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Short Communication

Gotra & Genetics - The science behind the Vedic thoughts and its application in modern day Indian society

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Abstract:

In India since Vedic ages the concept of Gotra exists. Gotra concept was emphasized in Vedic culture for decision on marriage. It is important to revisit the Gotra concept with the help of current knowledge on genetics. Gradual shortening of Y chromosome is one of the dire scenarios which requires further research with a special emphasize on effect of same Gotra marriage. Consanguinity is related to different genetic diseases, which emphasizes the importance of not marrying "blood relatives" or "biological relatives". The Vedic Rishis had observed the degeneration of the Y chromosome and they wanted to maintain as many individual healthy unique Y Chromosome lineages as possible. That would give a fair chance for males to continue to exist because Y Chromosomes get passed on over generations with almost negligible change in their genetic combinations, as they do not take part in mix and match with other Chromosome and the only way to stop that was to ensure that the 5% of the Y Chromosome which can be mixed and crossed over with its X counterpart be protected so that the remaining 95% which does not take part in the mix and match process (which self-heals by having duplicate copies of its genes) stays healthy. There are evidences which suggest gotra system maintains a genetic male lineage via Y chromosome and cousin marriages within the immediate family relations are known to cause genetic disorders. Whether we need to retain the Gotra rules in deciding marriage alliance and whether same Gotra boy and girl (when they come from distant families) still share the same genes like between immediate cousins – should be left to science. The Gotra System might have had its benefits in its initial days as it prevented marriages between closely related cousins then. We need further research, focused genetic studies on this aspect and if genetic studies based on analysis of same Gotra families have not found any problem with same Gotra marriages scientifically, then there is no point in continuing with the Gotra system to decide matrimonial alliances.

Keywords: gotra; gene; y chromosome; consanguinity; genetic disorder

What is a gene?

The actual definition of genes is a specific sequence of nucleotides in DNA or RNA that is located usually on a chromosome and that is the functional unit of inheritance. Genes are made up of DNA. The main functions include regulation, expression, function and evolution of genes in all biological contexts, including all prokaryotic and eukaryotic organisms as well as viruses. Some genes act as instructions to make molecules called proteins. However, many genes do not code for proteins. In humans, genes vary in size from a few hundred DNA bases to more than 2 million bases. The Human Genome Project, which is an international research effort determines the sequence of the human genome and identify the genes that it contains, estimated that humans have between 20,000 and 25,000 genes. Alleles are each of two or more alternative forms of a gene that arises by mutation and are found at the same place of chromosome. These small differences contribute to each person's unique physical features. [1]

What is a chromosome?

Chromosome is a thread-like structure packaged with DNA molecules. Each chromosome is made up of DNA tightly coiled around a protein called histone which supports its structure. Each chromosome has a constriction point called Centromere which divides the chromosome into two sections or 'arms. The short arm of chromosome is referred to as 'p arm' and the long arm of chromosome is referred to as 'q arm'. The location of centromere determines the characteristic shape of chromosome and also helps us to identify the location of a specific gene. Humans have 23 pairs of chromosomes and each pair comes from the father and the mother. So, the total number of chromosomes is 46 of which 23 chromosomes come from father and 23 chromosomes from mother. Out of these 23 pairs of chromosomes, 22 pairs are autosomes and one pair is known as the 'sex

chromosome'. During conceiving, if the resultant cell has 'XX' sex chromosomes, then the child will be girl and if the resultant cell has 'XY' chromosomes, then the child will be boy. So, we can infer that 'X' chromosome determines the female attributes of a child and 'Y' chromosome determines the male attributes of a child. When the embryo cell has XY chromosomes, the female attributes get suppressed by the genes in the Y chromosome and the embryo develops into a male child. [2] The Y chromosome is present only in the male's body. The Y chromosome is present only in the male's body. The X chromosome is significantly different than Y chromosome. The size of the Y chromosome is one-third the size of X chromosome. The Y chromosome is always preserved in the male lineage because the son always gets from his father and on the other hand, the X chromosome is not preserved in the female lineage, because it comes from both the father and the mother.

Gradual shortening of Y chromosome - the dire scenario

The size of Y chromosome has been decreasing since ages, as it has lost most of the genes and therefore reduced in size. A debate has occurred whether the Y chromosome will be able to survive since no other chromosome will be able to take over its functionality. There is no way to repair a Y chromosome as all the other chromosomes come in pairs. So, there is no chance for Y chromosome to repair itself by doing crossover with its chromosomal pair. This cross-over mechanism allows different combination of mix and matches to happen between the genes of the father and mother making the chromosome stronger by allowing the best of the matches to survive as they evolve in successive generation. The Y chromosome do not have corresponding equivalent chromosome in its pair. It can only exist in XY combination of which only a small 5 % of X chromosome matches with a Y chromosome and the rest 95% of Y chromosome which is crucial in the development of male characters have no matches at all. It is this 95% of Y chromosome which is completely responsible in humans for generating male characteristics. As discussed earlier, the Y chromosome has to depend on itself to repair any of its injuries and to reserve any duplicated genes created within it. The does not stop the damage of DNA in the Y chromosome as it escapes its local repair process and is being propagated into the male off-springs.[3]

This causes the Y chromosome to accumulate abnormalities over a prolonged period of evolution and scientists believed that this is the reason which is causing the Y chromosome to keep losing its weight. The other chromosome does not face this issue as both the corresponding pairs come from both the parent and most of the DNA damage can be corrected by the cross-over mechanism. This eliminates the damaged genes and one of the most important processes in the evolution of life.

