African Pygmies, origins, biology and culture

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14:00
L.Luca Cavalli-Sforza (Stanford)
Some social customs of Centrafrican Pygmies of interest from a genetic point of view

14:45
Serge Bahuchet (Museé de l'Homme, Paris)
Linguistic and cultural diversity of African Pygmies

15:15
Paul Verdu (Ann Arbor, Michigan)
Anthropological Genetics of Central African Populations: History of the Pygmy Peopling

15:45
Fernando Ramirez Rozzi & Alain Froment (CNRS, Paris)
Growth in Baka pygmies. New project, aims, and preliminary results

16:15
Chiara Batini, Joao Lopes, Francesc Calafell, Lluis Quintana-Murci, Lolke van der Veen, Lynn Jorde, Gabriella Spedini, Doron Behar, Cristian Capelli, David Comas & Giovanni Destro-Bisol (Leicester, Oxford, Barcelona, Rome "La Sapienza")
Ancient and recent events in Pygmy demographic history: insights from uniparental markers

Chairmen

Alfredo Coppa e Giovanni Destro Bisol

Some social customs of Pygmies of importance for natural selection

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There are social customs observed mostly but not exclusively among African Pygmies of the Central African Republic, living at the boundary with Congo Brazza, that might give natural selection advantage. The first is the common advice to "marry far". This has the power to reduce the average consanguinity of children and therefore decrease their mortality in young age. It has also the advantage of acquiring hunting territories far from those that are inherited with ancestry, and therefore less likely to be already owned, and this is probably the real motivation as the potential damage of consanguinity is not likely to be known. Another custom about marriage is that future husbands are expected to compensate their in-laws of the loss of one daughter by spending time and working for them a substantial amount of time, one or two years, during which future couples have time to know each other, and also become familiar with in-laws. This is also a kind of payment in lieu of "buying a wife" from her father which is customary in most of Africa.

Other customs have to do with childbirth. Having children more often than every three years makes it impossible for pairs to move around to other hunting territories, as is made necessary by the need of not reducing too much the reproduction by local overhunting. For women to be able to move with their band it is necessary that ehe last child be older than three years so that it can walk independently when the next child will be born, and this is obtained by sex taboo for three years after the last child. It is true, however, that mistakes are easily corrected by abortions. Another custom is that mothers stop sex for good after a daughter of her has a bab hy, so that a grandmother can dedicate herself to train and help her daughter bring up her child: a true kin selection. Something similar is normal in many other aboriginal oppoulations, having the same effect as an earlier menopause by 10-12 years. It is also possible that an early ""cultural menopause" has antedated the onset of physiological menopause, another example of a physiological or anatomical change determined by spontaneous mutation following the onset of a widespread custom (like the loss of vision in animals that live exclusively in the dark): the spread of a spontaneous mutation made possible or maybe even favored by the loss of organs and/or functions made useless by new customs or accidents.

Linguistic and cultural diversity of the African pygmies

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Under the European name « African Pygmies » are gathered more than 15 different ethnic groups, all of them speaking different languages. They show also different cultural characteristics, not all of them being rainforest hunter-gatherers!

The specificity of the « Pygmies » is that all the languages they speak are related to languages spoken by non-pygmy populations of the Congo Basin, issued from the three families existing in this region (Adamawa-Ubangi, Bantu and Sudanic). Careful examination of the status of the tongues spoken by Pygmy groups leads to some interesting historical hypothesis. We have to distinguish between dialects (two related tongues which are mutually intelligible) and languages (tongues which are not understandable without learning). Three of these groups (Baka, Aka, Asua) use full languages, related to non-pygmy languages (respectively Ngbaka -Ubangi-, Ngando –Bantu, and Mangbetu –Sudanic). The majority of the other groups speak various dialects from languages spoken by their neighbours (e. g. Gyeli, Twa-Ekonda, Medzan…). Very few speak a language similar to the language of their neighbours (Efe, Bongo).

