

# THE SCIENCE OF *KARMA* AND THE SCIENCE OF GENETICS

## THE SCIENCE OF *KARMA*

### WHAT IS *KARMA*?

The term *karma* is derived from the root '*krñ karaṇe*' by adding the suffix '*manin*' to the root and the common meanings of the term are—action, worth doing, implementation, duty, act, profession, tendency etc. So whatever is done falls under the category *karma*.<sup>1</sup> The term *karma* stands for two different meanings viz.; action and the subtle aggregates of the karmic matter. All types of movements whether physical or mental are known as actions. Apart from it, in Jaina Philosophy the term '*karma*' denotes the subtle aggregates of the karmic matter which are attracted and assimilated by the soul.

Philosophy is dominated by religions in India. This is the reason why all the theistic religions here have acknowledged the existence of the power called *karma* or something equivalent to it which affects, covers and blunts the natural powers, attributes and purity of the soul. Different Philosophies talk of it by different names e.g. *Vedānta* Philosophical system calls it deception i.e. ignorance.<sup>2</sup> Yoga Philosophy uses *karma āśaya*' or *kleṣa* (affliction) etc. words for it.<sup>3</sup>

The term '*adr̥ṣṭa*' (unseen) and '*saṃskara*' used in *Nyāya* school of thought also represent the same. The Buddhists call *karma* as '*vāsanā*' (predispositions) and '*avijñapti*' (non-knowledge).<sup>4</sup> '*dharma-dharma*' the term used in *Vaiśeṣika* Philosophy is also equivalent to the word *karma* used in Jaina Philosophy.<sup>5</sup> The term '*paśa*' (snare/fetter) employed in *Saiva* school of Philosophy is also synonymous to the word '*karma*' as used in Jaina Philosophy. The word *apūrva* (singular/unique) of the *mīmāṃsā* school of Philosophy is also used to denote the same concept.<sup>6</sup>

Fate, meritorious action, sin etc., are numerous words that are commonly used in Philosophical scriptures. In Jaina canonical literature

along with the word '*karma*' the terms such as '*karmaphala*', '*karmaraja*' etc., are also used.<sup>7</sup>

Many schools of Philosophy merely make a mention of *karma* while many others go deep discussing its various aspects. According to Nyāya school of Philosophy *karma* (*adṛṣṭa*) is an attribute of the soul. Good as well as bad actions leave an impression on the soul, and that is *adṛṣṭa*. It lingers with the soul till it bears its results. Its results are brought forth through God.<sup>8</sup> The Buddhists acknowledge the predispositions or impressions (*Vāsanā*) of the soul as *karma*. *Vāsanā* becomes the cause of pleasure and pain as per cause and effect relationship.

## **THEORY OF KARMA IN INDIAN PHILOSOPHIES**

Theory of *karma* in different Indian Philosophies are described below:

### **Doctrine of *karma* in Vedic Philosophy**

In the early Vedic period *yajña* (sacrificial fire) and deity were accorded a high status. When *karma* replaced deity in significance, the supporters of *yajña* assimilated *karma* theory and *yajña* was accorded the status of a deity and believed that *yajña* itself is *karma* and bears all results. In the age of logic and Philosophy this tradition was named as *Mīmāṃsaka* Philosophy. But in the Vedic tradition, along with the development of *yajñakarma*, deliberation on deity also developed. In the Brahmaṇa period single God *prajāpati* replaced the multiple deities of ancients as the God of Gods. *Prajāpati* created room for *karma* theory in their tradition, and they also assimilated *Prajāpati* and the *karma* theory in their own fashion. They believe that all the creatures do face the consequences of their *karmas* but it is the God of Gods (*devādhideva*) who determines the results. *Īśwara* (*devādhideva*) determines the results according to their *karmas* and not at his will. The Vedic Philosophies who accept this theory are *Nayāya Vaiśeṣika*, *Vedānta* and the later theistic *saṅkhya* Philosophy.<sup>9</sup>

*Karma* has been classified into three groups in Vedic Philosophy :

- (a) Accumulated (*saṁcita*)
- (b) Fate (*Prārabdha*)
- (c) Present actions (*Kriyamāṇa*)

(a) **Accumulated *karma***—This is the total accumulation of *karmas* of all the past births, the result of which cannot be faced as yet.

(b) **Fate *karma***—Fate is that *karma* which was the most prominent and forceful of the accumulated *karmas* before the present life came into existence and which has been so designed that the present life is determined through it.

(c) **Present action *karma***—Whatever *karmas* the man accumulates throughout present life is called *kriyamāṇa* (present actions). The next birth is basically determined and ascertained by the most forceful (or according to some, the most primary) *karma* out of the total of accumulated and *kriyamāṇa karmas*.<sup>10</sup>

### ***Karma theory in Upaniṣads***

*Upaniṣads* give a detailed description of the various singularities of this world in place of *karma*. This kind of contemplation is generally missing in the earlier Vedic literature.

(i) **Theory of time**—Time is discussed in *Śwetāśwatara Upaniṣad*.<sup>11</sup> It is stated that the only reason behind all of social factors, individual differences, pleasure, pain and activities of man is time.

(ii) **Theory of nature**—Theory of nature is discussed in *Upaniṣads*.<sup>12</sup> Whatever happens, or is going to happen, is based on the nature of thing itself. The nature cannot be defied.

(iii) **The theory of free will**—There is no particular reason behind the events taking place in the world, these occurrence is a mere chance. This theory puts emphasis on chance and propounds causeless reason theory. The *Nyāya* theorists mentioned that existence comes into being like the sharpness of a weapon without any casual or non-casual reasons.<sup>13</sup>

(iv) **Fatalism**—Occurrence of events is predetermined and they occur in the same order and way. No one can alter them. That which is to be, would be as it is. This theory too is given for the first time in *Swetāśwatara Upaniṣad*, but the theory is not given due consideration either here in or in other *Upaniṣads*.

(v) **The elements theory**—According to this theory the four elements, namely, earth, fire, air and water, are the basic factors behind this universe;

all the material, living and non-living things are the outcome of the various combinations of the four elements.

**(vi) Naturalism**—According to naturalism the nature, endowed with three attributes, is the only reason behind the growth of the universe and pleasure, pain and bondage of human.

**(viii) The theory of Gods**—This theory propounds that God is the creator and sustainer of this universe. Whatever takes place in the universe is the play of his will.

