



Basis of Genetics in Ayurveda – a review article

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ABSTRACT:

The concept of genetics has been cited in Ayurveda classical texts indicating that Scholars of Ayurveda had a fine understanding of concept of genetics thousands of years back. Different combinations of *mahabhutas* and *doshas* pertain to genotype and manifestations of such arrangements pertain to phenotype. Genotype in ayurveda has been defined as *beeja*, *beejabhaga*, *beejabhagavyava* to utmost extent. *Beeja* refers to the blueprint that has entire information of an individual. A *beeja* consists of small units, *beejabhaga*, which has further smaller units, *beejabhagavyava*. Genotype leads to manifestation of phenotype which refers to *Prakriti*. There are certain other factors which have an influence on *Prakriti*. It is the umbrella term in ayurveda which most appropriately corresponds to phenotype of individual. In short, phenotype is a manifestation of genotype and influencing factors. To support this fact, there are various descriptions in Ayurveda regarding the genetic and hereditary basis of diseases. In the present study, the objective is to understand the concept of genetics as per contemporary parlance.

Keywords: Genetics, *bhutas*, *beeja*, *beejabhaga*, *beejabhagavyava*, *prakriti*, phenotype

INTRODUCTION:

Genetics is the branch of biology concerned with the study of the genetic material of organisms, its manifestation as genes, and inheritance of those genes by the offspring. This more or less corresponds to the description of ancient Ayurveda scholar of how foetus is formed. Modern genetics has been categorized into many branches viz. Molecular Genetics, Epigenetics, Population genetics, for simplification. In present study, an attempt has been made to understand root of genetics in Ayurveda on contemporary ground. Acharya Charak on scheme of molecular biology states that *beeja* (seed) is the structural and function unit of human reproductive aspect. It is a blueprint within which many seed parts referred to as *beejabhaga* are impregnated. *Beejabhaga* has further smaller subdivisions called *beejabhagavyavas*. *Beejabhag* leads to manifestation of various organs of the body and *beejabhagavayaya* is responsible for the minutest particulars of that organ. Thus from the *beeja*, *beejabhaga* and *beejabhagavyava* of an individual, another human being is created with the same set of organs. In contemporary terms, *beeja* and its parts correspond to genotype. Genotype is a result of union of sperm and ovum at the time of conception. Epigenetics and Population genetics has its basis in description of *Prakriti*. Phenotype is the manifestation of genotype, as various *Prakriti* are formed depending upon factors other than genes i.e. *kala* (time factor), *garbhashya* (womb), *matur aahar vihar* (dietary and lifestyle regime of mother), *mahabhuta prakar* (five basic elements). *Prakriti* is again influenced by factors like *jati* (social structure), *kula* (race), *desha* (place of origin), *kala* (time factor), *vaya* (age), *pratyatma* (self/soul).

In another context, marriages within same *gotra* (lineage) have been prohibited in Ayurveda. It can be derived that it was believed to have implications on the progeny in short term and entire population in longer term. As per recent researches, consanguineous marriages increase the chances of genetic disorders in the offspring.

MATERIAL AND METHODS:

1. The present study has been done after thoroughly going through classical texts in relation to genetics in Ayurveda.
2. Literary review of *garbha*, *Prakriti*, *sharir* was prepared from Charak and Sushruta samhita.
3. All relevant references were looked for and an attempt was made to understand the concept in contemporary aspect.
4. Recent researches in relation to *Prakriti* and genetic study was assessed. A correspondence between *Prakriti* and genetics was established.