Bearing in mind that a language diverges in dialects when the group expands and the sub-groups gradually become isolated, and that the later stage is the diversification of sister-languages, we may assume that, during their history, the Pygmy populations underwent through successive phases involving the non-pygmy populations : a first phase of a life in association with the non-pygmy populations, during which the Pygmy group borrowed the language of the non-pygmy peoples ; then a phase of isolation during which this shared language evoluated in different dialects, spoken by the Pygmies on the one hand, and the non-pygmy peoples on the other hand, and lately, for some groups like Baka, Aka or Asua, by a stronger isolation during which their dialects evoluated in full languages, different from the farmers' languages. During this phase, which is still lasting nowadays, the Pygmy groups entered in contact with other farmers, but without exchanging their language.

It is most interesting to place this pattern in front of the results of the genetic studies, showing various levels of admixture between the different Western Pygmy groups. Thus we may hypothesize some relationship between linguistic status, level of admixture and size of the groups.

Anthropological Genetics of Central African Populations: History of the Pygmy Peopling

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Central Africa is currently peopled by numerous sedentary agriculturalists populations, neighboring the largest group of hunter-gatherer populations worldwide: the African Pygmies. Archaeological remains attest the presence of numerous *Homo sapiens* populations in the Congo Basin since at least 30,000 years. However, little is known about the origins of Pygmy populations.

We present results on 21 Central African Pygmy and neighboring Non-Pygmy populations genotyped at 28 autosomal microsatellite markers. Using population genetics, we describe the neutral genetic diversity of Central African populations and, using new Approximate Bayesian Computations (ABC), we compare several historical and demographic scenarios to reconstruct the history of Central African peopling.

We found high levels of genetic differentiation among African Pygmies and evidences of heterogeneous levels of asymmetrical gene-flow from Non-Pygmies into each Pygmy group, consistent with the socio-cultural barriers ruling intermarriages. ABC procedures strongly suggest that all populations designated as Pygmy in Western Central Africa recently (about 2,800 years ago) diverged from a single ancestral population, which itself diverged about 70,000 years ago from the ancestral lineage that gave birth to the Non-Pygmy populations. Finally we investigated, indirectly from genetic data, the effective dispersal of Pygmies using Isolation By Distance theory. We surprisingly found that, despite Pygmies' very mobile behaviour, limited parent-offspring dispersal is likely to be a key mechanism for the genetic isolation and subsequent differentiation of Western Central African Pygmy population.

Our results show that recent isolation and heterogeneous admixture enabled a rapid genetic differentiation of Western Central African Pygmies since the onset of the expansion of Bantu speaking populations about 3,000 years ago.

Growth in Baka pygmies. New project, aims, and preliminary results

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The mechanism of human growth variation is not fully understood. Does human growth differ under different environmental pressures? Does it present a solid genetic base? Is a unique pattern of human growth valid for all modern human populations? One of the major problems to characterize growth in some populations resides in the lack of chronology knowledge of growth steps. Indeed, hunter-gatherers groups do no have a record of birth and thus studies of growth have to estimate individual age on the bases of relevant historical events for the population under study.

Among modern human populations, pygmies stand at the most extreme position of human variation, with a height lesser than 1.55 meters (Cavalli-Sforza 1986). The reduced size is the final product of underlying processes and therefore it reveals that growth mechanisms are certainly different than in non-pygmies populations. The study of growth in pygmies groups would provide a better understanding of growth variation in modern humans.

