Pt. Govind Ballabh Pant Memorial Lecture : XIII

(Abstract)

Lalji Singh

September 10, 2007
at
Kosi-Katarmal, Almora

G.B. Pant Institute of Himalayan Environment and Development
Kosi-Katarmal, Almora -263 643
Uttarakahand (INDIA)

Lalji Singh (b. July 5, 1947; Jaunpur, Uttar Pradesh)

Director, Centre for Cellular & Molecular Biology (CCMB), Hyderabad 500 007. [Phone: 27160789 (Off); 27160555 (Res.); FAX: 27160252; Email address: lalji@ccmb.res.in].

Dr Lalji Singh obtained his M.Sc., and Ph.D (Cytogenetics) from Banaras Hindu University. He spent 13 years in the Institute of Animal Genetics, University of Edinburgh (1974-1987) before joining CCMB.

His research interests include - Molecular basis of sex-determination; DNA fingerprinting and genetic diversity; wildlife conservation; human genome analysis and ancient DNA studies.

Awards and Medals

INSA Young Scientist Medal (1974); Ranbaxy Research Award (1994); Shri Om Prakash Bhasin Award (1996); Joy Govind Law Memorial Medal of The Asiatic Society, Calcutta (1997); CSIR Technology Award (1992); Honorary Professor, 1998: School of Animal Sciences, University of Hyderabad; Honorary D.Sc., degree: Purvanchal University (2000); Visesha Puraskaaram: Dr Ramineni Foundation, USA; (2000); Goyal Prize in Life Sciences (2000); K N Bahl Memorial Gold Medal for 2001; New Millennium Plaques of Honour Award 2001-2002 for outstanding services in the field of Biological Sciences presented by the Prime Minister of India at the 89th Session of the Indian Science Congress(2002); Sixth Prof. S. P. Ray-Chaudhuri Memorial Lecture Award (2002); Indian Society of Health Environment Education and Research (ISHEER) award (2002);'Poorvanchal Ratna' Award by Veer Bahadur Singh Purvanchal University, Jaunpur (2003); Honorary D.Sc. degree by Mahatma Gandhi Kashi Vidyapeeth, Varanasi (2003); Vigyan Gaurav Award of the Council of Science & Technology, Government of Uttar Pradesh (2003); Biotechnologist of the Year of the Metro-Vision Media (2003); FICCI Award 2002-03 for R&D in Life Sciences by the Federation of Indian Chambers of Commerce and Industry, New Delhi (2003); Awarded PADMA SHRI by the President of India (2004); Honorary D.Sc. degree by Banaras Hindu University, Varanasi (2004); Intellectuals' Honour The Great Son of the Soil by the All India Conference of Intellectuals, Meerut (2004); Swami Sukhdevanand Rishi Samman in the field of Genetics by Mumukshu Ashram Siksha Sankul, Shahjahanpur (2005); ISWA Honorary Fellowship (2005), Indian Science Writers' Association (ISWA), New Delhi;Honorary D.Sc degree by Uttar Pradesh Rajarshi Tandon Open University, Allahabad (2006);J C Bose National Fellowship awarded by Department of Science & Technology (2006-2011);Honorary Professor, Sri Venkateswara University, Tirupati (2006); Dr L D Sanghvi Oration Award of the Indian Society of Human Genetics

Contd.....

Mystery of our origins

Lalji Singh
Director, Centre for Cellular & Molecular Biology
(CCMB), Hyderabad-500 007

Abstract

Modern humans arose about 150,000 years ago, possibly in East Africa and colonized Kalahari Desert and the Central Africa rain forest within Africa. Early humans even ventured out of Africa briefly, as indicated by the 90,000-year old skull and Oazeh fossils found in Israel. By analyzing the DNA of living humans from different locations, it has been possible to assemble a detailed reconstruction of prehistoric human colonization of the world. Examination of the variation in DNA, known as DNA polymorphism, provides new insights into the history of the human populations. Immigration of people can be tracked down based on the errors (known as mutations) occurred during copying of DNA. These mutations slowly accumulate in certain regions of the DNA. Whenever a population splits and there is no intermingling of these splits, different populations accumulate different set of mutations, which depend upon the geographical location and the environment around them. Based on these mutations, it is possible to construct family trees of different lineages and shared geneology of humankind, and even approximately assign dates to the branch-points.

The mitochondrial DNA (mtDNA) is a genetic element passed down only through women, while DNA of Y-chromosome is passed down to next generations only through men. Based on the mutations found in mtDNA, various groups (known as haplogroups) have been identified and several of these groups are specific to African populations L2 and L3 mtDNA signature about 85000 years ago, which now represent more than two-thirds of female lineages throughout most of Africa. It led directly to the only successful migration out of Africa which occurred sometime between 55,000 and 85,000 years ago. Which route did they take out of Africa?

The origin of the Andaman "Negrito" and Nicobar "Mongoloid" populations has stimulated a wide range of speculations. Their origins are really a mystery. No one knows where they came from; and how long they have been there. Could these Islanders hold the key to the mystery of our own origins? Their world could serve as a window to look into the past showing us how were we (humans) hundred thousand years ago when the first modern humans left Africa. To address these questions, we have analyzed the complete mitochondrial DNA (mtDNA) (16,569 base pairs) of five *Onges*, five *Great Andamanese* and five *Nicobarese*.

