



Genome Institute
of Singapore

Genome Institute of Singapore

60 Biopolis Street

#02-01 Genome

Singapore 138672

Tel: (65) 6478 8000 Fax: (65) 6478 9053

www.gis.a-star.edu.sg

PRESS RELEASE

December 11, 2009, 0300 hrs, Singapore

Scientific consortium maps the range of genetic diversity in Asia, and traces the genetic origins of Asian populations

Several genome-wide studies of human genetic diversity have been conducted on European populations. Now, for the first time, over 90 scientists from the Human Genome Organisation's (HUGO's) Pan-Asian SNP Consortium have extended this study to 73 Southeast Asian (SEA) and East Asian (EA) populations. This human genetic mapping of Asia has important implications, especially in the further understanding of migratory patterns in human history, and for the study of genetics and diseases. The findings were published online in a report in **Science** on 10 December 2009.

The study, conducted within and between the different populations in the Asia continent, showed that genetic ancestry was highly correlated with ethnic and linguistic groups. There was a clear increase in genetic diversity from northern to southern latitudes. The study also suggested that there was one major inflow of human migration into Asia arising from Southeast Asia, rather than multiple inflows from both southern and northern routes as proposed before. This indicates that Southeast Asia was the major geographic source of East Asian and North Asian populations (see accompanying picture). Moreover, the geographical and linguistic basis of genetic subgroups in Asia clarifies the need for genetic stratification when conducting genetic and pharmacogenomic studies in this continent.

One of the corresponding authors, Professor Edison Liu, Executive Director at the Genome Institute of Singapore (GIS), and the President of the HUGO which initiated and coordinated this research, said, "This study was a milestone not only in the science that emerged, but the consortium that was formed. 10 Asian countries came together in the spirit of solidarity to understand how we were related as a people, and we finished



Genome Institute
of Singapore

Genome Institute of Singapore
60 Biopolis Street
#02-01 Genome
Singapore 138672
Tel: (65) 6478 8000 Fax: (65) 6478 9053
www.gis.a-star.edu.sg

with a truly Asian scientific community. We overcame shortage of funds and diverse operational constraints through partnerships, good will, and cultural sensitivity.”

Professor Liu also added that, “Affymetrix, led by Dr. Giulia C. Kennedy and based in the US, is our primary technology partner in this endeavour. We greatly appreciate their support. Our next goal is to expand this collaboration to all of Asia including Central Asia and the Polynesian Islands. We also aim to be more detailed in our genomic analysis and plan to include structural variations, as well as over a million single nucleotide polymorphisms in the next analysis.”

Quotes from the co-authors:

“A full delineation of the genetic history of Asian populations requires a genome-wide study with high density markers. This is the next goal of the Consortium.”

Professor Li Jin
Fudan University

Director of the Chinese Academy of Sciences and Max Planck Society (CAS-MPG)
Partner Institute for Computational Biology

“Computational approaches played a very important role in this study, and as we worked on the analysis together, we began to develop a community. It was a great experience.”

Dr. Shuhua Xu

Associate Professor at Chinese Academy of Sciences and Max Planck Society (CAS-MPG) Partner Institute for Computational Biology (PICB) in Shanghai

“We have breached political and ideological boundaries to show that the people of Asia are linked by a unifying genetic thread. It was exciting to work together with scientists of such high caliber with contrary views and of diverse background –kudos to Prof Ed Liu”.

Professor Samir Brahmachari

Director General Council of Scientific and Industrial Research and
Secretary Department of Scientific and Industrial Research of the Government of India



Genome Institute
of Singapore

Genome Institute of Singapore
60 Biopolis Street
#02-01 Genome
Singapore 138672
Tel: (65) 6478 8000 Fax: (65) 6478 9053
www.gis.a-star.edu.sg

“In addition to providing a profound understanding of the peopling of Asia, this project has helped build bridges among population geneticists of various Asian countries.”

Professor Partha Majumder

Professor & Head, Human Genetics Unit, Indian Statistical Institute and
Director, Centre for Population Genomics, Kolkata, India

“This study marks a milestone of the collaboration among the geneticist from the 10 Asian countries and paves the road to a better understanding of our origin. We would like to extend this study not only in the direction of population genetics but also towards medical and health related issues.”