Jaina and Buddhistic canonical literatures are highly critical of all these views. This critical thought forms the basis of a well-established theory of *karma*. According to Dr. Nathmal Tāntiyā, it seems that the theory of *karma* has come up in the protest to various nature-oriented theories and beliefs.<sup>14</sup>

### **The meaning of *karma* in Nyāya Vaiśeṣika Philosophy**

In *Nyāya Vaiśeṣika* Philosophy the term *karma* is used in the sense of movement, as the movement in the hand through the association and efforts of the spirit.<sup>15</sup> That which is a substance, dependent on the substance, devoid of any attribute and free from any causality in association and dissociation, is *karma*.<sup>16</sup> In *Nyāya Siddhānta Mukṭāwali karma*, has been differentiated into five types :

- (i) *Utkṣepaṇa* (projection)
- (ii) *Ākucana* (contraction)
- (iii) *Prasāraṇa* (expansion)
- (iv) *Gamana* (movement).<sup>17</sup>

### **Interpretation of *karma* in Gītā**

In the words of *Tilaka*, the term *karma* is used in the *Gītā* not only in the narrow sense of *yajña karma*, *yāga karma* (sacrifice) and *smārta karmas*.<sup>18</sup> All the physical and mental acts whatever man does are *karmas* according to *Bhagwata Gītā*.<sup>19</sup> There are signs of the theory of time, nature, naturalism, God and deities in *Gītā*. The author of *Gītā* accepts all these theories as and when required. He assigns the status of casual factor

sometimes to time, then to nature, then to disposition and sometimes to *Puruṣa* or God.<sup>20</sup>

Three types of *karmas* are mentioned in *Gītā* :

- (1) *Karma*,
- (2) Non-*karma* (*akarma*)
- (3) Bad *karma* (*vikarma*).

(1) ***karma***—All the good and auspicious actions performed with the desire of good results are *karmas*.

(2) **Bad *karmas***—All the bad/inauspicious actions that are performed to fulfill mere lust are called bad *karmas*. In addition to this, actions done with the desire of fruits and with malice, are called bad *karmas* too. According to *Gītā* the penance one undergoes with stupid stubbornness, with physical, vocal and mental pain and with a desire to harm others, is called a malignant penance.<sup>21</sup> Generally, physical, mental and vocal violence, falsehood, stealing, etc. are considered to be bad *karmas*.

(3) **Non-*karma***—The actions performed with detachment. With a sense of duty, are termed as non-*karmas*. *Gītā* says that the actions performed by man becoming indifferent with God, without arrogance in his present condition, does not produce any other result but salvation, therefore, it is non-*karma*.<sup>22</sup>

Taking *Manusmṛti* as the base *Tilaka* describes the following ten kinds of sinful conduct in *Gītarahasya*<sup>23</sup> :

- (a) Physical—(i) violence, (ii) stealing, (iii) fornication.
- (b) Vocal—(i) falsehood, (ii) taunting, (iii) harsh words, (iv) improper betting.
- (c) Mental—(i) wishing to appropriate other's wealth, (ii) malice, (iii) wrong insistence.

The *Gītā* states that "He, who is equipoise towards all the creatures both in pleasure and pain, is a supreme yogī."<sup>24</sup> The author of *Gītā* hints that for salvation it is essential to get freedom from both auspicious as well as inauspicious *karmas*. *Śrī Kṛṣṇā* says, O Arjun! whatever actions you indulge in, whatever you eat, whatever sacrificial fire you do, whatever charity you give or whatever chanting you perform, entrust all the

auspicious/inauspicious *karmas* to me, that is, relinquish any attachment or ownership towards them. Thus, having the feelings of renunciation, you will be free from bondage of *karmas* producing good or bad results and will get me.<sup>25</sup>

The author in *Gītā* explains that both auspicious and inauspicious *karmas* are bondage and for salvation it is essential to rise above them. A wise man relinquishes both good and bad or virtue and sin.<sup>26</sup> Stating the characteristics of a true devotee he says that, he who has relinquished both good and bad, i.e. who has risen beyond them both, that devotee is dear to me.<sup>27</sup>

The great Philosopher of his time Dr. *Radhākṛṣṇa* puts forward the same idea in his introductory essay to *Gītā*. Whether we are bound by good desires or by bad desires. We are ultimately bound, what difference does it make whether we are in iron chains or in golden chains? We are, after all, in chains.<sup>28</sup>

Like Jaina Philosophy *Gītā* also states that when sinful actions are reduced to nothing through virtues then the man is free from dualism of love-hatred and devotes himself to me with a firm determination.<sup>29</sup>

Thus, *Gītā* guides man from bad to good actions and from good to pure or desireless action for a moral spiritual life. **The ultimate goal of *Gītā* is to build up a desireless vision of life rising above good and bad.**

### ***Karma* Defined in Epics**

(a) **Idea of *karma* in *Ramāyaṇa***—Reference to reincarnation in *Ramāyaṇa* represent the general nature of *karma* theory. The theory of reincarnation is discussed in detail in fourth chapter in *Vālmīki's Ramāyaṇa*. With reference to reincarnation, compulsorily facing the consequences of one's *karma* is undisputed acknowledged there.<sup>30</sup>

(b) **Idea of *karma* in *Mahābhārata***—The essence of the Philosophy of *karma* in *Mahābhārata* is that the whole life is full of *karmas*. It is clearly acknowledged there that doing evil or righteous deeds, man essentially faces their evil or auspicious consequences in this world.<sup>31</sup> Pleasing fruits of good *karmas* and painful fruits of evil actions is generally doubtlessly established. All kinds of creatures, wise, foolish, valiant and coward have to undergo the

evil or auspicious results of the un-availed *karmas* of their previous birth in the present life. One gets the results of only actions done by oneself at various stages of life, no one faces the results of the *karmas* not performed by him.<sup>32</sup> *Mahābhārata* supports this view at several places. It is stated there that one must behave the same way towards others as one desires for oneself.<sup>33</sup>

Under all types of circumstances—relinquishment—charity, joy-pain, dear-hated etc. one must treat others as his own soul.<sup>34</sup> Only he, who treats others as himself, enjoys the pleasures of paradise.<sup>35</sup> The treatment one finds pleasing to oneself must be given to others. O! Yudhiṣṭara! this is the distinction between righteousness and unrighteousness.<sup>36</sup> The seer pronounces in *R̥ṣibhāṣita Sūtra* virtues and sins committed in the previous lives are the root causes of progeny.<sup>37</sup>

### **Doctrine of *karma* in Buddhist Philosophy**

Buddhist thinkers too have used the term '*karma*' in the case of activity. They too call the physical, speech and mental activities as *karma*. Although the Buddhist have used the term *karma* for physical, linguistic and mental activities yet consciousness has been accorded primacy there and consciousness is called *karma*. Buddha pronounced, monks! consciousness is *karma*, I state. Man indulges in action (*karma*) physically, linguistically or mentally only through consciousness.<sup>38</sup>

In this context the meaning of consciousness being *karma* implies that all these acts are possible only if consciousness is associated with them. Consciousness is recognized as *karma* in Buddhist Philosophy, but that does not mean other *karmas* stand cancelled. They acknowledge the relative significance of all the aspects of *karma*. Thus, we find that though the term *karma* has been used in the sense of activity there, the meaning of the term is wide ranging, more than activity, in *karma* theory. The term includes physical, mental and linguistic activity and the effect of these activities left on pure consciousness. Generally the term *karma* denotes activities, the purpose of activities and their outcome. *Ācārya Narendra Deva* writes, "Mere consciousness (purpose) and action are not the whole of *karma*. We need to take into consideration the resultant consequences of *karma* too."<sup>39</sup>

Buddhism basically accepts two types of *karma*—

- (i) *Citta karma* (mental actions).
- (ii) *Caitaṣika karma* (*karmas* arisen out of acts and speech).