During the last 30 years, several works have focused on the growth of pygmies groups. All are founded on the assumption that the reduced size in pygmies results of a deficiency in the GH-IGF axis. However, at the moment it is not clear at what level of this axis the deficiency applies neither if the deficiency exists all along the life of pygmies or if it is limited to a stage of their growth. Some few works attempted to follow up body growth longitudinally in African pygmies, but as mentioned before the lack of a chronological framework has led authors to concentrate in the first five years of life (Bailey 1991, van Eijk 1986) or to deduce individual ages from historical events and to reduce the longitudinal study to a couple of years (van Koppel et al. 1986). It is noteworthy that whereas Bailey (1991) found differences in weight and size from birth between Mbuti pygmies and neighbours Lese, in the analysis of Baka pygmies van Eijk records similar weigh and size at birth as Bagandu and Bamileke and suggests differences in these parameters appear around the age of 5.

The knowledge of growth in pygmies can only be resolved by a longitudinal study at population level where chronology is known. We started such a kind of study in 2007 at Bosquet, Southeast Cameroon. Bosquet is a catholic mission installed around 1973 in the equatorial rain forest in a land not occupied by Bantu, in order to help Baka pygmies. It comprises a medical center which yields records of birth from the seventies till today. The number of Baka pygmies has fluctuated from Bosquet foundation to today. The last census carried out in 2009 indicates a population of around 800 Baka individuals. Baka families arrange by quartiers the names of which remember the area from where they come.From 2007, we conduct an annual mission to Bosquet in order to follow up growth in individuals from 3-4 to 18-20 years. Only individuals whose birth has been recorded in the medical center at Bosquet are considered in our study.

Height and weight are measured in non-adult individuals; many other anthropometric measurements are also taken in adults. Anthropometric measurements are completed by the study of dental growth; oral inspection enables to classify each tooth as absent, in eruption or in occlusion in order to characterise the dentition. A record of menarche is under process. All these characters are coupled with chronological ages. Since record of birth is available from 1988, we obtain from mothers the age at first birth and the interval of births. Blood samples are taken from young individuals at different ages in order to study the genetic, endocrinologic and epigenetic profiles of Baka. In addition, casts of dentition have been obtained during several years in the same individuals, to allow the study of tooth morphology and discrete characters in teeth. They are also used to study microwear and the turnover of microwear over time.Merimee et al. (1989), using the study of Aka pygmies from CAR, have suggested that the lack of growth spur in teenagers

is responsible of the reduced size in African pygmies. However, von Koppel et al. (1986) observe an activation of growth in adolescence. But it is true that the assessment of growth spur can only been carried out in longitudinal studies, while von Koppel et al.'s analysis comprises only a couple of years. We have already recorded changes in size and weight during 4 years in around 200 individuals, and our purpose is to follow them up over 2-3 more years. A longitudinal study of around 6-7 years at population scale will certainly enable to assess the growth spur in Baka pygmies.Dental growth is assumed to be a good proxy for individual growth in inter-species comparisons (Schultz 1935, Smith 1989, 1991). Indeed, the age of M1 eruption is highly correlated to several life history variables and thus the establishment of the age of M1 eruption would allow to document life history in fossil hominid species. However, it is not known if this observation applies to intra-species comparison. In fact, the age of M1 eruption is only known in very few modern human populations, and dental ages founded principally on European standards are used to attribute individual ages to children from all others groups. The characterisation of dental growth in Baka population at Bosquet will enable to establish the chronology of dental growth steps and to observe if Baka follow similar pattern as other populations. Several life history variables are obtained in Baka. Their correlation with dental steps will be assessed. If dental growth and life history variables do not differ in Baka, it would mean that these aspects have a solid genetic base in modern human and could be used to characterise our species. Conversely, if these aspects differ, or the correlation between them is not significant, genetic history or environmental pressures would have to be further explored as causes of differences

The genetic base of the GH-IGF axis deficiency has not been found at the moment. It is possible that this deficiency does not affect individual during the whole life but is limited to a short period during growth. Indeed, although criticism exists about the validity of results, Merimee et al. (1987) have observed a lower activity of the IGF 1 receptor in teenagers. Our longitudinal study will enable to detect if concentration or activity differ during growth in Baka when compared to non-pygmy populations.

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