Professor Yuan-Tsong Chen

Academician, Distinguished Reserch Fellow and Director
Institute of Biomedical Sciences, Academia Sinica, Taipei, Taiwan

“What began as a simple desire of scientists from 10 countries to undertake a mutually informative study of basic genomics in the Asia-Pacific Region developed into a project of much greater significance in understanding our origin. This consortium is an excellent example of how scientific collaboration and cooperation between scientists from developing and developed countries can increase the power of scientific study.”

Professor Carmencita Padilla

Professor, College of Medicine and
Director, Institute of Human Genetics
National Institutes of Health Philippines
University of the Philippines, Manila

“The PASNP consortium has shown that a scientific collaboration by scientists from diverse culture, race, religion and economic strata is possible. The success of this collaboration is grounded in its show of human spirit growing strong in the face of great challenges, and rising to meet a common scientific goal. With initial obstacles overcome, we now look forward to the next phase of the study.”

Professor Bin Alwi Zilfalil

Associate Professor, School of Medical Sciences
Universiti Sains Malaysia, Kelantan, Malaysia



Genome Institute
of Singapore

Genome Institute of Singapore
60 Biopolis Street
#02-01 Genome
Singapore 138672
Tel: (65) 6478 8000 Fax: (65) 6478 9053
www.gis.a-star.edu.sg

“It was a dream come true after many years of discussion among Asian geneticists. This collaboration shows that we can work together very well in this part of the world and there is great complementarity in answering questions about the fundamental genetics of 60% of the world’s population. A worthwhile start to what will hopefully be a long term scientific endeavour.”

Professor Maude E Phipps
Monash University (Sunway Campus), Malaysia

“This study is a model of international collaboration at its best, where scientists from ethnically rich countries could collaborate with those from technologically more advanced centers on equal basis, to produce genomic data of fundamental significance. For our country, a huge archipelago with more than 500 ethnic populations, such data is of public health importance and has had an immediate impact in the study of disease distribution.”

Professor Sangkot Marzuki
Director, Eijkman Institute for Molecular Biology, Indonesia

“This project reflects a spirit of the scientific co-operation of colleagues in the region. This is beyond the limitation of politics and economic constrain of member countries. All of this will lead to the betterment of mankind in the future.”

Professor Suthat Fucharoen
Thalassemia Research Center, Institute of Molecular Biosciences
Mahidol University, Thailand

“The work described here is only the start. We wish to extend both the number of samples and ethnic groups.”

Professor Sumio Sugano
Professor, The University of Tokyo, Laboratory of Functional Genomics, Graduate School of Frontier Sciences

“The consortium's outcome is particularly timely as a whole human genome can be sequenced in one day, and it will become an important resource for the next level of genome research in Asia and beyond. The consortium has acquired key experiences of sampling, deposition, coordination, bioinformatic processing, and interpreting



Genome Institute
of Singapore

Genome Institute of Singapore

60 Biopolis Street

#02-01 Genome

Singapore 138672

Tel: (65) 6478 8000 Fax: (65) 6478 9053

www.gis.a-star.edu.sg

tremendous amounts of genomic data.”

Dr. Jong Bhak

Director, Theragen Bio Institute, Theragen Co. Ltd.

Formerly:

Korean BioInformation Center (KOBIC), Korea Research

Institute of Bioscience and Biotechnology (KRIBB), Korea

“This work truly shows how Asian scientists can share their thoughts, resources, and technologies to elucidate basic mechanisms of human diversities. Without sharing data of each ethnic group and support, this would have not been possible.”