*karma* in Buddhism are classified in two more ways :

- (i) *Akuśala karma* (sinful *karmas*).
- (ii) *Kuśala karma* (virtuous *karmas*).

(i) ***Akuśala karma***—According to Buddhism on physical, vocal and mental basis *akuśala* (sinful) *karmas* are the following ten types :

(a) **Physical sin**—(i) *prāṇatipāta* (violence), (ii) *adattādāna* (stealing), (iii) *kamesu micchasāra* (fornication).

(b) **Vocal sins**—(i) *musavāda* (falsies), (ii) *pisunāvācā* (pishum speech), (iii) *pharusāvācā* (harsh word), (iv) *samphalāpa* (useless bragging).

(c) **Mental sins**—(i) *abhijjā* (greed), (ii) *vyapāda* (mental violence or malice), (iii) *micchādiṭṭhi* (false perception).<sup>40</sup>

(ii) ***Kuśala karma* (Virtuous deeds)**—It is stated in *saṃyukta Nikāya* that he who donates food, drinks, clothes, bed, sitting objects in charity enjoys virtues as if streams of virtues falling to him from all sides. The following acts are stated to be *caitaṣika* (virtuous) in *Abhidhammatya saṃgrah* :

- (1) Devotion
- (2) Awareness
- (3) Shame towards sin
- (4) Fear of sins
- (5) Relinquishment
- (6) Friendliness
- (7) Equipoise
- (8) Purity of mind
- (9) Cheerfulness in body
- (10) Lightness of body
- (11) Sweetness of mind
- (12) Sweetness of body
- (13) Lightness of mind

- (14) Simplicity of mind
- (15) Simplicity of body.<sup>41</sup>

### **Doctrine of *karma* in Western schools of Philosophy**

Numerous western thinkers consider it essential to rise above good and bad for fullness of moral life. Bradley believes that morality leads us beyond good and bad.<sup>42</sup> The dualism of good and bad rules in moral life but that dualism must come to an end in the state of self fullness. Therefore, for complete realization we will have to rise above morality (good and bad). Bradley agreed that righteousness (spiritualism) is above morality. According to him morality ends in spiritualism, where individual establishes harmony with God rising above the dualism of good and bad. Bradley says that in the end we reach to such spot where all processes come to an end although the best action starts from here. Here our morality blossoms in the extreme and merge in God and we experience immortal love all around with all contradictions to an end.<sup>43</sup>

What Bradley differentiated between morality and spirituality the same differentiated by Indian Philosophies between practical morality and spiritual morality. Practical morality pertains to good and bad. Here the vision of conduct is relative to society and its objective is public welfare. Spiritual morality pertain to the realm of pure consciousness (detached or renunciatory vision of life) and it is relative to the individual. **Its ultimate objective is to lead man from bondage to salvation.**

### ***Karma in Patāñjali Yoga darśan***

When traces (*samskara*) of afflictions get accumulated in the mind they produce desired *karma*. There is no action possible without passion of love and pleasure (*rajoguṇa*). When the passion of love and pleasure associates with virtues (*satoguṇa*) there arises the tendency of knowledge, righteousness, renunciation and spiritual grace. When passion of love and pleasure associates with malignant qualities (*tamoguṇa*) there arises the tendency towards contrary acts like ignorance, lack of righteousness, attachment and lack of gracefulness. These two types of *karma* are called auspicious-inauspicious, sin-virtue or lustrous-dark.

The consequences of such actions that are routed in five afflictions are to be faced in both the births, present and future.<sup>44</sup> These are in two forms :

1. afflictive (malignant dominant)
2. non-afflictive (virtue dominant).

The great sages and yogīs who have uprooted afflictions through desireless, non-attachment practices reduced their *karmas* to mere duties do not have to face their consequences. Desired *karmas* arises only when the traces (*saṃskaras*) of afflictions are rooted in the subtle mind. According to Yoga *darśana* these *karmas* result into birth, life, pleasure, pain etc., since both virtuous as well as sinful actions bring their results.<sup>45</sup>

### **Jaina Doctrine of *karma***

The Jaina doctrine of *karma* seems to have developed against a number of other doctrines about creation. Some regarded time (*kāla*) as the determinant factor of creation. Every event occurs in time and hence is determined by time, other believed in nature (*svabhāva*) as the determining factor of creation. Things are determined by their own inherent nature. There is nothing, inside or outside, over and above nature that determines the course of events. This leads to the doctrine of determinism (*niyati-vāda*). There were others who believed in the fortuitous and accidental nature of occurrences of events. There were other doctrines as well.<sup>46</sup> The believers in *karma* or unseen potency (*adr̥ṣṭa*), the after-effect of a good or bad action, regarded these theories as inspired by materialistic tendencies and therefore rejected them as untenable. The Jaina Philosophers accorded proper place to these doctrines as testified by our experience, while installing *karma* in the supreme position. *karma* is the ultimate determinant of the course of events. Even time, nature and *niyati* are determined by *karma* and that is no such thing as fortuitism. These factors, in so far as they are given to experience, are only the expressions of the working of the supreme law of *karma*.<sup>47</sup> *Karma* is the fundamental factor responsible for the relation between spirit and non-spirit, that is, the world order. ***Karma is a process where by an action (karma) produces its reaction (phala).***

In the words of the *Yuvācārya Mahaprajña* (presently *ācārya*), spiritualism cannot be explained without the theory of *karma*. Therefore it is

a great theory. It is essential for the man who wishes to feel the inner essence of spiritualism to dive deep into the unfathomable depths of the theory.<sup>48</sup> Generally, activities are called *karma*. Activities are of three types :

- (i) Physical
- (ii) Mental
- (iii) Vocal.

In classical terminology they are called 'yoga'. But in the Jaina tradition this activity oriented meaning of *karma* is only a partial explanation of the term '*karma*'. In this theory the intention or end of activity is also given due thought. *Ācārya Devendrasūri* defines *karma* as 'the intention for activity of the creature'.<sup>49</sup> Prominent Jaina scholar *Pandita Sukhalājī* says that whatever is done by a creature owing to ignorance, passion etc., reasons, it called *karma*.<sup>50</sup> Thus, he includes both the activities as well as the intention behind that activity into the fold of *karma*. There are two aspects of Jaina thought :

- (i) attachment—hatred, passions etc. feelings
- (ii) karmic matter (*karma pudgala*).

