

*Mahalanobis, Anthropometric Diversity and the Birth of
Human Genetics in India*

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and
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Prasanta Chandra Mahalanobis

(1893-1972)



A firm believer that scientific and rational views lay the foundations of modern age



**ISI was adopted as a model
for the first Institute of Statistics
established in the USA
at the Research Triangle Park, NC
by Gertrude Mary Cox.**

His first encounter with Statistics was by chance

1912— Passed B. Sc. with honours in Physics from Presidency College, Calcutta, and left for England to study at King's College, Cambridge.

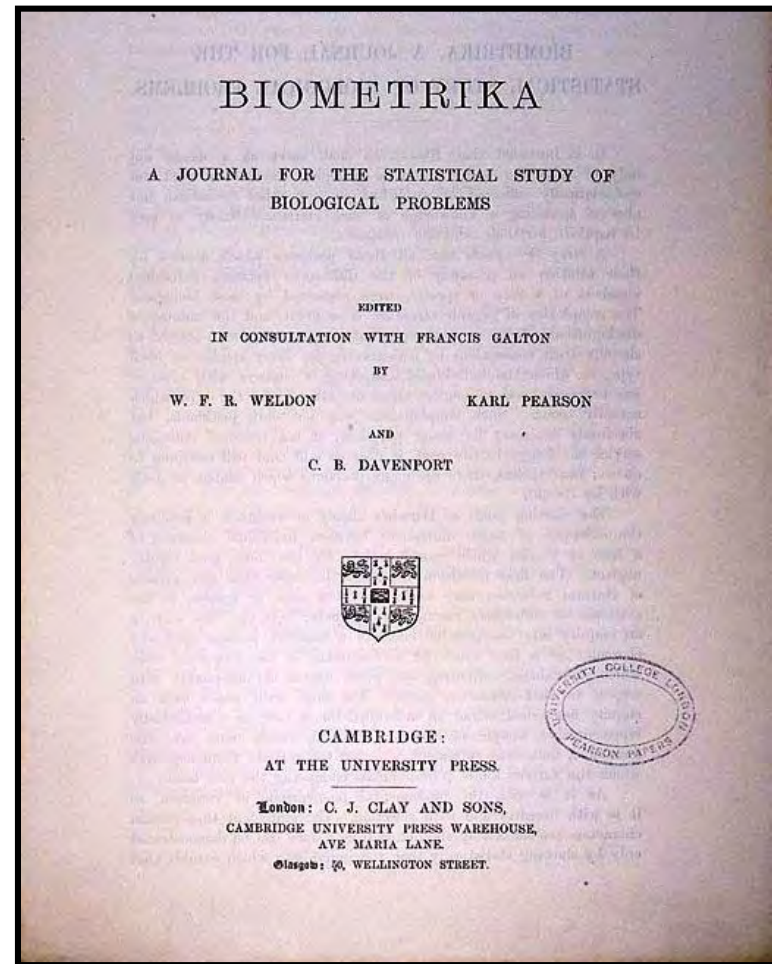
1915 — Returned home for a short vacation, and never went back!

Was asked to teach Physics at Presidency College.

1922 — Became a Professor of Physics at Presidency College, and served until 1948.

Just before leaving
Cambridge, his tutor,
W. H. Macaulay, drew
his attention to
Biometrika.

He found some of the
papers rather
interesting, and
brought a set of
volumes of *Biometrika*
back to India.



- Statistical Laboratory in Presidency College

1931 – Indian Statistical Institute





“Prasanta, you have to do work in India similar to what Karl Pearson has done in England.”

(translated from a note in Bengali by P. C. Mahalanobis dated 17 April 1945)

1920: Indian Science Congress in Nagpur.

Meets Nelson Annandale, *Director* of the *Zoological and Anthropological Survey of India*.

1922: Anthropological observations on the Anglo Indians of Calcutta. Part I: Male Stature.
Records of the Indian Museum

... More

Presidential Address to the Anthropology section of the Indian Science Congress in 1925

1925 "Analysis of Race Mixture in Bengal."

- Do the Anglo-Indians show a greater affinity with the higher castes of Bengal or with the lower castes?
- Is there any appreciable similarity with the aboriginal tribes?

Measure of distance between population groups based on anthropometric measurements

Unease with CRL and Proposal of D^2

Karl Pearson's "Coefficient of Racial Likeness" (CRL)

Mahalanobis realized that CRL was a *test of divergence* between samples drawn from two populations *rather than a measure of the actual magnitude of the divergence*, because the magnitude of CRL was dependent on sample size.