Hyang-Sook Yoo

Korea Reserch Institute of Biotechnology & Bioscience

Figure:

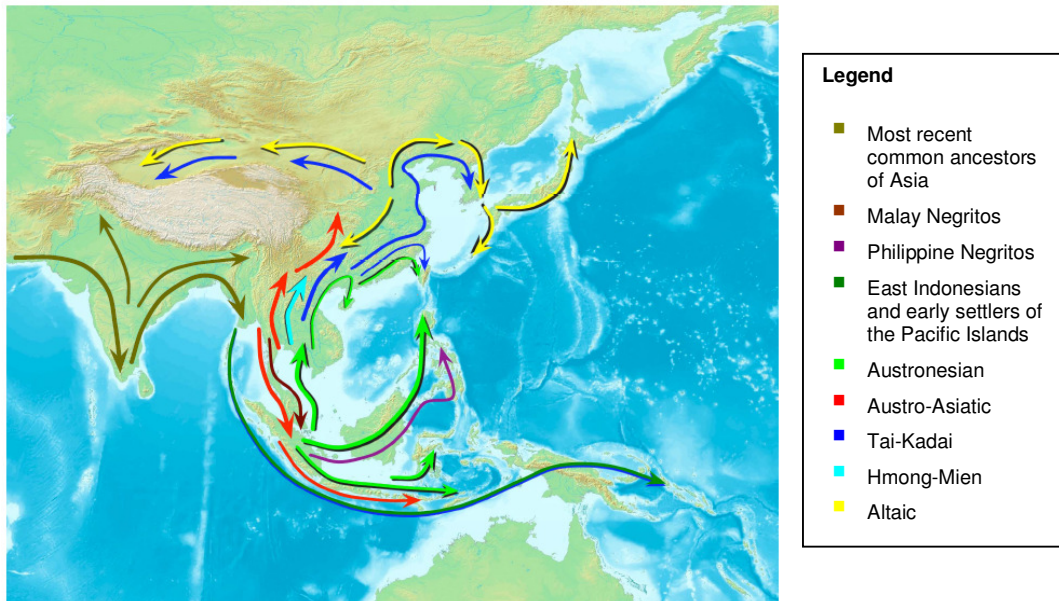
Putative Pre-Historical Migration Routes of Asian Human Populations

This figure shows plausible routes of pre-historical migration of Asian human populations.

According to our study, the PanAsia SNP Initiative, the most recent common ancestors of Asians arrived first in India (aqua-green). Later, some of them migrated to Thailand, and South to the lands known today as Malaysia, Indonesia, and the Philippines. The first group of settlers must have gone very far south before they settled successfully.

These included the Malay Negritos (brown), Philippine Negritos (purple), the East Indonesians, and early settlers of the Pacific Islands (dark green).

Thereafter, one or several groups of people migrated North, mixed with previous settlers there and, finally, formed various populations we now refer to as Austronesian (light green), Austro-Asiatic (red), Tai-Kadai (dark blue), Hmong-Mien (light blue), and Altaic (yellow) etc.





Research publication:

The research findings described in the press release can be found in a report in the December 10, 2009 online issue of ***Science*** under the title “**Mapping Human Genetic Diversity in Asia**”.

Authors:

Mahmood Ameen Abdulla,¹ Ikhlaq Ahmed,² Anunchai Assawamakin,^{3,4} Jong Bhak,⁵ Samir K. Brahmachari,² Gayvelline C. Calacal,⁶ Amit Chaurasia,² Chien-Hsiun Chen,⁷ Jieming Chen,⁸ Yuan-Tsong Chen,⁷ Jiayou Chu,⁹ Eva Maria C. Cutiongco-de la Paz,¹⁰ Maria Corazon A. De Ungria,⁶ Frederick C. Delfin,⁶ Juli Edo,¹ Suthat Fuchareon,³ Ho Ghang,⁵ Takashi Gojobori,^{11,12} Junsong Han,¹³ Sheng-Feng Ho,⁷ Boon Peng Hoh,¹⁴ Wei Huang,¹⁵ Hidetoshi Inoko,¹⁶ Pankaj Jha,² Timothy A. Jinam,¹ Li Jin,^{17,38} Jongsun Jung,¹⁸ Daorong Kangwanpong,¹⁹ Jatupol Kampaunsai,¹⁹ Giulia C. Kennedy,^{20,21} Preeti Khurana,²² Hyung-Lae Kim,¹⁸ Kwangjoong Kim,¹⁸ Sangsoo Kim,²³ Woo-Yeon Kim,⁵ Kuchan Kimm,²⁴ Ryosuke Kimura,²⁵ Tomohiro Koike,¹¹ Supasak Kulawonganchai,⁴ Vikrant Kumar,⁸ Poh San Lai,^{26,27} Jong-Young Lee,¹⁸ Sunghoon Lee,⁵ Edison T. Liu,⁸ Partha P. Majumder,²⁸ Kiran Kumar Mandapati,²² Sangkot Marzuki,²⁹ Wayne Mitchell,^{30,31} Mitali Mukerji,² Kenji Naritomi,³² Chumpol Ngamphiw,⁴ Norio Niikawa,⁴⁰ Nao Nishida,²⁵ Bermseok Oh,¹⁸ Sangho Oh,⁵ Jun Ohashi,²⁵ Akira Oka,¹⁶ Rick Ong,⁸ Carmencita D. Padilla,¹⁰ Prasit Palittapongarnpim,³³ Henry B. Perdigon,⁶ Maude Elvira Phipps,^{1,34} Eileen Png,⁸ Yoshiyuki Sakaki,³⁵ Jazelyn M. Salvador,⁶ Yuliana Sandraling,²⁹ Vinod Scaria,² Mark Seielstad,⁸ Mohd Ros Sidek,¹⁴ Amit Sinha,² Metawee Srikummool,¹⁹ Herawati Sudoyo,²⁹ Sumio Sugano,³⁷ Helena Suryadi,²⁹ Yoshiyuki Suzuki,¹¹ Kristina A. Tabbada,⁶ Adrian Tan,⁸ Katsushi Tokunaga,²⁵ Sissades Tongsimma,⁴ Lilian P. Villamor,⁶ Eric Wang,^{20,21} Ying Wang,¹⁵ Haifeng Wang,¹⁵ Jer-Yuarn Wu,⁷ Huasheng Xiao,¹³ Shuhua Xu,³⁸ JinOk Yang,⁵ Yin Yao Shugart,³⁹ Hyang-Sook Yoo,⁵ Wentao Yuan,¹⁵ Guoping Zhao,¹⁵ Bin Alwi Zilfalil,¹⁴ Indian Genome Variation Consortium²

Participating Institutions

¹Department of Molecular Medicine, Faculty of Medicine, and the Department of Anthropology, Faculty of Arts and Social Sciences, University of Malaya, Kuala Lumpur, 50603, Malaysia.

²Institute of Genomics and Integrative Biology, Council for Scientific and Industrial Research, Mall Road Delhi, 110007, India.

³Institute of Molecular Biosciences, Mahidol University, Salaya Campus, 25/25 M. 3, Puttamonthon 4 Road, Puttamonthon, Nakornpathom 73170, Thailand.

⁴Biostatistics and Informatics Laboratory, Genome Institute, National Center for Genetic Engineering and Biotechnology, Thailand Science Park, Pathumtani 12120, Thailand.

⁵Korean BioInformation Center (KOBIC), Korea Research Institute of Bioscience and Biotechnology (KRIBB), 111 Gwahangno, Yuseong-gu, Deajeon 305-806, Korea.

⁶DNA Analysis Laboratory, Natural Sciences Research Institute, University of the Philippines, Diliman, Quezon City 1101, Philippines.

⁷Institute of Biomedical Sciences, Academia Sinica, 128 Sec 2 Academia Road Nangang, Taipei City 115, Taiwan.