By karmic matter is meant those molecules which are attracted and glued to the spirit owing to a particular actions of the spirit, associated with the spirit to form the karmic body (*karma śarīra*) and on the maturity of a particular time, producing some specific experiences in the form of their results, dissociate from the spirit. These are called matter *karmas*. In brief the concept of *karma* in Jaina Philosophy is concerned with the molecules that affect and blunt the power of the spirit. As the creature engages in any type of mental, speech or bodily acts, *karma*-oriented matter atoms rush towards him from all sides.

Through the attachment and hatred oriented activities of the soul, infinite subtle fine particles existing in the space rush magnetically to it and get associated to the soul and they are called *karmas*.<sup>51</sup> According to Jaina *lakṣaṇāvali* "like boxes full of collyrium powder, full of gross and subtle particles, ordained particles liable to be converted into *karmas* in the world, associating and binding the creature according to their acts, the particles those obscure knowledge and perception (veil of knowledge and perception

and forming pleasure-pain, auspicious, inauspicious, age, name, high-low status and energy obscuring etc.) are called *karmas*.<sup>52</sup>

Jīvas (spirit/soul) are conscious formless beings. The subtle filth glued to it is called *karma*. *karmas* are material atoms, inert. The atoms of *karma* are called *karmadala* (atom groups). The atoms of *karmas* get glued to the soul owing to its adhesiveness caused by attachment and hatred and activities of association. The *karma* atoms are glued to the soul from the time immemorial. If some of them get dissociated from the soul, the new ones get glued. Thus this activity goes on constantly.<sup>53</sup> The soul acquires the property to attract *karma Vargaṇā* because of false belief, vowlessness, negligence, passions and activities and that is *karma*. *Karma Vargaṇā* is a kind of subtle dust which can be perceived only by an omniscient individual.

The matter atoms, getting attracted through attribute and non attribute feature and getting attached to the soul veil its real form, deform it, such matter atoms gathered by the soul are called *karmas*. Well known scholar of Jainism *Paṃdita Sukhalālaṅjī* opines—Although there is some details in the theory of *karma* in the Vedic and Buddhist literature it is so little that there exists no significant and prominent literature. On the contrary, thoughts on *karma* theory in Jaina Philosophy is subtle, well organized and very wide ranging.<sup>54</sup>

Professor *Mālavaṇiyāṅjī* another prominent Jaina scholar also writes, "Present day scholars agree that in the *pre-upaniṣadika vedika* literature there is no deep thinking on *karma* or *adṛṣṭa*. And that '*karma* is the cause' such a theory is unanimous opinion of *Upaniṣads* also cannot be stated.<sup>55</sup> In Jaina Philosophy *karma* is accepted as a mass of matter atoms, *karma* is directly related to the soul and the body. *Karma* is a concrete matter, which gets bound to the soul. The cause of the action of the soul is *karma*.<sup>56</sup>

Prominent Jaina scholar *Paṃdita Sukhalālaṅjī* says "the action that is performed by the soul under the influence of false belief etc. reasons is called *karma*. He has included both, the cause as well as the action of jīva under *karma*.<sup>57</sup> In *Jaina siddhant dīpikā Ācāryasṛī Tulasī* defines *karma* as "the subtle particles which are attracted by the tendencies of soul and which are fit to be transformed as *karma pudgala* are called *karma*."<sup>58</sup>

## METAPHYSICAL BASE OF THEORY OF KARMA

Metaphysical base of theory of *karma* is described as under—

### Characteristics of the soul

To understand the doctrine of *karma* we must first know about the soul and its characteristics. The soul is different from body. It is the soul which is providing vitality and knowledge required to make the body functional. Some people don't believe in the existence of soul. They must be asked the question as to why a dead body which has all the physical parts and component does not function. The answer is because the soul has left the body. It is the soul which experiences the pleasure and pain, receives signals from outside world through the sense organs, thinks and takes decisions and provides vitality and knowledge for functioning of a machine or complex as the body. **The life in the body is due to the soul.**

According to Jaina Philosophy, the soul is one of the six realities that constitute this universe. The other important reality is the physical matter, both subtle and the aggregate. The Jainas declared energy also as matter (pudgala)—more than two and half thousand years back. Science came to the same conclusion only in the twentieth century.<sup>59</sup>

A reality of substance has three properties—

- (1) It undergoes transformation and changes its form. Each form is called a *paryāya*.
- (2) It has the property to destructions, i.e. one form is destroyed and other originates.
- (3) In the process of transformation and destruction the intrinsic nature of the reality is preserved i.e. its basic characteristic is permanent and is not altered. Such properties are easily evident in physical matter. For example when a substance changes its form from solid to liquid and to gas, the chemical composition does not change.

So is the case with soul. The soul leaves one body on death and enters another body according to some well defined rules. Here 'death' only implies that the soul leaves the present body, the soul in fact does not die. **The soul is immortal and only changes its form when it enters from one body to**

**another.** In this process *karma* of soul are carried forward to the next body and the soul leaves a life in accordance with these *karma*. The *karmas* are the impressions of the actions performed by the soul.

The soul according to Jainas has the following characteristics :

- (i) It is beginningless and endless. Its origin cannot be known. It is immortal and cannot be destroyed by any means whatsoever, not even by a hydrogen bomb.
- (ii) It occupies body like oil in a seed i.e., why do people confuse body with the soul? Indeed they are different.
- (iii) The soul contracts or expands according to the size of the body. In this process of contraction and expansion the number of space points called *pradeśas* of soul remain unchanged.
- (iv) The soul is a non-physical entity, it is known only through its ability of knowing. **The soul is the knower.** All the knowledge that exist in the world today is due to the soul's power of knowing. For example, the discovery of law of relativity by Einstein was because of the power of knowing of his soul.
- (v) The soul is the basis of knowledge, perception, bliss and power experienced by a living organism.
- (vi) The soul is a source of innumerable kinds of power. The main powers are power of knowledge, power of vitality or potential and power of determination.
- (vii) The invisible soul is known by its ability of knowing. The soul is also known by functions of body like laughter, dancing, pleasure and pain, speech, movement etc. Without the soul these functions cannot be performed by the body.
- (viii) The fine subtle matter, known as *karma vargaṇās* (variform) attracted by the soul from the surroundings is converted in *karma*.
- (ix) The thoughts and actions of a person leave impression on the soul. The impressions are recorded on the *karma vargaṇās* attracted by the soul. These *karma varganās* constitute a material body known as *karma śarīra* or *karma* body. This *karma* body containing the impressions accompany the soul when it transcends from one body to other.

- (x) The soul and *karma* body are always held together. The question as to who came first in existence is meaningless like the question of egg and hen.
- (xi) The soul is a non-physical entity but behaves somewhat like a physical body so long as the material *karma* body is attached to it. On liberation the *karma* body is dissociated and separated and the soul comes in its pure form.
- (xii) All souls are alike except for the *karma* body which differs. This means that every soul is at a different stage of development.