- Analysis of Race Mixture in Bengal.
 "first (provisional) measure of caste distance", D .

Mahalanobis went back to England in 1926-'27 and spent about six months in Karl Pearson's laboratory in the University College London.

A large body of anthropometric data on various European population groups was available in Pearson's laboratory.

Mahalanobis undertook an extensive analysis of these data and closely examined the usefulness of the CRL for measuring population relationships.

In the process, statistical shortcomings of the CRL became clearer to him.

Correlations among anthropometric measurements had to be taken into account in the measurement of group affinities.

1930 "On Tests and Measures of Group Divergence"
Journal of the Asiatic Society of Bengal,
New Series Vol. 26. No. 4.

The formulation of the D^2 statistic, derivation of its properties and its applications are undoubtedly the most profound contributions of Mahalanobis.

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ANTHROPOMETRIC SURVEY OF THE UNITED PROVINCES, 1941 : A STATISTICAL STUDY*

By P. C. MAHALANOBIS, D. N. MAJUMDAR AND C. R. RAO

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*The present anthropometric survey of the United Provinces was undertaken in 1941 at the instance of Mr. M.W.M. Yousfi, the Census Commissioner of India, and Mr. B. Sahay, Superintendent, Census Operations, U.P. (1941), and conducted under the supervision of Dr. D. N. Majumdar of Lucknow University.