DISCUSSION:

As per Ayurveda, at the time of fertilisation, four set of four *mahabhutas* each (basic elements; *akasha mahabhuta* excluded), thereby having a total of sixteen *bhutas* (elements), i.e. one set derived each from the mother, the father, from nutrition of the mother, and from the self (soul/past deeds). Among these factors, the *bhutas* related to past deeds of the soul and the parents significantly influence the physical, physiological

and psychological traits of the progenyⁱ. Resemblance to parents is also determined by the deeds of past life. Four *karmajabhutas* (derived from the past deeds of self) which are associated with the soul enter into the fetus at a speed as fast as that of mind and is not visible by naked eye. This process of inheritance of blueprint of sixteen elements is known as *beejadharmā*.ⁱⁱ The parental factors and basic elemental factors can be included in *Shukra Shonita Prakriti* (sperm & ovum factors), and *Mahabhuta-Vikara Prakriti* (metaphysical and elemental factors) as mentioned by Acharya Charakⁱⁱⁱ. Inheritance is the process of passing on of genetic information from parentages to offspring.

Genetics as the branch of biology has been classified into many subfields like molecular genetics, epigenetics, population genetics, for enhanced understanding of concept of inheritance. Although no such apparent classification was there in Ayurveda, but at various contexts, references of genetics is derived which can be described as under.

A. Molecular genetics

In molecular genetics, the differences in the structures or expression of DNA molecules manifest as variation among organisms. It determines the structure and function of genes in an organism's genome. At molecular level, concept of *beeja*, *beejabhaga* and *beejbhagavyava* has been well explained by Ayurveda scholars. If any part of the seed or *beeja* i.e. *beejabhaga* is defective, it would result in a defect in concerned part of the body, representative of chromosomal or genetic defects^{iv}. Defects in *indriyas* are attributed to *daiva* (past deeds), or fate, in the texts.

In a separate context of *Atulyagotriya* (having different ancestors), acharyas have emphasised on the importance of marriages between different *gotras* (clan).

'*Atulya*' means diverse or which cannot be compared and '*Gotra*' denotes the progeny (clan) of a common ancestor. The scholars of ayurveda emphasised upon the importance of diversity in progeny i.e. *Atulya Gotra* and thus laid down the foundation of genetics in Ayurveda^v. Consanguineous marriage is defined as a union between two individuals who are related. Such marriages are associated with an increased risk for congenital malformations and autosomal recessive diseases, with some resultant increased postnatal mortality.^{vi} Various researches are still ongoing to establish a relation between consanguineous marriages and genetic disorders like Down's syndrome, increased risk of Diabetes, cardiovascular diseases, infertility etc. This implies to the fact that ancient scholars were aware of various disorders caused due to in-breeding within related families, and thus they instructed to forbid marriages within a *gotra*. They addressed the disorders right from the stage of conception to ensure good health within families and societies.

In a different context, Ayurveda scholars have described the factors determining the sex of a child, causes of twin or multiple pregnancies. This is another reference of their understanding of genetics. Due to defects in the sperm, ovum, past deeds of the soul, uterus, time and mother's diet and lifestyle, *doshas* get vitiated causing various abnormalities in physical features like complexion etc. and sense organs.

Determination of Sex:

They opine that in determining the sex of foetus, one gets male or female child depending upon the dominance of *shukra* (sperm fraction) or *shonita* (ovum fraction) after fertilisation, respectively. It means, if the proportion of *shonita* is more, the offspring is going to be a female. On the other hand, if *shukra* part is more, then the offspring is going to be a male^{vii}. Alongwith quantity, the functional potency of *shukra* and *shonita* also influence the formation of accessory sex characters.

In present time, some aspects of sex determination such as the evolution of sex chromosomes and the molecular mechanism of sex determination are well understood. XX/XY sex-determination system is present in almost all mammals. Here, it can be inferred that, ovum part mentioned by acharyas correspond to the X chromosome/allosome of mother, and sperm part corresponds to Y chromosome. Permutation and combination of X and Y chromosome ultimately decide the sex of foetus.

Cause of twin or multiple pregnancy:

Bifurcation of the zygote having overall dominance of *shukra* leads to development of two male foetus. And bifurcation of the zygote having dominance of *shonita* (ovum) leads to development of two female foetus. The aggravated *vayu* splits the zygote in various ways which can result in multiple pregnancies. It is also attributed to the effect of past deeds or destiny by various scholars^{viii}.