Full development means liberation or emancipation of the soul. The souls are of two kinds :

- (1) The Mundane soul (*jīva*)
- (2) The liberated soul

The mundane soul has *karma* body attached to it and takes rebirth. The liberated soul has no *karma* body and does not take rebirth, it is free from the cycle of birth and death. So by soul we shall mean the mundane soul (*jīva*).

**In the absolute sense the soul has only characteristics cétanā or consciousness. The levels of development of consciousness of souls are different and so each individual in the world is different from other. The genetics says DNA of any two living beings of universe never resembles, so each individual in the world is different from other from the angle of genetics.**

Consciousness is the exclusive property of the soul and is not found in any other substance. The liberated souls have the infinite power of knowledge and perception. Each liberated soul is omniscient, omnipotent and experiences infinite bliss. A liberated soul is perfect and independent and is not dependent on any other agency for any thing. The Jainas don't believe God as the creator of universe, in fact, each liberated soul is a God or *parmātmā*.<sup>60</sup>

Consciousness sentient or the conscious substance is called soul.<sup>61</sup> Such souls are infinite.<sup>62</sup> They exist independently.<sup>63</sup> They are not part of any other spirit or any supreme spirit. Every soul has infinite consciousness. They can know infinite universes. All spirits are same as regards

consciousness but all don't have similar development of consciousness.<sup>64</sup>

**The cause of difference of development of individual soul is due to his *karma*.**<sup>65</sup> Spirit itself is the doer of *karma*, when the spirit enjoys its own pure consciousness it is in tune with its pure nature. While it indulges in other emotions it is the doer of actions.<sup>66</sup> Spirit indulges in good as well as bad actions and as a result karmic matter enters into the spirit spaces and gets attached there. Thus spirit, is the doer of actions. That means, it is creator of its joy and sorrow. It is mentioned in *Uttarādhyayana Sūtra* "spirit itself is *Vaitaraṇī* river and it itself is the *kūta śālmālī* tree. Spirit itself is the desire fulfilling cow *kāmadhenu* and it itself is the *Nañdana* forest. Spirit is that creates as well as does not create sorrow and happiness."<sup>67</sup> The reason behind this is that it is the spirit that indulge either in righteousness or in evil, its *karmas* are binding according to its deeds. It is these *karmas* that result into good or bad consequences. Spirit is free in earning good or bad *karma*. **Therefore, it is stated, *Bañdhappamokkho Tujjha ajjhatheva, bondage or salvation depends upon the spirit itself.***

### **Characteristic of matter (*pudgala*)**

That which associates and dissociates, such complementary—corporeal inert matter is termed as matter or 'atom'.<sup>68</sup> That which associates and dissociates through joining and separation are called atoms. Atom is a relational term for matter or whatever is swallowed or taken in by spirit in the form of body, food, sense, perceptions or sense objects etc. is called atom.<sup>69</sup> Worldly spirit takes upon matter body, senses etc. in every birth.<sup>70</sup> That which possess the quality of dissociation and completion is atom.<sup>71</sup>

**(a) Atom with regards to attribute**—It is mentioned in *Tattvārtha* "atom are attributed with touch, taste, smell and colour."<sup>72</sup>

Atoms are of two kinds—

- (i) Atom,
- (ii) Group of atoms.

Atoms are endowed with 30 attributes—

**Touch**—cold, hot, sticky, dry, rough, smooth, light, heavy.

**Taste**—acidic, sweet, bitter, sour and pungent.

**Smell**—fragrance and stench.

**Colour**—Black, blue, red, yellow and white.

Although parabolic, circular, square etc. shapes are found in atoms but these are not its attributes.<sup>73</sup> The subtle molecule, though being partless and indivisible contains colour, smell, taste and touch—these four attributes and infinite modes.<sup>74</sup> One molecule attributes with one colour, one smell, one taste and two senses of touch (one pair out of cold-hot, dry-adhesive etc.). One atom having differentiation in colour, smell, taste and touch from one colour, smell, taste and touch is perfectly admissible in Jaina Philosophy. A mono attribute atom can stay minimum for one time and maximum countless time in one condition.<sup>75</sup> This rule stands true for all the atoms from double attribute atoms to infinite attribute atoms. Later on there are changes in them. This colour related rule applies to smell, taste and touch as well.

**(b) Form of atom (matter)**—In Jaina tradition impenetrable, indivisible, imperceptible and indivisible trace of matter is called atom or molecule.<sup>76</sup> A student of modern science may have doubts regarding the attributes of the atom because atom is no more indivisible. If atoms were not indivisible, it would not be termed absolute + particle. The particle accepted as atom in science is divisible, we do not deny. This problem is taken up in Jaina canonical text *Anuyogadwara* where the dual nature of atom is given in detail :

- (i) Subtle atom
- (ii) Practical atom.<sup>77</sup>

Subtle atom is described in previous para. Practical atom is formed through an aggregation of infinite subtle atoms.<sup>78</sup> As a matter of fact, it is a lump atoms, still it is not generally perceptible and cannot be broken by common arms and weapons. It is extremely minute, therefore it is termed as practical atom. Atom described in modern science is comparable to this practical atom in Jaina theory. So divisible nature of atom is acceptable to Jaina theory also from this aspect.

### ***Karam Vargaṇā* (groups)**

There are many types of atoms in the space (*lokākāśa*). One type of atoms does not combine with others. These atoms fall into first *vargaṇā* (group). In second *vargaṇā* (group), two atoms combine, and onwards. Second group is subtler than first one, and third one subtler than second one. Every atom has colour, smell, taste and touch. There are eight touch qualities:

- (i) Rough
- (ii) Smooth
- (iii) Hot
- (iv) Cold
- (v) Light
- (vi) Heavy
- (vii) Sticky
- (viii) Dry.

The stickiness and dryness are the important qualities of the touch for binding two or more atoms together. There are infinite levels (degrees) of stickiness and dryness.

- (i) For atoms of similar touch quality (stickiness or dryness) to bond, there should be at least a difference of two levels in their stickiness and dryness.
- (ii) For atoms of opposite touch quality (one with stickiness and an other with dryness) they should have similar level (at least two) of touch quality or a difference of two. The quality level should be even (2, 4, 6 etc.) The atoms with odd levels (1, 3, 5 etc.) do not join with each other.
- (iii) Therefore there are infinite number of individual atoms that don't join with others. The group of such atoms is known as first *vargaṇā*.
- (iv) Similarly there are infinite numbers of 2 atoms joined (such groups are called second *vargaṇā*) infinite numbers of 3 atoms joined (called third *vargaṇā*) are going upto the group of infinite atoms joined.
- (v) Now we come to great group called *Mahāvargaṇā*. In the first *Mahāvargaṇā* there are infinite number of first *Vargaṇās*, second,

third upto infinite *Vargaṇās*. In second *Mahāvargaṇā* the first group has one more atom joined than the last group of the first *Mahāvargaṇā* (the first row of this *Mahāvargaṇā* has infinite number of such groups) and the last group has infinite more atoms joined than the last group of first *Mahāvargaṇā* (the last row of this *Mahāvargaṇā* has infinite number of such groups). Similarly third, fourth and upto sixteenth *Mahāvargaṇā* are there in universe. The number of atoms are more and the size is finer in the second *Mahāvargaṇā* than in the first *Mahāvargaṇā* and onwards.