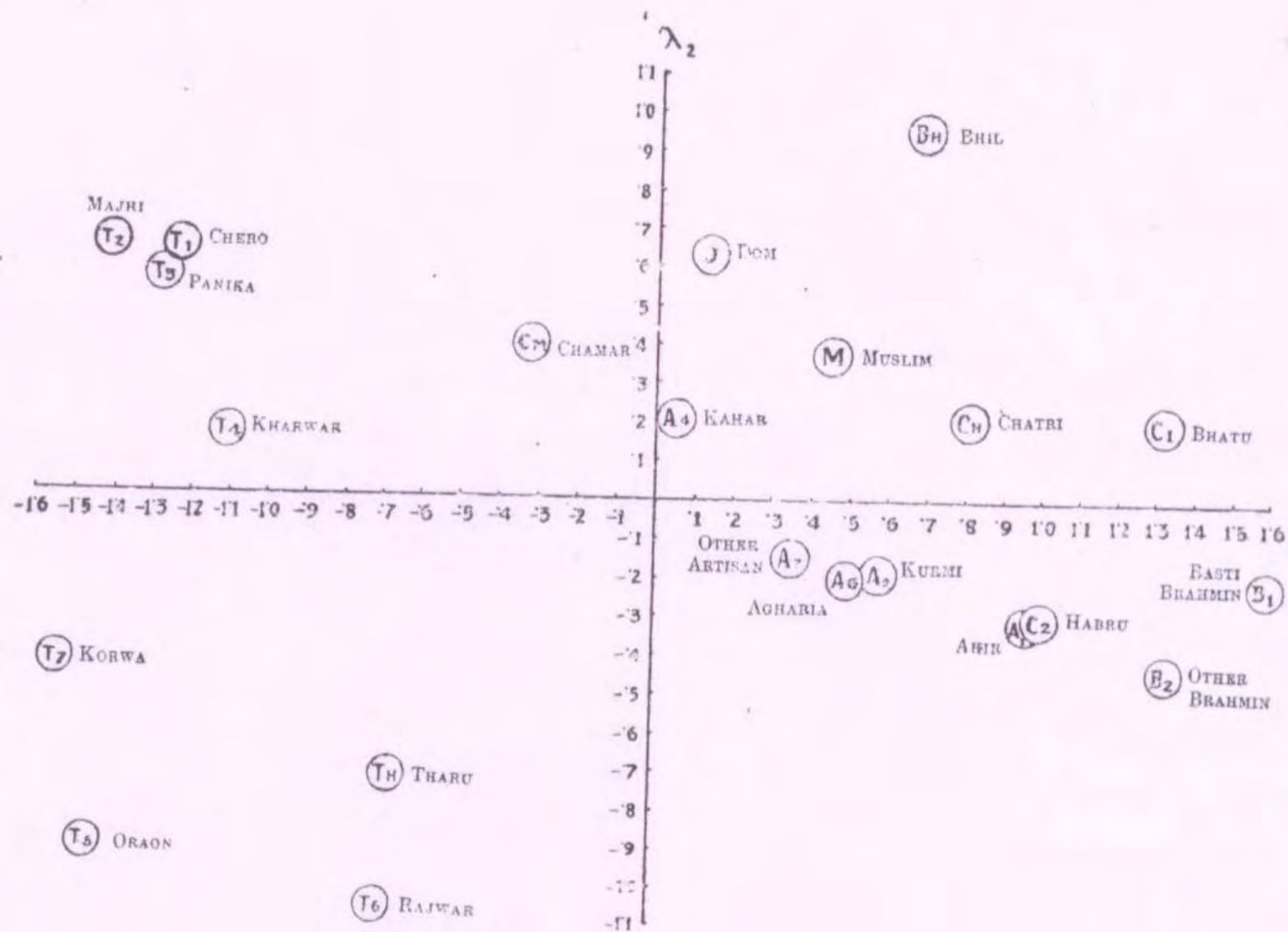
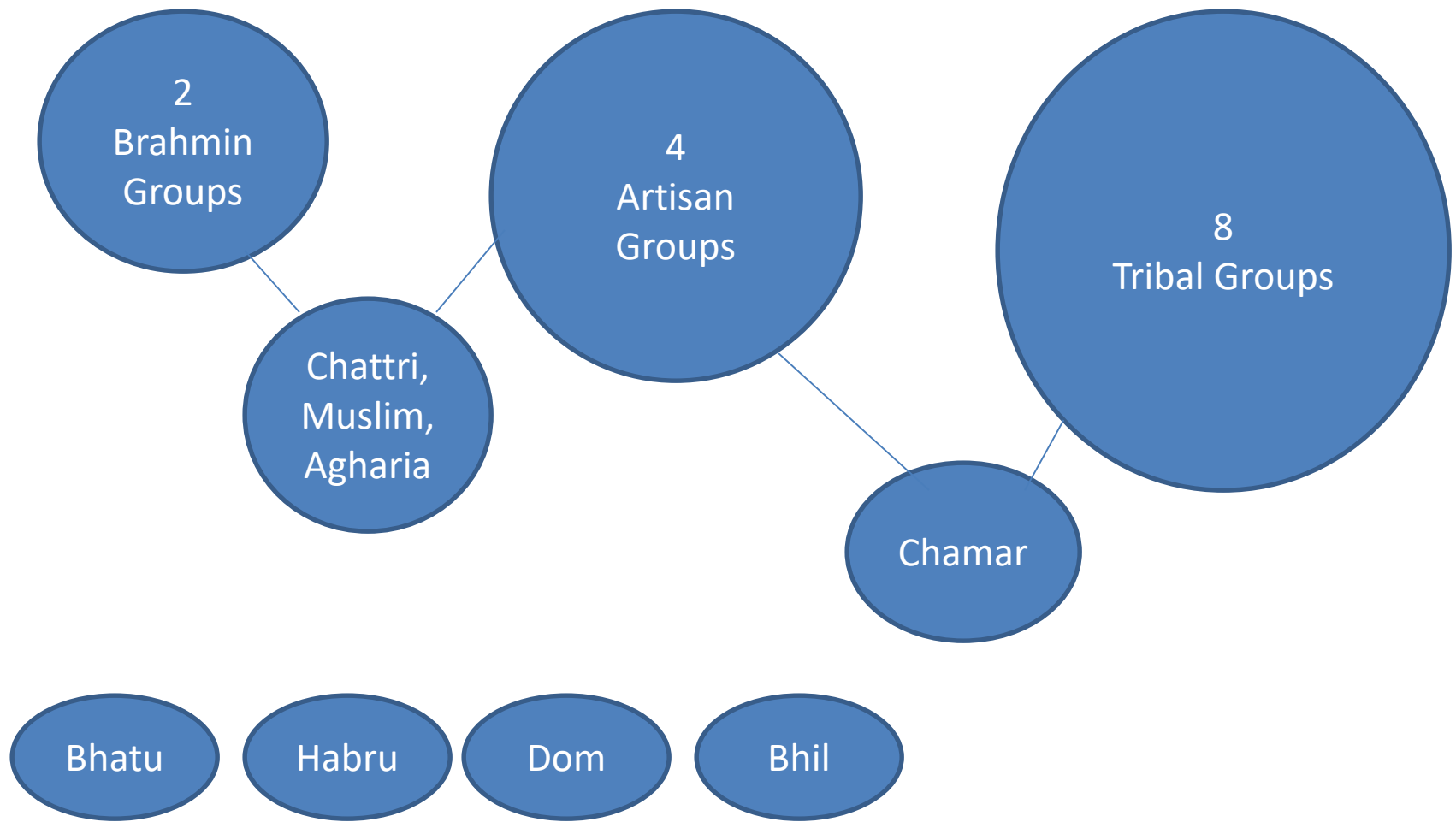