B. Epigenetics

Epigenetics is the branch of genetics related to study of heritable phenotype changes that do not involve alterations in the DNA sequence, but often involves changes that affect gene activity and expression. It also describes any heritable phenotypic change which may result from external or environmental factors, or be part of normal development.

Pertaining to ayurveda, these factors can very well be understood from *Kala garbhashaya Prakriti*, *Matur ahar vihar Prakriti* mentioned under the *dosha prakriti* description^{ix}.

***Kala-Garbhasaya Prakriti* (time factor and womb at the time of conception)**

It has two aspects- *Prakriti of Kala* (time) and *Prakriti of Garbhasaya* (womb)

Prakriti of Kala (time)

There are different effects of time factor on union of sperm and ovum. It is measurable time. *Ayurveda* emphasises significance of time in terms of *yuga*, *vaya* (lifespan), day and night, season, time passed after food intake. *Dosha* variation within physiological limits depends upon all these factors. For instance, in early hours of day, kapha is dominant; in mid day, pitta is dominant; in late hours of day, vata is dominant. Accumulation of *Vata* is observed in *Grishma*, aggravation in *Varsa* and alleviation in *Sharada* respectively,

of *Pitta* is observed in *Varsa*, *Sarata* and *Hemanta* respectively and of *Kapha* is observed in *Shishira*, *Vasanta* and *Grishma* respectively.

Predominance of a particular *dosha* in respective season imparts similar characteristics to plants, food, or basically everything we are ingesting. After ingestion, it ultimately shows its predominance in maternal organs including ovum, uterus, and in turn ultimately affecting embryo.

Prakriti of garbhasaya –status of womb

This indicates health status of uterus during time of conception including age of a woman. If sexual organs are not developed properly, a male and female should not indulge in intercourse. Both partners are imperative to have achieved physical and psychological maturity before indulging in act of intercourse. Conception in reproductive age is imperative to have a healthy progeny. There is increased risk of complication of pregnancy, congenital deformity if Conception occurs before or after normal reproductive age.

Normal uterus and time of coitus are not the only suggestions but the position of partners during intercourse is also indicated. Position of partners, their physiological and psychological status like hunger, thirst, frightened, lost somewhere, happy or sad mood, angry mood, very young or very old age, suffering from diseases, all these factors affect foetus. Any abnormality in these factors renders abnormality to the child.

Planning of conception according to time, season, age, healthy or diseased state as per *Prakriti* etc. and consultation therefore is important for healthy progeny. A male and female should take advice regarding their diet and other important instructions for confirming quality of their sex gametes that will unite and give birth to a child.

***Matur Ahara Vihara Prakriti* (dietary and lifestyle regime of mother)**

During pregnancy, the *Ahara* (dietary habits) and *Vihara* (lifestyle regime) of the mother affects the nature of the child she is going to deliver. If the desires of pregnant women are not fulfilled, the child develops untoward characters.

These predictors are mentioned under *Satmyaja Bhava* (wholesome regimen) and *Rasaja Bhava* (nutritional aspect) of six procreator factors necessary for formation, growth and development of foetus^x.

Satmyaja bhava imparts characteristics to individual which includes the state of freedom from diseases, lack of laziness and lack of greed, clarity of senses, excellence of voice and fertility and optimum libido.

Rasaja bhava imparts characteristics to individual which includes formation and growth of the body, sustenance of life, satiety, nourishment and enthusiasm.