- (vi) The *Mahāvargaṇā* with odd number has no use to the living beings. The body of human beings and *Tiryanka* (other than humane, hellish and heavenly beings) called *Audārika śarīra*, is made from second *mahāvargaṇā*. The body of hellish and heavenly beings called *vaikriya śarīra* is made from fourth *mahāvargaṇā*. Similarly *āhāraka śarīra* (special holy body—only very knowledgeable monks can have capacity to develop), *Taijasa śarīra* (body of vital energy), *ānāpāna* (respiratory system), *bhāsā* (speech), *Manah* (mind) and *kārmaṇa śarīra* are made from sixth, eighth, tenth, twelfth, fourteenth and sixteenth *Mahāvargaṇā* respectively. All non-liberated living beings have *Taijasa śarīra* and *Kārmaṇa śarīra* in addition to their gross body.
- (vii) The universe is full of *karma* particles. On the tip of a needle, there are infinite number of *karma* particles. The modern religious saints have exposed the fine *karmas* in terms of four touch energy particles spread all over the surrounding in the universe. All types of activities produce vibrations in the living being which attract the karmic particles producing a psycho-physical force called *karma*. Thus, *karma* is psycho-physical fine force. Many scholars suggest that the karmic force contributes some energy to slow down or hasten the physical and psychical processes in our body and brain. This results in reducing or maximizing the glandular secretions, hence any material or mental state taken in the body may be causing karmic inputs of course, *karmas* are finer than these

secretions or *genes* of body system. The *karmas*, thus, form one of the finer bodies of our system.<sup>79</sup>

We shall now revert to the question, how the *karmas* are formed and bounded with the soul. Let us assume that a soul has a *karma* body attached to it. The past impressions on the *karma* give rise to *kaṣāya* or passions. The passions are desires carrying feeling of love and hate or attachment and aversion. There are four main types of passions—anger, pride, illusion or deceit and greed. Based on the degree the passions can be further sub classified. These passions introduce impurities like aberration in the soul. The abilities of the pure soul in the form of infinite knowledge, perception etc. are diminished when passions are assimilated with it. Thus a mundane soul has limited knowledge, perception, vitality and pleasure. The property of pure soul is said to be obscured by *karma*. A *karma* is known by particular property it obscures. For example the knowledge of the soul is obscured by knowledge obscuring *karma*. More is the coverage less is the power of knowing of an individual and vice-versa.

A living being is engaged in actions all the times. The action can be performed by the body, speech or some combinations of these agencies. These actions are accompanying passions induced vibrations in the soul. The nature of vibration depends on the type of action and the magnitude of vibration depends on the degree of passion. Two things happen due to vibrations in the soul. First, the *karma* body vibrates on account of the principle of resonance, second the vibrating soul attracts *karma vargaṇas* from the surroundings. The *karma vargaṇās* are kind of subtle matter particles with four touch assumed to be present all over the cosmos. The *karma vargaṇās* are aggregates of atoms but still are invisible to eyes. An atom called *paramāṇu* according to Jainas, is the smallest indivisible, indestructible particle of matter. There is only one kind of *paramāṇu* in the universe and all other material atoms and particles are aggregates of large number of *paramāṇus*. For example, the atoms of various elements known to science are aggregates of Jaina *paramāṇus*. The Jainas believe that the *paramāṇu* has not yet been discovered by science.

The *karma vargaṇas* bonding with the soul become part of *karma* body and are called *karma*. This *karma* is a group of specific *vargaṇā*

having four touch only that carries the impression of a particular action and which form a part of the *karma* body. How long do these *karma* remain in the *karma* body? Each *karma* has a life and after that it separates out from the *karma* body. The shedding of *karma* from the *karma* body is known as *nirjarā*.

### **Principle of cause and effect of *karma***

**The law which regulates the action of *karma* is based upon the principle of cause and effect, so that the saying "As you sow, so you reap" presents the whole doctrine in a nutshell.** Every action whether mental or physical is a sowing of the "seed" or in the technical language of the Hindu Philosophy the engendering of *karma*. In the act of sowing the seed or engendering the *karma*, the soul has the choice of acting or retaining from action, but once the seed is sown or *karma* engendered, its freedom is replaced by an inevitable liability to bear its consequences. This is what constitutes the bondage of the soul. *karma*, therefore, is a kind of force which compels the soul to bear the consequences of its right and wrong actions, and this force originates in the very action itself which is performed by the soul and at the very moment of its performance.<sup>80</sup>

The term *karma* means activity/actions by the living being mental, vocal or physical. If there is no activity, there is no life. Many actions are deluding, selfish or with attachment, while many are otherwise. The *karma* theory promotes the Gītā sermon of non attachment, non delusion, non-selfishness and desirelessness for the happy worldly life. It promotes self elevation along with public elevation morally and physically.

In general, the *karma* theory aims at individual spiritual upliftment. It is just unfortunate that this spiritualism has taken us too far to become self centered, egoistic and selfish. The individualism or spiritualism became an isolated system. The isolationism has its good and bad effect for the society. It is interconnected and interrelated system with environment and other entities each effecting one another. Thus, the scope of *karma* theory has gone very wide to include group *karmas*, national or international *karmas*. This has improved the utility of *karma* theory for spreading universal brotherhood and increasing the overall happiness in the world. It has a

potency of making the world more peaceful and as well as physically progressive.<sup>81</sup>

### **Interaction of soul and *karma***

Jains have gone in extra ordinary depth to describe the theory of *karma*. The involvement of the soul with *karma* has no beginning. The soul of *saṃsarī* has always been impure, just as a gold in gold mine. As gold cannot be purified until it goes through the refinement process, the soul cannot be purified until it goes through proper purification process of achieving perception, perfect knowledge and perfect conduct. As long as the soul is impure, it will continue the cycle of birth and death (the cycle of transmigration—*saṃsāra*). The impurities are called *karmas*. There is a continuous interaction between soul and *karma*. It is very likely that most souls will have endless journey through the cycle of four destinies—*deva* (heavenly beings), *manuṣya* (human beings), *nārakī* (hell beings) and *tiryanka* (animal, plants and all other living beings). *karma śarīra* is made of *karma* particles, *karma* particles are *pudgalas* (non-living, *ajīva*), like *ātmā*, *pudgala* is one of the six basic substances (*dravyas*). *karma śarīra* is the subtle body. It cannot be seen by the most magnificent microscope or any similar instrument, obviously, atoms of *kārmaṇ śarīra* are the subtlest of all.