Chart 11.31 U. P. Anthropometry (1941) : Caste and Tribal Constellations (λ_1, λ_2)



- **“Among the groups forming the main sequence, there is close correspondence between social status and resemblance to the Brahmins.”**
- **“There are a number of cases in which the physical evidence definitely indicates possible origins contrary to accepted opinion.”**

“ ... (we) adopted a neutral word ‘group’

... A ‘group’ consists of individuals belonging to the same caste, religion or tribe and living in the same district ...”

**[Foreword to “Bengal Anthropometric Survey, 1945.
Sankhya 19, page 204]**

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“One of the important contributions ... is the demonstration of regional differences within a social group, that is, between individuals adopting the same caste, tribal or religious name (label), but living in different areas (districts).

This shows that a term like ‘Brahmins of Bengal’ has to be used with some caution ...”

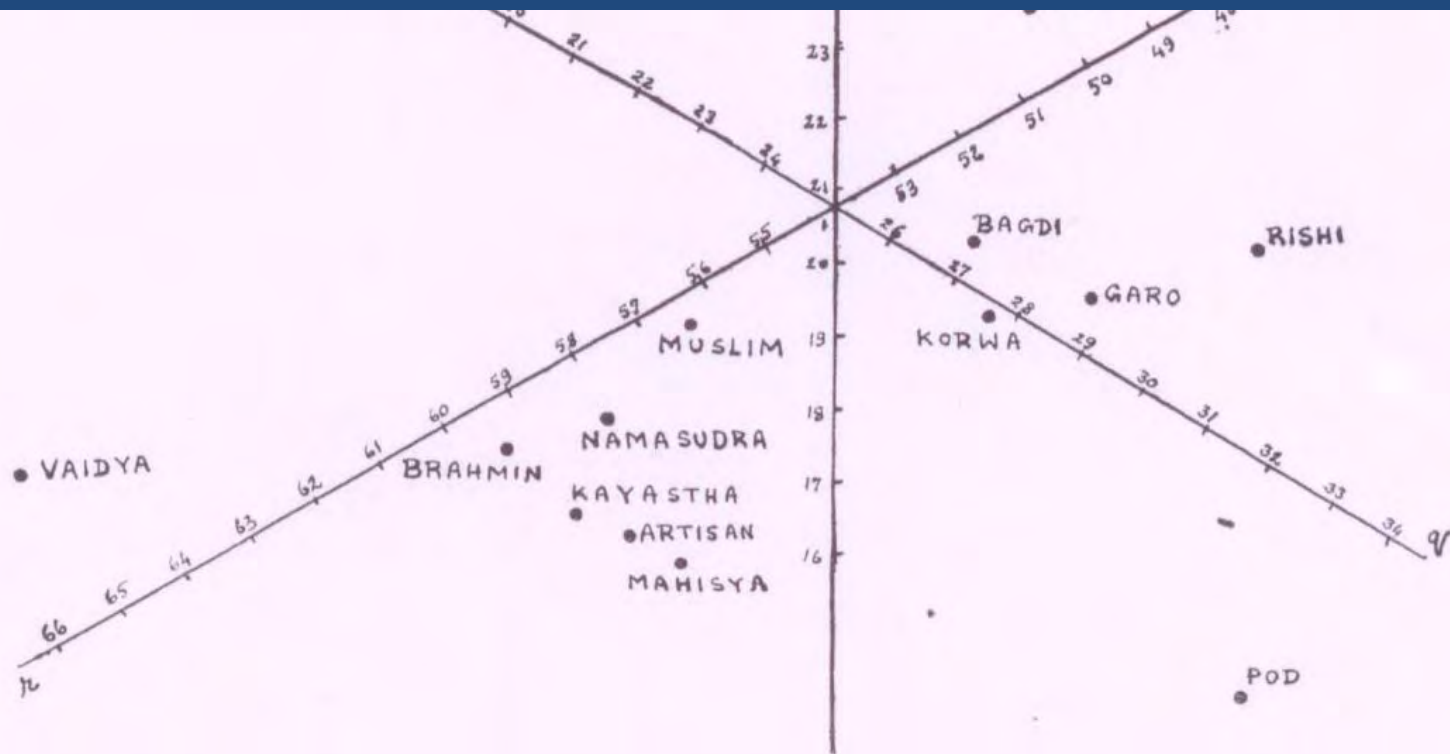
“Another interesting feature ... is that sometimes there is closer resemblance between caste groups within a district than between individuals of the same caste group belonging to different districts.”

