An important and highly interesting account of chemical hypopigmentation induced by especially the monobenzyl ether of hydroquinone used in bleaching creams makes very useful and interesting reading. Outbreaks of leucomelanoderma and a new skin disease of face called *achronosis* leading to darkening and coarsening of the skin, and appearance of pink black papules in especially black South Africans should serve as a warning to others intent upon becoming fair. South Africa has actually banned such creams in 1990. An interesting discussion on alleged sudden whitening of hairs establishes that such a phenomenon occurs in situations of extreme emotional or pathological trauma. However, the exact mechanism causing this is not understood.

Sociological implications of skin colour – what the author chooses to call the social-biological interface, have been very well discussed in the penultimate chapter 10. The general qualities of purity and goodness ascribed to the white colour in various cultures, legends and myths, have been shown to prevail almost throughout the world. Europe, Africa, India, Japan, China, America – all races in the society apparently seem to subscribe to this colour symbolism – white being good and black bad. The propensity of Indians to fair colour is also highlighted. It is pointed out the caste system or 'Varna' also means colour and the brahmins were associated with white, yellow and brown with the Kshatriya caste, and black with Shudras. Indeed, reflectance spectrum studies have proved that higher caste hierarchy or the brahmins have the least pigmentation. Muslim attitude to blackness was again similar and it has been

described how in the muslim world the white slaves were rarely used for menial tasks or hard labour and were, instead even promoted to the rank of Governor or General.

The father of taxonomy, Linnaeus in 1758, had classified human kind as *Homo enrapetes* (white), *Homo Americanas* (red), *Homo Asiaticus* (brown) and *Homo Afer* (black) with correspondingly negative behavioral traits.

The racist philosophy afflicting humankind, the doctrine of Aryanism leading to the master race cult of Adolf Hitler, and the excesses of the Third Reich have also been unsparingly projected. The 20th century problems including the Klu Klux Klan in America, apartheid in S. Africa, and the general racial discrimination in Europe and the West, including even Australia have also been commented upon. The black consciousness movement 'black is beautiful' also finds adequate projection. Sociological aspects of pigment disorders such as albinism, vitiligo and chemically induced ones are very well discussed with authentic examples. An interesting aspect is the relation between skin colour and blood pressure e.g. in countries like USA and S. Africa, which are designated as high stress areas for the blacks.

The concluding chapter on evolution of skin colour seeks causes for pigmentation or its absence. Various hypotheses and theories are discussed in fair detail. Thus, the very first and obvious cause of melanin protection from UV radiation is discussed at great length. To a large extent, depigmentation of the early Africa originated hominids may be ascribed to selection pressure due to sunburn. It is argued that a light skinned person with sunburn would be unable to sweat efficiently due to solar load and would soon die of physical exhaustion due to hyperthermia.

The ability of human sweat glands to reduce heat load is reviewed in tandem with melanin's ability for photoprotection.

Concealment or camouflage has also been proposed as one of the reasons for evolution of colour. However, there are several arguments against this, the foremost being that black is actually a bad colour for concealment.

An unusual hypothesis suggesting that resistance against disease can be associated with increase in pigmentation has been suggested by Wassaman

in 1955. Unfortunately, it does not find many supporters.

The synthesis of Vitamin D in the skin by exposure to UV-B light has been suggested as a reason for depigmentation in the northern latitude. Although excess Vitamin D can cause toxicity, over-exposure to sunlight does not do so since prolonged irradiation causes Vitamin D to reach a plateau and, moreover, the compound is degraded into a variety of photoproducts.\*

The occurrence of rickets due to deficiency of Vitamin D is a factor which has been incorporated widely in evolutionary hypothesis. It is suggested that cloud, fog, mist, etc. as well as reduction in number of sunshine hours and intensity of light in Northern latitudes would severely inhibit Vitamin D synthesis giving rise to pelvic deformity of rickets. These would make child birth impossible and severely hamper hunting ability, resulting in possible extinction of the species. Blond hairs, blue eyes and fair skins characteristic of these latitudes would be able to survive by evolving a depigmented skin for utilizing available UV by allowing it to traverse the stratum corneum to induce the synthesis of Vitamin D. There are, however, evidences both in support as well as against this hypothesis and these have been discussed in some detail. Indeed, it is now apparent that the short stature of pygmies is not due to Vitamin D deficiency. Rickets is considered a disease of industrialization and overpopulation and it is unlikely that it would have appeared in antique man who was an open air hunter-gatherer.