### ***Karma śarīra***

Jaina *karma* subject is '*dvandvātma*'. One meaning of *dvanda* is duality. It is duality of light and darkness, purity and impurity, detachment and attachment, alertness and carelessness, awareness and ignorance and insight and outwardness. Another meaning of '*dvanda*' is *yuddha* (battle). This is to the subject of battle between *jīva* and *ajīva*, battle between *ātmā* and *karma*. The duality will be over when *ātmā* wins the *yuddha*. All we have to do is to disassociate *ātmā* from *karma*. In fact, our final and only object is to disassociate *ātmā* from *karma* and to realize our own (*ātmā*'s) qualities.

We have seen that some students do very well in the class while others struggle. Some earn money easily while other struggle. There is nothing but suffering in some people's life while others enjoy their lives.

Question may arise in our mind that how some live longer while others die at younger age. Why there is such a contrast in the life? What are the root causes behind these and how that can be overcome? These all happen due to our *karma* (*kārmaṇ śarīra*).

### **Role of *karma śarīra***

We *saṃsarī* living beings, are constituted of two *dravyas*, *jīva* and *ajīva*. *Ātmā* is formless and invisible, and it is everywhere in our body. In *saṃsarī* (worldly-non liberated) *jīvas*, *cetanā* (quality of *ātmā*, consciousness) is associated by *karma* particles everywhere in our body. Also, *karma* particles are everywhere in the space. As long as they are not associated with *cetanā* (quality of *ātmā*-consciousness) they are ineffective. Our activities—"like and dislike" (attachment and aversion) work as a magnet and attract *karma* particles. When they associate with our soul they are called *karma*. *Karma* and soul have been associated since time immemorial. Every moment we are adding *karma* continuously due to our activities of attachment and aversion. Often we have partial separation meaning disassociation of some *karma* through austerities (*tapas*). *Karma śarīra* is the hindrance (obstacle) that does not allow us to realize the true qualities of soul, does not let us become what we should be by our own nature, does not let us become *paramātmā* from *ātmā*. *Kevalīs* (*siddhas*) do not have any association with *kārmaṇ śarīra*, we all want to achieve this state.

The relation between the spirit and non-spirit is responsible for the worldly existence. Apart from the gross body, there is a subtle body which serves as a link between spirit and non-spirit. The soul, with the Jains undergoes a change every moment although never losing its density. The soul has a number of potencies and each moment of its existence is an integration of these potencies. The nature of karmic body at any moment is determined by this integrated existence of the soul. The soul is pure and perfect in its intrinsic nature. It is only due to its relation with *karma* that the soul comes to have passions (*kaṣāya*). And the relation being beginningless, the problem which of the two—the passions and the *karma*—come first does not arise.<sup>82</sup>

In *pancāstikāya*, referring to the long ago linkage between soul and karmic matter as "soul karmic matter cycle". It is mentioned that, "the mundane soul which is bound in the cycle of birth and death, has the effect of love and hatred. These effects attract new *karma*. *Karma* leads to birth in various states. Birth produces a body, a body possesses senses, senses enjoy their subjects, interest in subjects gives rise to love and hatred. Thus, with emotions of mundane soul arise karmic *pudgalas*, with karmic *pudgala* arise emotions. This flow is beginningless and infinite with reference to non-awakened soul and beginningless and finite with reference to awakened soul.<sup>83</sup> **The conclusion is that when other Philosophical systems call action and *saṃskār* of soul as *karma* Jaina Philosophy calls the concrete karmic matter attached to soul as *karma* caused by love and hatred emotions of the soul.**

## THE SCIENCE OF GENETICS

### AN INTRODUCTION TO THE SCIENCE OF GENETICS

Genetics is called the science of heredity. Genetics may be defined as the study of the way in which *genes*—the functional units of heritable material operate and are transmitted from parents to offsprings. Modern genetics also involves study of mechanism of *gene* action, that is the way in which the genetic material effects physiological reactions with in the cell. Heredity and variations, two sides of the same coin are the subject matter of the science of genetics. Heredity is the sum of all biological processes by which particular characteristics are transmitted from parents to their offsprings. Among organisms that produce sexually, progeny are not exact duplicates of their parents but usually vary in many traits.

In many languages the same words are used for both the inheritance of biological traits and the inheritance of property. Biological and legal inheritance are, however, very different processes. Inherited objects are actually transferred from one owner to another. Inherited traits are not offspring inherit a genetic constitution from their parents. The hereditary endowment, the sum total of the *genes* that the individual has received from both parents, is called the genotypes. The genotype must be contrasted to the

phenotype, which is the organism's outward appearance : its bodily structure, physiological processes, behaviour etc. Although the genotype determines the broad limits of features on organism may develop, the features that actually develop i.e. the phenotype depends upon complex interactions between the *genes* and their environment. Since the environment, both internal and external, of an individual changes continuously, so does the phenotype. Thus the same individual shows different phenotypes in childhood, in adulthood and in old age. The genotypes, on the other hand, does not change during an individual's life time. In conducting genetic studies it is crucial to discover, the degree to which the observable that, the phenotype is attributed to the pattern of *genes* in the cells, the genotype and to what extent it arises from environmental influence.

The essence of heredity is the reproduction of carriers of genetic information, the *genes*. As a result, biological organisms, including human beings, reproduce organism resembling themselves, human children are always recognizable human and have phenotypes similar to those of their parents, on the other hand since the offspring of sexually reproducing organism receive varying combinations of genetic material from both parents, no two offspring (except for identical twins) have exactly the same genotype. The genetic resulting phenotype is never, exactly the same, even among identical twins.<sup>84</sup>

### **Genetics—core science of biology**

Genetics is often called the core science of biology. Genetics impinges upon almost every kind of study of life. Anthropology, medicine, biochemistry, physiology, psychology, and comparative morphology all have interactions with genetics like so many actual and potential practical applications. The understanding and control of hereditary disorders and the breeding of improved crops and live stock are just two such applications. **The genetic code is believed to have arisen naturally as an automatic consequence of natural laws. Perhaps those may be the laws of *karma* theory. The structure of genetic code has the remarkable property of minimizing mutational load and optimizing the speed of evolution.**

## Genetics—science of potentials

In a sense genetics can be called a science of potentials since it deals with the transfer of information from parents to offsprings and between generation. Similarities or resemblances are traced to the information system. Not all variations are inherited but only those caused by *genes* as well as those caused by the interplay of *genes* with environment.