“Anthropometry alone cannot tell the tale; we have to supplement by other physical, genetic and serological data ...”
(Mahalanobis, page 311).

“Our experience with anthropometry has not been convincing, and the blood group variations also need to be looked into ...”
(Majumdar, page 323).



“Until we have reinforced our findings by data on other systems, MNS and Rh, we do not think the picture of blood groups based on the ABO system, can give any clue to **ethnic origin** of the castes in Bengal, or for that matter, of any other part of the country.” [Majumdar, page 322]



Mahalanobis, Prasanta Chandra

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Book Title _____



“Innovation, systematization and concrete applications are the hallmarks of the applied statistics practiced by Mahalanobis.”

“Anthropometry alone cannot tell the tale; we have to supplement by other physical, genetic and serological data ...”
(Mahalanobis, page 311).

Anthropometry and Human Genetics Unit

- 1960 C.R. Rao formed a Haematology Unit
- 1963: Anthropometry Unit
 - Brijesh Verma ... furniture design
 - 1965: M.R.Chakravartti, F. Vogel - ABO blood group types and susceptibility to leprosy and smallpox
- S.R. Das (AnSI)
 - Biswa Nath Mukherjee
 - Swapan Kumar Das
- H.L. SHAPIRO (Am Museum of Nat Hist & Columbia U)
- R.L. KIRK
- N.M. BLAKE

John Curtin School of Medical Research
Canberra, Australia

- K.C. Malhotra (*Irawati Karve*)
 - **Focus**: *Measuring diversity and affinities*
 - ISI's collaboration with the USSR Academy of Sciences
- Amitabha Basu (*William Pollitzer*)
 - **Focus**: *Genetic diversity in relation to adaptation to environmental stresses*

Mid-1980s: Molecular genetic technologies were introduced.
Strongly supported by B.N. Mukherjee

