Getting under the skin

Skin: A Natural History

Nina Jablonski

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Reviewed by Ian J Jackson

Skin looms large in human experience. It is one of the most discussed aspects of our appearance, and is used by others to assess our health, wealth and culture. For example, skin wrinkles and pigmentation provide insight into our age and ancestry. We use skin to advertise our individuality via suntans, facelifts, piercings and tattoos.

What skin is best at, of course, is keeping our insides in and keeping the outside out. In *Skin: A Natural History*, Nina Jablonski argues that what goes out and what comes in through the skin have been major factors in human evolution.

Jablonski is Professor of Anthropology at Pennsylvania State University and has long studied primate evolution, with a particular focus on human pigmentation. This short monograph aims to cover the whole range of biological and cultural aspects of human skin, and more or less succeeds.

The book's final chapters, on skin as a canvas on which cultural statements are painted, tattooed, cut or etched, are fascinating. In contrast the short chapter on skin diseases seems weak, since it is difficult to document the whole of dermatological disease in 20 pages without merely producing a list. The real strength of the book, however, is the first 100 pages, which deal with Jablonski's principal research interests.

Human evolution, her thesis goes, began with bipedalism, allowing our ancestors to travel larger distances at higher speeds. On the African plains this is hot work, so we lost the hairy coat of our ape cousins and increased the number of sweat glands to keep cool. Bare, unpigmented skin in the powerful sun is bad news, so we co-evolved dark pigmentation for protection. Much later, for those very few humans that left Africa, this dark skin was a disadvantage, so dark pigmentation was lost. This is why Northern Europeans in particular are pale skinned, and at high risk for skin cancers when they move back to tropical climes.

While this may sound uncontroversial, even that bald description contains disputable elements. Indeed, there is significant disagreement regarding the exact nature of the evolutionary forces that affected human skin color. These arguments make the first six chapters a compelling read. Jablonski, as the author, has the advantage of the last word, and strongly promotes her own conclusions, with which some may disagree. Nevertheless getting there is an informative journey.

One such evolutionary controversy Jablonski discusses is the question of why humans evolved dark skin pigmentation after being exposed to the negative effects of the African sun. What was the selective pressure that led to epidermal pigmentation as protection? Skin cancer is unlikely to be a factor, acting too little (in the case of melanoma) or too late in reproductive life.

Jablonski has long been a proponent of the folate hypothesis. This theory posits that action of ultraviolet radiation on unpigmented skin leads to a catastrophic reduction in folate levels, leading not only to problems in embryonic development but to a range of other adverse effects on reproduction. While this may be an appealing hypothesis, experimental evidence for photodegradation of folate *in vivo* has been lacking. It is therefore unfortunate that the attention Jablonski gives the folate hypothesis is largely at the expense of other theories. For example, sunburn may have been a driving force for evolution of darker skin, since sunburn adversely affects sweat gland function and can lead to infections.

Moving forward to more recent evolutionary history, Jablonski describes the selection pressures that resulted in the differences in human skin pigmentation. While genetic evidence indicates that there was positive selection in order to maintain dark pigmentation in the African population, it was possible that simple genetic drift following loss of selection for dark skin could have accounted for pale skin in Europeans. However, recent evidence has shown that positive selection for pale skin was probably taking place in Europe, since a gene involved in controlling pigmentation shows almost complete dimorphism between European and African populations, with Europeans having what looks like a mutant form. DNA variants linked to this gene in Europeans bear the hallmark of a selective sweep: a rapid spread by selection of the new allele through the population.

While selection pressure caused Europeans to have pale skin, the exact nature of that selective force is not entirely certain. Jablonski favors the 'vitamin D hypothesis'. This theory holds that at higher latitudes, where sun exposure is lower, darkly pigmented skin blocks the ultraviolet radiation to such a degree that key ultraviolet-dependent processes, such as vitamin D synthesis, are insufficient.

I agree with Jablonski that the vitamin D hypothesis is the best candidate for the selective force. Nevertheless, there are some who have argued that there is enough sunlight in summer months at high latitudes to generate enough vitamin D and to exclude this selective pressure; however, no strong alternative hypotheses have been proposed.

Human genetics and comparative genomics will continue to inform us about how our skin has evolved over time. Our skin is one of the main features that define us as human, and as individuals. *Skin: A Natural History* is an entertaining and informative examination of what makes our skin uniquely human.

The author is in the MRC Human Genetics Unit, Western General Hospital, Edinburgh, UK.
E-mail: ian.jackson@hgu.mrc.ac.uk

COMPETING INTERESTS STATEMENT
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