We have used the mtDNA sequence to trace the emigration of Andamanese. Comparison of the complete mtDNA sequences of the Onge and Great Andamanese with the mtDNA sequences of the populations, known so far across the world, has revealed that the mitochondrial DNA sequences of the Onge and the Great Andamanese do not match with any of the populations in the world, including 6,500 samples covering the entire Indian subcontinent. Therefore, the Onge and Great Andamanese are unique in their origin. Novel mutations found by us in the mtDNA of the Onge and the Great Andamanese have helped in placing them in two unique branches (defined as **M31 and M32)** in the human evolutionary tree.

Our study suggests that two ancient maternal lineages have evolved in the Andaman Islands in genetic isolation independently. This may be due to the initial penetration of the northern coastal areas of Indian Ocean by modern humans in their out-of-Africa migration about 50-70 thousand years ago. Therefore, they are the windows to look into the past and hence they need to be preserved. This observation, therefore, supports the existing 'out-of-Africa' hypothesis. There was only a single dispersal from Africa, most likely via Southern coastal route, through India and onward into South-East Asia and Australia. Similar analysis of Nicobarese revealed that they belong to two lineages (B and F), which are commonly found in China, Malaysia, Myanmar and Thailand, suggesting their recent arrival from the east during the past 18 thousand years. We have also carried out a study on the Great Andamanese, Onge and Nicobarese, using autosomal microsatellite markers. The Andaman "Negrito" populations do not show particular affinities either with the African populations or with the Indian populations confirming their unique origin. In contrast, Nicobarese show close affinities with the Southeast Asian populations, suggesting their recent entry in the Island.

Using 11 whole mtDNA and 2231 partial coding sequences of Indian M lineage selected from 8670 HVS1 sequences across India, we have reconstructed the tree including Andamanese-specific lineage M31. We defined one novel haplogroup M41, and revised the classification of haplogroups M3, M18 and M31.

Our result indicates that the Indian mtDNA pool consists of several deep rooting lineages of macrohaplogroup 'M' suggesting in situ origin of these haplogroups in South Asia, most likely in the India. Moreover, our reanalysis of the Andamanese-specific lineage M31 suggests population specific two clear-cut subclades (M31a1 and M31a2). Onge and Jarwa share M31a branch while M31a2 clade is present in only Great Andamanese individuals. Overall our study supported the one wave, rapid dispersal theory of modern humans along the Asian coast.

(2006);Honorary D.Sc degree by Deendayal Upadhyay Gorakhpur University, Gorakhpur (2007);Honorary D.Sc degree by MJP Rohilkhand University, Barielly (2007); Rashtriya Ekta Samman 2007 by National Unity Conference, New Delhi.

Membership of Professional Societies

Member, Professor S P Ray-Chaudhuri Memorial Foundation; Past President, Indian Society of Cell Biology; Member, Society of Biological Chemists of India; President, Indian Society of Human Genetics; President, P M Bhargava Foundation; Founder Member and President, the Association for the Promotion of DNA Fingerprinting and Other DNA Technologies.

Membership of the Editorial Boards

Journal of Biosciences (former Member); Journal of Basic & Applied Biomedicine; Journal of Genetics; Journal of Forensic Medicine and Toxicology; International Journal of Human Genetics; Indian Journal of Biotechnology; Proceedings of Andhra Pradesh Akademi of Sciences.

Fellowship of Indian and Foreign Academies

Fellow, Indian Academy of Sciences, elected in 1989; Fellow, National Academy of Sciences, elected in 1991; Fellow, Indian National Science Academy, elected in 1993; Fellow, Andhra Pradesh Academy of Sciences, elected in 2000; Fellow, National Academy of Agricultural Sciences, elected in 2001; Fellow, National Academy of Medical Sciences, elected in 2002. Fellow, Third World Academy of Sciences, Trieste, Italy (2002).

Research Contributions

In order to explore the tremendous potential of indigenously developed technology, Dr Lalji Singh has proposed, pursued and established a new centre, the Centre for DNA Fingerprinting and Diagnostics (CDFD) at Hyderabad under the Department of Biotechnology (DBT), as an Officer on Special Duty (OSD), CDFD.

Based on the studies of Dr Lalji Singh and his colleagues on Wildlife Conservation, Government of India has set up a "Laboratory for the Conservation of Endangered Species (LaCONES)" in Hyderabad close to the Nehru Zoological Park in collaboration with the Central Zoo Authority of India, New Delhi; the Dept. of Forests, Govt. of A.P, Hyderabad; the Centre for Cellular & Molecular Biology (CCMB), Hyderabad and the Dept. of Biotechnology (DBT), New Delhi.

G.B. Pant Memorial Lectures

I: Dr. M.S. Swaminathan, FRS -1991

II: Dr. T.N. Khoshoo, FNA 1992

III: Mr. V. Rajagopalan,
Vice President, World Bank 1993

IV: Prof. U.R. Rao,
Member, Space Commission 1994

V: Dr. S.Z. Qasim,
Member, Planning Commission 1995

VI: Prof. S.K. Joshi,
Vikram Sarabhai Professor 1996

VII: Prof. K.S. Valdiya,
Bhatnagar Research Professor 1997

VIII: Prof. Vinod K. Gaur
Distinguished Professor 1998

IX: Prof. H.Y. Mohan Ram,
INSA Senior Scientist 2000

X: Prof. J.S. Singh,
Emeritus Professor, BHU 2004

XI: Prof. Madhav Gadgil
Center for Ecological Sciences, IISc, Bangalore - 2005

XII: Dr. S.S. Handa
Ex-Director, RRL Jammu (CSIR) - 2006