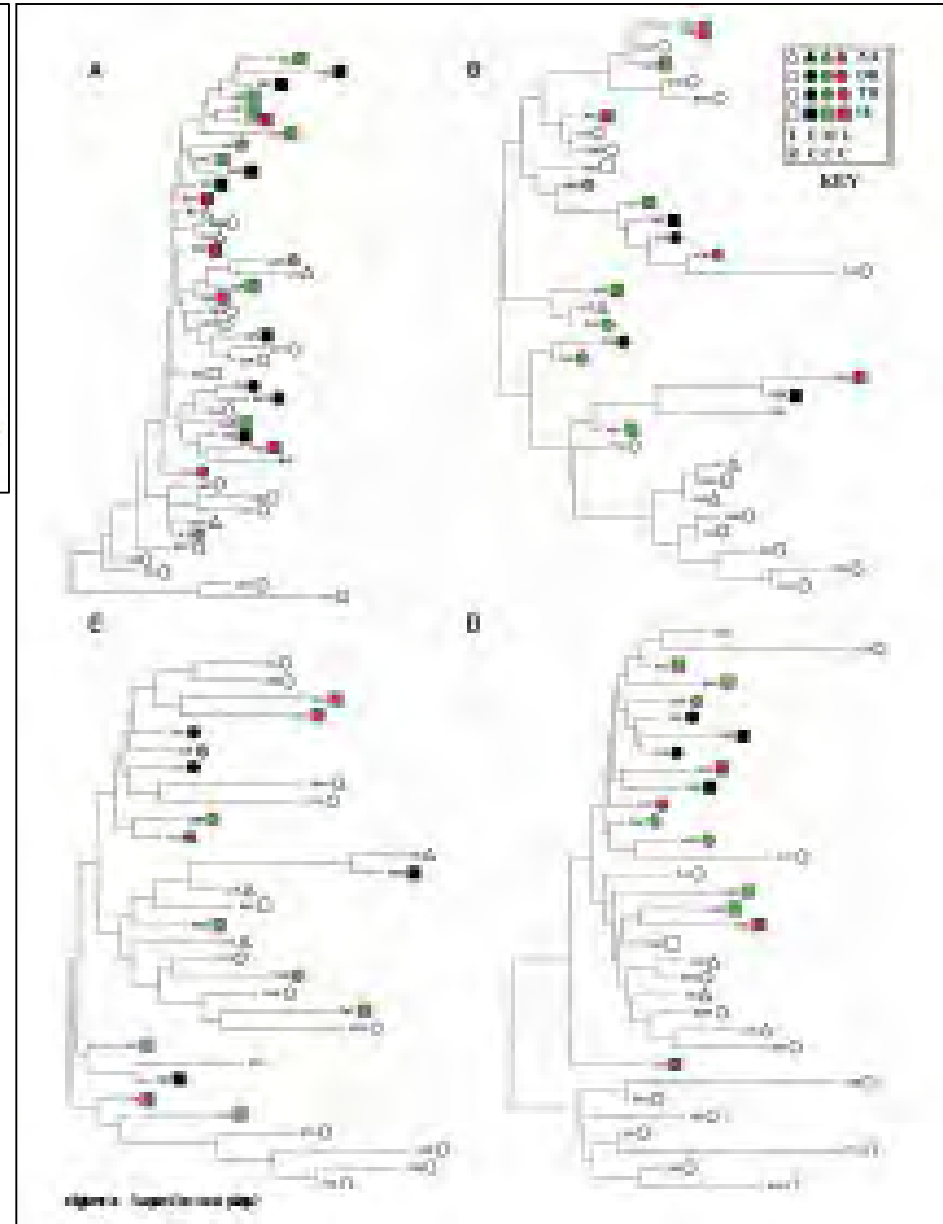
- Human Genetics Unit

Genome Research 13:2277–2290 (2003)

Ethnic India: A Genomic View, With Special Reference to Peopling and Structure

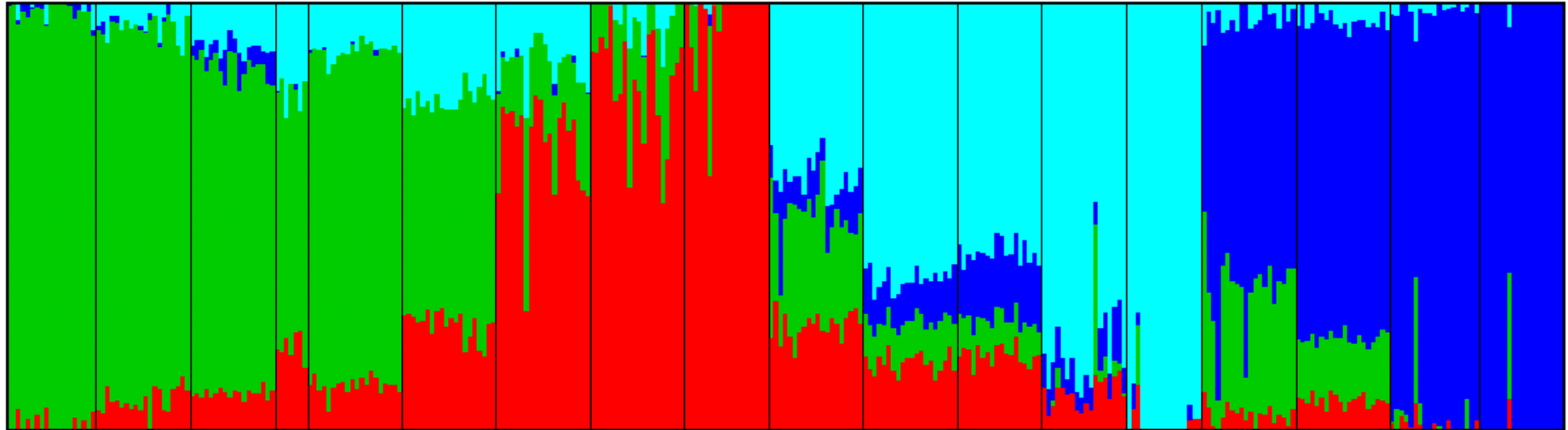
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**FOOTFALLS OF HOW
MANY DISTINCT
ANCESTRAL TYPES ?**

Four, not Two



Indo-European

Dravidian

Austro-Asiatic

Tibeto-Burman



Genomic reconstruction of the history of extant populations of India reveals five distinct ancestral components and a complex structure

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