So, to summarize the Y chromosome is crucial for the creation and evolution of males. It does not participate in the mix - and - match mechanism which helps us to eliminate any defective DNA and creating a better version in any successive generation. This tendency may lead to the extinction of Y chromosome over the next few million years which will lead to the extinction of males.

Laws of Inheritance

Gregor Johan Mendel proposed three laws of inheritance which are classified as

1. Laws of dominance: In heterozygous conditions, the allele whose characters are expressed over the other allele is called the dominant allele and the characters of this dominant allele are called dominant characters.
2. Laws of segregation: Two traits come together in one hybrid pair, do not mix with each other and are independent of each other.
3. Laws of independent assortment: There are separate genes for different traits and characters and they influence and sort themselves independently of other genes. This law also states that at the time of gamete and zygote formation, the genes are independently passed on from the parent to the offspring.

Gotra

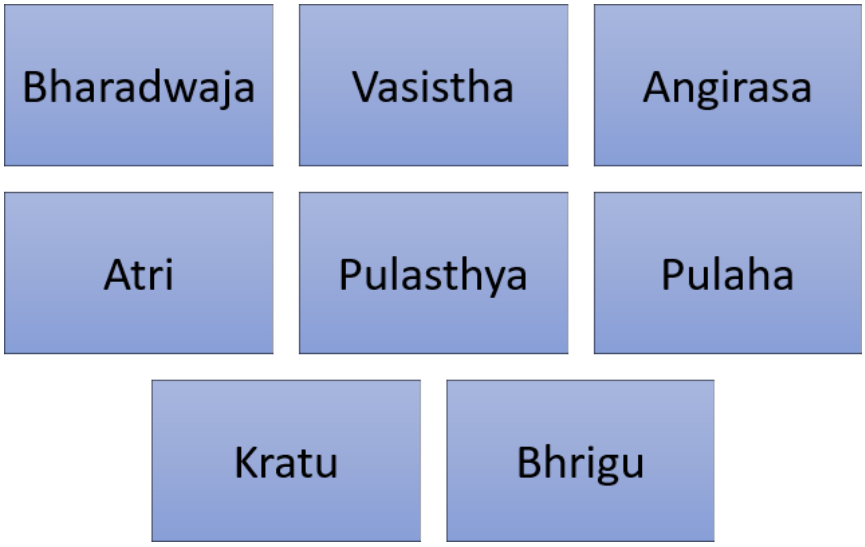
In Vedic culture, the term Gotra is commonly considered to be equivalent to clan, referring to the descendants in an unbroken male line from one main ancestor. "The word Gotra denotes the progeny (of a sage) beginning with the son's son." The progeny of the seven sages known as 'Saptarishis' are declared to be Gotras, however, these Saptarishis are different from another since all these Rishis have acted as 'Saptarishis' at one time. Gotra forms an exogamous unit. Marriage within the same Gotra was regarded as incest and hence prohibited. Marriages within the same Gotra ('sagotra') marriages are not permitted in the traditional.

This custom was established to avoid marriages between blood relatives in the backdrop of more abnormalities in children born to sagotra couple.The 'Gotras' go after the name of the Rishi and his progeny. For example, families belonging to the Bharadwāja Gotra are the followers of Bharadwāja Maharishi. People with same Gotra are considered to be siblings. The classification of Gotra came into existence in Vedic period.

Modern genetics corroborate this view point. If a bride is picked up from another Gotra, she will become a new member of the followers of Bharadwāja, gotra thereby increasing the number of the followers.

Saptarshi Mandalam

In astronomy, Saptarishi Mandalam is known as 'Ursa Major or Big Bear'. It is Bear because the seven stars of Saptarishi Mandalam with other neighbouring stars resemble a Bear. It is 'Big' because another cluster like and mirror image of it just above it is called 'Ursa Minor' or 'Little Bear' wherein Polaris is a star in line with Merak and Dubhe stars. At present, Bhrigu, Vasishta, Āngirasa, Atri, Pulasthya, Pulaha and Kratu are the Saptarishis.



