

## An Investigation of the Incidence of light Eyes within a Brahman Population

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In the early days of genetics, before the blood groups and other simply inherited variations were known in man, eye color was used as an example of simple inheritance, brown eyes being cited as dominant to blue. Although it is not uncommon to find families in which both parents have brown eyes with one or more light eyed children, the inheritance is not as simple as it was formerly thought to be. True blue eyes are much rarer than most people assume, as the majority of light eyed people have small amounts of yellow or brown pigment in the iris. It is possible that true blue eyes, in which all melanin is absent, may be simply inherited, but a really sound investigation has yet to be done. Most so-called blue eyed people would not fit into this category.

In 1955 Lehman and Chelius reported their investigations of eye color in 30 families, within which there were 90 children. The report includes excellent kodachrome photographs of the eyes of all members of 4 families, a total of 17 persons. Most of the parents were of intermediate eye color, a mixture of blue, gray and brown. Among the children, 57.7% had intermediate color approximating that of the parents, 16.6% had lighter eyes than either parent, and 25.5% had darker eyes than either parent. The authors concluded that multiple genes are responsible for variations in eye color.

Light eye color appears to be restricted to Caucasians, or to those of mixed Caucasian descent. Within Caucasians there is an obvious correlation between pigmentation of skin, hair and eyes. Presumably some genes have effects on the production of melanin in all of these structures. The correlation is far from complete, however. An especially notable exception is the individual possessing dark hair and very light eyes. It is not an infrequent occurrence among people of Irish descent. The foregoing observations suggest that in addition to genes having a general effect on the production of melanin, there may be an additional gene (or genes) which inhibit melanin production in the iris. Thus persons with black hair and very light eyes would possess the required genes for relatively heavy melanin production, plus the inhibitor.

Populations of hybrid origins, part of the ancestry being Caucasian, provide good source material for investigation of the genetic basis for the occurrence of light eyes along with dark hair and skin. First generation offspring in East Asian families where one parent is Caucasian and the other is non-Caucasian sometimes result in light eyed

children with swarthy or brown skin and jet black hair. This sort of observation has been made too frequently to account for the light eyes on the assumption that the non-Caucasian parent was heterozygous for eye color, light eyes being recessive. These light eyes do not occur among unmixed non-Caucasians. The obvious alternative explanation is that the light eyes are due to a dominant gene (or genes) contributed by the Caucasian parent. The purpose of the investigation reported herewith was to investigate the inheritance of light eye color within a population of mixed Caucasian and non-Caucasian ancestry, in order to test the hypothesis that light eyes may sometimes result from a dominant inhibitor gene.

### **The Chitpavan Brahmins**

The Chitpavan Brahmins are a Brahmin subcaste, inhabiting the narrow strip of land lying between the Arabian sea and the Sahyadri ghats, and extending 200 miles north of Bombay to Broach, and 150 miles south of Bombay to Ratnagiri. The population is estimated to be between 100,000 and 150,000.

The Chitpavan Brahmins are noted for the high incidence of light eyes among them. Their hair is black and their skin is usually light brown, lighter than that of most Indians. Their features are distinctly Caucasian, suggesting a high proportion of Aryan ancestry. A survey of 103 school children by Karve and Dandekar in 1951 gave 84 with dark eyes, and 19 (18.44%) with light eyes.

A more recent survey by the junior author in 1962 gave 36 out of 302 (11.92%) with light eyes. Those classed as having light eyes are easily recognizable and are usually called "blue eyed" by casual observers. Although the two estimates differ by approximately 6%, the samples were not very large and the differences are statistically insignificant.

### **Family data**

Data on eye color were assembled from 39 kindreds, among which there were totals of 113 sets of parents and 349 offspring (only those examined by the junior author are included in these data). Table 1 summarizes the family data, in regard to the occurrence of dark versus light eyes.