According to recent researches, parental nutrition, in utero exposure to stress or endocrine functions, male-induced maternal effects such as the attraction of differential mate quality, and maternal as well as paternal

age, and offspring gender could all possibly influence a germline epimutation which is ultimately expressed in offspring and the degree of intergenerational inheritance.^{xi}

Not only this, the effect of psychological status of parents during intercourse explained under *satvaja bhava* has also been proved by recent researches. In a preclinical study, Epigenetic inheritance of depression-related phenotypes has also been reported. Inheritance of paternal stress-induced traits across generations involved small non-coding RNA signals transmitted via the paternal germline.^{xii}

Importance of acclimatization to surroundings and environmental conditions, positive mental strength and self-consciousness are imperative for a healthy progeny beyond mere union of maternal and paternal factors.

C. Population genetics:

Population genetics is a branch of genetics that deals with genetic differences within a population or and between populations. It is a part of evolutionary biology and researches in this branch of biology examine phenomena such as adaptation, speciation, and population structure.^{xiii} This concept is in similitude with *Jatyadi Prakriti*^{xiv} mentioned by *Acharya Charaka*. These are the six factors under which group of people with certain common inherited features that distinguish them from other groups of people. These factors influence the *Prakriti*.

Jatiniyat Prakrit (caste/origin as per social structure- Social grouping plays an important role in moulding the personality of an individual.

Kulaniyat Prakriti (race) - The character & conduct of a race always reflects upon the physical features and temperament of the offspring. Caucasian races, Mongolian races, Negroid races- all have different set of physical, psychological and social characteristics.

Deshaniyat Prakriti (place) - In *Ayurveda*, a great stress has been made on the *Desha* factor in the context of *Prakriti*, *Vyadhi* and origin of *Dravyas*. A group of various individuals in a common location may share some common characteristics which are passed on to progeny.

Kalaniyat Prakriti (time and season) time factor is mentioned in various contexts like in occurrence of disease and their treatment, seasonal regimen, dietetic regulations and its metaphysical existence. Time factor has been equally linked with the conception and development of the fetus.

Vayaniyat Prakriti (age), Age factor also influences the genetic makeup of the individual. Age is defined as that state of *Sharira*, which specially depends upon *Kala Pramana*. This clearly indicates the influence of age of sperm and ovum on the individual i.e. the best outcome of conception occurs if it happens in reproductive age.

Pratyatmaniyat Prakriti (individual's habits pertaining to soul). Each individual has some distinctive character, which is different from others. Two individuals of same *Jati*, *Kula*, *Vaya* etc. may still not have same characters. This variation which is characteristic of each individual is known as '*Pratyatmaniyata*

Prakriti which imparts altogether different personality e.g. in case of twins, this *Pratyatmaniyata* can be better understood.

To further depict genetics, Scholars at several sites have described congenital defects viz. *sahajarogas* (present since birth), *kulajarogas* (hereditary disorders) or *adibalapravritta*. (defects in the male and female reproductive elements). Different types of defects in *shukra* (sperm) and *shonita* (ovum) is mentioned in Ayurveda^{xv} which ultimately leads to defects in progeny.

CONCLUSION:

- Genetics in ayurveda depends upon status of *Shukra* (sperm), *shonita* (ovum), *atma* (soul), *garbhayashaya* (healthy uterus), *kalasampat* (suitable time for conception), wholesome food and good antenatal and post natal care are described in detail.
- Abnormality in sperm and ovum, uterus, psychiatric illness of parents, unwholesome diet, faulty lifestyle, wrong timing of intercourse and lack of strength have serious implications on genetic inheritance of offspring.
- Reasons for congenital defects/sexual disorders is primarily vitiated *vayu* but the basis behind vitiation is unjust past deeds
- The six factors responsible for embryonic development (*garbhakara bhava*) influence different developmental processes in offspring. These include inheritance of genetic traits from parents (*matrija* and *pitrija bhava*). The physical form and structure, physiological properties and developmental processes, behavior are influenced by nutritional and habitual factors (*rasaja* and *satamyaja bhava*). The psychological and spiritual development is influenced by transmigrated soul (*atmaja* and *sattvaja*).

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