Another interesting hypothesis is that of cold injury. It appears that the Negroids and other coloured people are more susceptible to cold injury such as frozen feet compared to caucasoids. Melanocytes are apparently more easily destroyed by freezing. Conditions inducing frost bite would introduce selection pressures in Northern latitudes, which would favour reduced skin pigmentation. Frost bite not only cripples but often causes death due to secondary infection. Frostbite of the penis is mentioned as an amusing, if otherwise, serious negative effect on reproductive fitness. The extraordinary cold conditions of the ice ages would swiftly select against pigmented skin if the frostbite hypothesis is correct.

It becomes obvious that none of the popular hypotheses mentioned seem to

fully account for evolution of dark skins on the one hand and elimination of pigmentation on the other. Various other biochemical, behavioural and genetic perspectives have also been fleetingly touched, but no definite assertions are made on their validity.

In conclusion, this compilation is not only technically faultless, but also provides useful information and insight into multi-disciplinary perspectives touching upon biology, medicine, sociology and anthropology. The author must also be complimented for making the account comprehensible to laymen readers of average intelligence and education, apart from providing fascinating material for thought for the specialist experts as well. In the final analysis, the adage of shallow 'skin depth' seems to apply as much to colour as to the various prejudices associated with it. The colour of human skin is essentially due only to a cell layer or two: dispassionately considered a fit example of much ado about nothing!

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**An Ecological History of India.**  
Madhav Gadgil and Ramachandra Guha.  
Oxford University Press, New Delhi.  
1992 274 pp.

In their preface to the book, Gadgil and Guha state that India's biological resources are misused and the burden of this misuse in our daily life is only

dimly perceived by the rich and the powerful. Hence their attempt to reconstruct an ecological history of India.

The book is divided into three parts. Part I deals with a generalized framework for consideration of ecological history. Through a number of examples, the authors examine the conditions under which humans exercise prudence in their use of natural resources, analyse the social conflicts that exist between and within different models of economic activity in human society, and examine the impact of changing patterns in resource use over a period of time. Whilst this section in general lends itself to easy reading, a few minor questions sometimes arise on the issue of interpretations. Thus, for example, emphasis to be laid on factors for persistence of hunter gatherer/shifting agriculture societies in India, the hilly terrains of the north-east, central and southern India, should have been analysed in some more detail. In this context, it would have clarified matters if a vast body of information available from this sub-continent, on ecological, social and economic issues on this topic had been taken into consideration by the authors.

Part II provides an account of the ecological history of pre-modern India. A few interesting points emerge: (a) that the caste system promoted narrow niches in terms of resource use and that coexistence of castes in a given area was through mutual avoidance, a point that we still see amongst the tribes of north-east India, (b) conservation practices were strongly reinforced by religious beliefs. The weakness in this section is in statements that are often not authenticated by reference to literature, thus for e.g., a reference to

the pertinent literature would have been appropriate when the authors talk about taxation policy followed by the Moghuls on page 107.

Part III deals with the impact of British colonialism and the carry-over effects of this in the post-British period in independent India. For obvious reasons, this section is better authenticated through a synthesis of a vast body of literature. However, it would have been appropriate if the authors had integrated the vast body of information recently generated on the rainforest ecosystem function from this country (cf. page 198-199). It would have also been appropriate in this section to have elaborated a little more on what we understand today as 'sustainable tropical forestry management', in order to set a positive tone to the whole discussion.

Written lucidly and easily and without jargon, the book is of value to all those who are concerned with environmental problems that beset this country with its exploding population, putting heavy pressure on rapidly declining biomass resource base. Coping with the twin problems of increasing population pressure and rapid industrialization in the context of natural resource management is a great challenge. This book helps in a better understanding of the problems that we face; the solutions are still elusive.

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