It is readily apparent that both simple dominance and simple recessiveness are ruled out as being responsible for light eye color. Dark  $\times$  dark parents have a high proportion of light eyed children, far in excess of the maximum of 25% which would be expected even if all of the parents were heterozygous for a recessive gene for light eyes. Dark eyes cannot be recessive to light eyes, as indicated by the high incidence of light eyed children in families in which both parents are dark eyed. Light  $\times$  light parents produced 18.1% dark eyed offspring, additional evidence against simple dominance of dark to light eyes. No gene frequency analysis is required to substantiate these conclusions, and in fact it would be invalid here, because the sample was selected for light eyes.

**Tab. 1. The frequencies of dark and light eyes, arranged according to eye color parents, and the numbers of dark and light eyes among the offspring from each type of mating**

Parents			Offspring				
Mating type	Frequency	%	Dark	%	Light	%	Total
Dark × Dark	50	44.2	84	57.3	61	42.7	145
Dark × Light	56	49.6	105	57.7	77	42.3	182
Light × Light	7	6.2	4	18.1	18	81.9	22
Total	113		193	55.3	156	44.7	349



Photograph of a light-eyed Chitpavan Brahman.  
Note the mixture of blue and brown color in the iris

An investigation of this sort obviously falls far short on the objectivity one desires. The distinction between dark and light eyes is somewhat arbitrary, depending to some extent upon who does the classification. It should be noted, however, that the senior author saw members of several of the families after the junior author had made his classifications, and in no instance was there disagreement.

Light eyes are more noticeable in people with black hair and brown skin than in blonds. The contrast is so striking that those possessing the most eye pigment in our light eyed category would likely be classed as having medium brown or hazel eyes, if they had fair skin and very light hair. Figure 1 is an example of this situation. This

subject is classed as light eyed, but the eyes are mixed brown and blue with as much brown as blue area. Yet the eyes appear distinctly light when this individual is seen either alone or with a group of Indians classed as "dark eyed". The latter are characterized by solid black or brown iris, with no blue or gray portions. Although simple one gene dominance of light over dark eyes appears to be ruled out, multiple genes with partial or complete dominance of light color are almost certainly involved. The occasional occurrence of light eyed offspring from first generation mixtures of Caucasians and non-Caucasians (especially in Asia), would seem to make such a conclusion unavoidable. The great variety in color patterns among light eyed people calls for the interaction of several genes.

### Conclusions

An investigation was made on the occurrence of light versus dark eye color in 39 Chitpavan Brahman kindreds. This included 113 sets of parents and 349 offspring. Simple 1 gene dominance for either dark or light eyes is not supported by the data. The inheritance is complex; involving multiple genes.

### Bibliography

LEHMAN W. and CHELIUS J., 1955: *Veber das Zerhalten der Mischfarbigen Iris bei Eltern und Kindern.*  
KARVE I. and DANDEKAR, 1951: *Anthropometric measurements of Maharashtra.* University of Poona.

### RIASSUNTO

È stata compiuta una ricerca sul colore chiaro o scuro dell'iride in 39 gruppi familiari di Chitpavan, comprendenti 113 coppie parentali e 349 figli. I dati non sono in favore dell'eredità dominante semplice, nè per l'iride chiara, nè per quella scura. L'eredità è complessa e comporta numerosi geni.

### RÉSUMÉ

Une recherche a été faite sur l'iris claire ou foncée chez les Brahmins Chitpavan. 39 groupes familiaux ont été examinés, comprenant 113 couples parentaux et 349 enfants. Les données n'indiquent pas une hérédité dominante simple, mais plutôt une hérédité complexe avec plusieurs gènes.

### ZUSAMMENFASSUNG

39 Sippen der Chitpavan Brahmanen, darunter 113 Eltern und 349 Kinder wurden auf helle oder dunkle Farbe ihrer Regenbogenhaut untersucht. Die Ergebnisse sprechen weder bei

heller noch bei dunkler Iris für die einfach dominierende Vererbung. Die Vererbungsweise ist komplex und betrifft zahlreiche Gene.