- ⁸Genome Institute of Singapore, 60 Biopolis Street 02-01, Genome, 138672, Singapore.
- ⁹Institute of Medical Biology, Chinese Academy of Medical Science, Kunming, China.
- ¹⁰Institute of Human Genetics, National Institutes of Health, University of the Philippines Manila, 625 Pedro Gil Street, Ermita Manila 1000, Philippines.
- ¹¹Center for Information Biology and DNA Data Bank of Japan, National Institute of Genetics, Research Organization of Information and Systems, 1111 Yata, Mishima, Shizuoka 411-8540, Japan.
- ¹²Biomedical Information Research Center, National Institute of Advanced Industrial Science and Technology, 2-42 Aomi, Koto-ku, Tokyo 135-0064, Japan.
- ¹³National Engineering Center for Biochip at Shanghai, 151, Li Bing Road, Shanghai 201203, China.
- ¹⁴Human Genome Center, School of Medical Sciences, Universiti Sains Malaysia 16150 Kubang Kerian, Kelantan, Malaysia.
- ¹⁵MOST-Shanghai Laboratory of Disease and Health Genomics, Chinese National Human Genome Center Shanghai, 250, Bi Bo Road, Shanghai 201203, China.
- ¹⁶Department of Molecular Life Science Division of Molecular Medical Science and Molecular Medicine, Tokai University School of Medicine, 143 Shimokasuya, Isehara-A Kanagawa-Pref A259-1193, Japan.
- ¹⁷State Key Laboratory of Genetic Engineering and MOE Key Laboratory of Contemporary Anthropology, School of Life Sciences, Fudan University, 220 Handan Road, Shanghai 200433, China.
- ¹⁸Korea National Institute of Health, 194, Tongil-Lo, Eunpyung-Gu, Seoul, 122-701, Korea.
- ¹⁹Department of Biology, Faculty of Science, Chiang Mai University, 239 Huay Kaew Road, Chiang Mai 50202, Thailand.
- ²⁰Genomics Collaborations, Affymetrix, 3420 Central Expressway, Santa Clara, CA 95051, USA.
- ²¹Veracyte, 7000 Shoreline Court, Suite 250, South San Francisco, CA 94080, USA.
- ²²The Centre for Genomic Applications (an IGIB-IMM Collaboration), 254 Ground floor, Phase III Okhla Industrial Estate, New Delhi 110020, India.
- ²³Soongsil University, Sangdo-5-dong 1-1, Dongjak-gu, Seoul 156-743, Korea.
- ²⁴Eulji University College of Medicine, 143-5 Yong-du-dong Jung-gu, Dae-jeon City 301-832, Korea.
- ²⁵Department of Human Genetics, Graduate School of Medicine, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan.
- ²⁶Department of Paediatrics, Yong Loo Lin School of Medicine, National University of Singapore, National University Hospital, Lower Kent Ridge Road, 119074, Singapore.
- ²⁷Population Genetics Lab, Defence Medical and Environmental Research Institute, DSO National Laboratories, 27 Medical Drive 117510, Singapore.
- ²⁸Indian Statistical Institute (Kolkata) 203 Barrackpore Trunk Road, Kolkata 700108, India.
- ²⁹Eijkman Institute for Molecular Biology, Jl. Diponegoro 69, Jakarta, 10430, Indonesia.
- ³⁰Informatics Experimental Therapeutic Centre, 31 Biopolis Way, 03-01 Nanos, 138669 Singapore.
- ³¹Division of Information Sciences, School of Computer Engineering, Nanyang Technological University, 50 Nanyang Avenue, 639798, Singapore.
- ³²Department of Medical Genetics, University of the Ryukyus Faculty of Medicine, Nishihara, 207 Uehara, Okinawa 903-0215, Japan.
- ³³National Science and Technology Development Agency, 111 Thailand Science Park,



Pathumtani 12120, Thailand.

³⁴Monash University (Sunway Campus), Jalan Lagoon Selatan, 46150 Bandar Sunway, Selangor, Malaysia.

³⁵RIKEN Genomic Sciences Center, W502, 1-7-22 Suehiro-cho, Tsurumi-ku, Yokohama 230-0045, Japan.

³⁶Department of Biochemistry, University of Hong Kong, 3/F Laboratory Block, Faculty of Medicine Building, 21 Sasson Road, Pokfulam, Hong Kong.

³⁷Laboratory of Functional Genomics, Department of Medical Genome Sciences Graduate School of Frontier Sciences, University of Tokyo (Shirokanedai Laboratory), 4-6-1 Shirokanedai, Minato-ku, Tokyo 108-8639 Japan.

³⁸Chinese Academy of Sciences and Max Planck Society (CAS-MPG) Partner Institute for Computational Biology, Shanghai Institutes for Biological Sciences, Chinese Academy of Sciences, Shanghai 200031, China.