Consanguinity

Consanguinity is defined as "genetic relatedness between individuals descended from at least one common ancestor." In simple terms, consanguinity means two individuals are "blood relatives" or "biological relatives." There are many cultures in which it is favored to marry a blood relative for various reasons chief of which are retaining property within the household where dowry system is prevalent and the other is for compatibility. It is a deeply rooted tradition in nearly in approximately 1/5 of the world's population. most commonly in the Middle East, West Asia, and North Africa. Increased risk for birth defects and genetic disorders in children of consanguineous marriages because of "autosomal recessive" genetic disorders and other conditions related to a number of different factors between related people (i.e., multifactorial disorders). [4]

Discussion on Atulya gotra (Marriage in different clan)

The concept of marriage in different clan has been mentioned centuries ago by the ayurvedic scholars. They knew this fact that the diseases which are by the genes from one generation to the other result in occurrence of disease. Even for procreation of a healthy child, it is necessary that both partners should be mutually from a different clan.

Relation with modern clinical medicine

The Gotra system was defined around 4th century BC, to accommodate changed social rules and laws. For many genes, the body copes with just a single working copy but when both the copies are faulty, the person gets autosomal recessive diseases. Unlike other chromosome, there is no way for Y chromosome to repair itself by doing crossover with its chromosomal pair. All other chromosomes come in similar other pairs and repairs themselves by copying over DNA from the paired chromosomes (examples of diseases are cystic fibrosis, Phenylketonuria, spinal muscular dystrophy). With passage of time the system became an important parameter for finalizing a wedding and is now a well-established system even in the modern society. Diseases like galactosemia, retinoblastoma, albinism, sickle cell anemia, thalassemia, Tay - Sachs disease, autism, growth hormone deficiency, adenosine deaminase deficiency, and juvenile muscular dystrophy are due to genetic disturbance. [5]

These 7 Rishis are called Gotrakarin meaning roots of Gotras. All other Brahmin Gotras evolved from one of the above Gotras. What this means is that the descendants of these Rishis over time started their own Gotras. The total number of established Gotras today is 49. However, each of them finally traces back to one of the roots Gotrakarin Rishi.

Gotra System – An attempt to protect the Y chromosome from becoming extinct?

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The Vedic Rishis had observed the degeneration of the Y chromosome and they wanted to maintain as many individual healthy unique Y Chromosome lineages as possible. That would give a fair chance for males to continue to exist because Y Chromosomes get passed on over generations with almost negligible change in their genetic combinations, as they do not take part in mix and match with another Chromosome.

And the only way to stop that was to ensure that the 5% of the Y Chromosome which can be mixed and crossed over with its X counterpart be protected so that the remaining 95% which does not take part in the mix and match process (which self-heals by having duplicate copies of its genes) stays healthy.

There were chances that the resulting male can be a victim of such defective gene expression, and any such gene expressions which took place in the 5% exposed area of the Y chromosome would be fatal for the continuity of that Y chromosome. Even after hundreds of generations there would still be chances of any defective genes being propagated within these successive generations, and marriage within the same Gotra would provide a golden opportunity for these genes to express themselves, thereby causing the genetic abnormality in the offspring.

Should Gotra System be used to decide marriages?

Please note that of all the scientific reasoning mentioned in the article about the Gotra System, the ONLY PROVED science is that the

- Gotra System maintains a Genetic Male Lineage via Y Chromosome.
- Cousin marriages within the immediate family relations are known to cause Genetic Disorders.

Whether we need to retain the Gotra rules in deciding marriage alliance and whether same Gotra Boy and Girl (when they come from distant families) still share the same genes like between immediate cousins – should be left to science.

The Gotra System might have had its benefits in its initial days as it prevented marriages between closely related cousins then. But how appropriate would it be following this system thousands of years later today in deciding matrimonial alliances? If Genetic studies based on analysis of same Gotra families have not found any problem with same Gotra marriages scientifically, then there is no point in continuing with the Gotra system to decide matrimonial alliances [6].

Conclusion:

Marriage is finally more of a bond between two souls rather than two bodies, so it's nobody's business to interfere in a marriage where the boy and girl are above minimal legal age required for marriage and are marrying with mutual consent. It is also a duty of modern medicine clinical researcher to devote time in exploring the effect of same Gotra marriage on next generation's genetic lineage.

References

1. Jobling MA, Tyler-Smith C. (2003). The human Y chromosome: an evolutionary marker comes of age. *Nature Reviews Genetics*. 4:598–612.
2. Escoffier L, Smouse PE, Quattro JM. (1992). Analysis of molecular variance inferred from metric distances among DNA haplotypes: application to human mitochondrial DNA restriction data. *Genetics*. 131:479–491.
3. Ayub Q, Mohyuddin A, Qamar R, Mazhar K, Zerjal T, et al. (2000). Identification and characterization of novel human Y-chromosomal microsatellites from sequence database information. *Nucleic Acids Res*. 28: e8.
4. Ramasundrum V, Tan CT. (2004). Consanguinity and risk of epilepsy. *Neurol Asia*, 9 (Suppl 1): 10-11.
5. Mehndiratta, MM; Paul, B; Mehndiratta, P (2007). Arranged marriage, consanguinity and epilepsy *Neurology Asia*. 12 (Supplement 1): 15–17.
6. Singer, Milton; Cohn, Bernard S., eds. (2007). Structure and change in Indian society (1. paperback printing ed.). New Brunswick, N.J.: Aldine Transaction. p. 408. ISBN 978-0202361383.