³⁹Genomic Research Branch, National Institute of Mental Health, NIH, 6001 Executive Blvd, Bethesda, Maryland, 20892 USA

⁴⁰Research Institute of Personalized Health Sciences, Health Sciences University of Hokkaido, Tobetsu 061-0293, Japan.

Writing Team *:

- Prof. Edison Liu, Genome Institute of Singapore, 60 Biopolis Street 02-01, Genome, 138672, Singapore. email: liue@gis.a-star.edu.sg
- Dr. Mark Seielstad, Genome Institute of Singapore, Genome Institute of Singapore, 60 Biopolis Street 02-01, Genome, 138672, Singapore. email: seielstadm@gis.a-star.edu.sg
- Prof. Li Jin, State Key Laboratory of Genetic Engineering and MOE Key Laboratory of Contemporary Anthropology, School of Life Sciences, Fudan University, 220 Handan Road, Shanghai 200433, China
- Dr. Xu Shuhua, Chinese Academy of Sciences and Max Planck Society (CAS-MPG) Partner Institute for Computational Biology, Shanghai Institutes of Biological Sciences, Chinese Academy of Sciences, Shanghai 200031, China

About the Human Genome Organization

www.hugo-international.org

Human Genome Organisation (HUGO) is an international organisation formally established in 1988 to foster collaboration between genome scientists around the world. It is entering the 20th year of its history by making an inflection in its direction. Now that the human genome has been sequenced, we are seeking the biological meaning of its information content. To this end, it is focusing on the medical implications of genomic knowledge. Moving forward, HUGO is also working to enhance the genomic capabilities in the emerging countries of the world. The excitement and interest in genomic sciences in Asia, Middle East, South America, and Africa are palpable and the hope is that these technologies will help in national development and health.



Genome Institute
of Singapore

Genome Institute of Singapore
60 Biopolis Street
#02-01 Genome
Singapore 138672
Tel: (65) 6478 8000 Fax: (65) 6478 9053
www.gis.a-star.edu.sg

The HUGO Pan Asian SNP Consortium began in 2004 when a group of like-minded geneticists and genomicists from Asia decided to develop a collaborative programme to address the genetic architecture of Asian populations. The consortium was unique in the breadth and depth of involvement of Asian genetics communities and the engagement of so many Asian populations in the analysis.

About the Genome Institute of Singapore

www.gis.a-star.edu.sg

The Genome Institute of Singapore (GIS) is a member of the Agency for Science, Technology and Research (A*STAR). It is a national initiative with a global vision that seeks to use genomic sciences to improve public health and public prosperity. Established in 2001 as a centre for genomic discovery, the GIS will pursue the integration of technology, genetics and biology towards the goal of individualized medicine. The key research areas at the GIS include Systems Biology, Stem Cell & Developmental Biology, Cancer Biology & Pharmacology, Human Genetics, Infectious Diseases, Genomic Technologies, and Computational & Mathematical Biology. The genomics infrastructure at the GIS is utilized to train new scientific talent, to function as a bridge for academic and industrial research, and to explore scientific questions of high impact.

About the Agency for Science, Technology and Research (A*STAR)

www.a-star.edu.sg

The Agency for Science, Technology and Research (A*STAR) is the lead agency for fostering world-class scientific research and talent for a vibrant knowledge-based and innovation-driven Singapore. A*STAR oversees 14 biomedical sciences, and physical sciences and engineering research institutes, and seven consortia & centre, which are located in Biopolis and Fusionopolis, as well as their immediate vicinity.

A*STAR supports Singapore's key economic clusters by providing intellectual, human and industrial capital to its partners in industry. It also supports extramural research in the universities, hospitals, research centres, and with other local and international partners.



Genome Institute
of Singapore

Genome Institute of Singapore

60 Biopolis Street
#02-01 Genome
Singapore 138672
Tel: (65) 6478 8000 Fax: (65) 6478 9053
www.gis.a-star.edu.sg

For enquiries, please contact the following:

Genome Institute of Singapore

Winnie Serah Lim

Office of Corporate Communications

Tel: (65) 6478 8013

(65) 9730 7884

Email: limcp2@gis.a-star.edu.sg