### Basic concepts of genetics

The basic concept in genetics are :

- (i) *Gene* is the unit of inheritance.
- (ii) *Genes* are arranged on chromosomes in a linear order.
- (iii) Chromosomes occur in pairs in sets in all cells except germ cells—spermatozoa in male and ova in female.
- (iv) Members of different *gene* pairs and chromosomes segregate to different reproductive cells.
- (v) Members of different *gene* pairs assort at random with respect to other *gene* pairs.
- (vi) *Genes* are units of DNA and are capable of replication. They carry chemically coded message that can be transcribed and translated into proteins.
- (vii) Polygene (many *genes*) control qualitative characters like—skin, colour, size etc.
- (viii) *Genes* in a population establish an equilibrium that continues generation after generation without a change. This can be changed by a mutation (sudden heritable change) or migration, inter-marriages, selection and genetic drift.
- (ix) Inheritance patterns are assorted with systems of making like inbreeding i.e. consanguineous marriages (by marriage of close relatives) and out breeding (marriages of non-relatives).

### The physical basis of heredity

It appears from the study of Jaina Biology that heredity is the tendency of individuals to resemble their progenitors<sup>85</sup> or the tendency like to beget like. That is to say, the individuals resemble their progenitors

structurally with some traits. Further it is stated in *Bhagavatī Sūtra* that the united body of the mother and father in the child lasts as long as its worldly body exists, but it comes to an end with the perish of the physique of the child or last after getting weaker and weaker.<sup>86</sup>

Each new generation of organisms from two sensed to five sensed closely resembles their progenitors as is evidenced by the fact of the classification of animals in Jaina Biology on the basis of the senses and structures<sup>87</sup> and certain distinctive parental characteristics which appear frequently in successive generations of a given family tree. **Although the resemblances between parents and offsprings are close, they are usually not exact. The offsprings of a particular set of parents differ from each other and from their parents in many respects to different degrees due to *karma*.**<sup>88</sup> These variations are characteristics of living things.<sup>89</sup> According to Biology some variations are inherited, that is they are caused by segregation of heredity factors amongst the offspring other variations are not inherited but are due to the effects of the *karma* or of temperature, moisture, food, light or other factors in the environment on the development of the organism<sup>90</sup> as biology explains.

### **The development of genetics**

Jaina Biology indicates that parental characters are transmitted through both the sperm and egg.<sup>91</sup> It is suggestive from this fact that inheritance is governed by units (factors) present in the cells of each individual as is evidenced by the embriogenic development<sup>92</sup> and the transmission of parental characters or traits. This contention of Biology on the development of genetics is implied in the Jaina view when the details of cell division and fertilization are known from the evidences furnished by Jaina Biology.<sup>93</sup> It should be noted in this connection that the growth of each plant or animal is due to cell divisions plus increases in the size of the cells which comprise the organism. The division of cell is an extremely regular process called mitosis<sup>94</sup> in modern biology.

## **Heredity and environment**

It is suggestive from the study of rise of *karma* etc. from the points of view of *dravya* (substance), *kṣetra* (locus), *kāla* (time), *bhava* (life of birth), and *bhāva* (condition)<sup>95</sup> that both physical and mental traits are the result of the interplay of both genetic (from the aspect of *dravya*) and environmental factors (i.e. from the aspects of *kṣetra*, *kāla*, *bhava* and *bhāva*).

According to Biology "a few *genes*, such as those that determine the blood groups, produce their effect regardless of environment. The expression of other *genes* may be markedly affected by altered environment.<sup>96</sup> The upper limit of person's mental ability is determined genetically as it indicates in the later stages (*dasas*)<sup>97</sup> of its life but how fully he develops inherited abilities is determined by environmental interferences by his training and experience.<sup>98</sup> It is easy to understand why the offspring of intelligent parents are sometimes less intelligent (*manda*) than either parent because of past *karma*.<sup>99</sup> Biology explains that since the co-ordinate of many pairs of *genes* is involved in intelligence the fortuitous combination of these which produced the intelligent parents be broken by genic segregation. Conversely, the chance recombination of favourable *genes* may produce a brilliant child from average parents, but genius are never produced by feeble minded parents).<sup>100</sup>

The inherited *gene* complex or genetical mould of an organism is called genotype. It is determined by the number type and a management of *genes* in the originating fertilized egg or seed. The trait actually contributed by the offspring or its outward appearance is called phenotype. The phenotype includes all observable traits whether anatomical, physiological, psychological, mental or whatever. The phenotype of an organism is, therefore, the consequences of the growth—and development of a genotype in a certain environment. **In short, the fertilized egg develops into a new organism because of the action of *genes* and chromosomes it inherits from its parents on the ambient environment.**

Every organism has its own characteristic form of metabolism whereby it responds during the course of its development to the components of its external environment such as food, nutrients, water, air, heat, light etc. in its own peculiar way. Although metabolic patterns are different in

different organisms, the goal of every metabolism is essentially the same, namely, to enable the organisms to assimilate the materials in its environment to become a more or less faithful copy of its parents and other ancestors. That it becomes a faithful copy is due safely to the *genes* and chromosomes it inherits in the originating bit of parental body. But the qualifying "more or less" is a consequence of the environment in which the initial 'bit' grows. Thus while the *genes* inherited in the parental bit ensure the recurrence of the forms of metabolism in the progeny, the ambient environment in which the bit grows determines the way the inherited metabolism actually manifests itself. **This is why both heredity and environment go hand in hand in shaping the life of the offspring from cradle to grave.**

It is therefore obvious that consideration of life without its environmental support is all but meaningless. All life is the out come of a complicated interaction between heredity and environment. However, even though both the heredity and environment determine the characteristics of the offsprings, different characteristics in the offsprings do differ widely in the degree to which they are dependent on hereditary *genes* and the prevailing environment. At one extreme there are traits which wholly depend on the *genes* the organism carries regardless of the environment so long as it is at all compatible with survival and growth. A case in point is varieties of peas which may either be wrinkled or round, whether a pea which wrinkled or round is purely a *gene* effect. Likewise, whether a man will be blood group A or B, whether a cow will be horned or hornless and whether a mouse will be gray or white, depends wholly on *genes* it carries no matter what the environment is. On the other hand, there are cases where even individuals having identical *genes* may develop different qualities in different environments.<sup>101</sup>

### **Genetics—study of heredity and *genes***

Genetics is the study of heredity in general and of *genes* in particular. Since prehistoric times man has recognized the influence of heredity and has applied its principles to the improvement of cultivated crops and domestic animals. A Babylonian tablet more than 6000 years old for example shows

pedigrees of horses and indicates possible inherited characteristics, other old caving shows cross pollination of date palm trees. Most of mechanisms of heredity however, remained a mystery until the 20<sup>th</sup> century when scientifically supported information become available.

Genetics overlaps with many different branches of biology and with many other sciences like chemistry, physics, mathematics, sociology, psychology and medicine. Microbiologist who study inheritance in micro organisms are called microbial geneticists, cytologists who study the genetics of cells are called cytogenetics. Biology or molecular geneticists investigate the chemical nature of the *genes* and its method of action. Some physicists have applied their technique to molecular genetics and solved certain problems of human and animal behaviour. Specialists in medical genetics or genetic counseling act on the knowledge that many of men's applications are hereditary.

### **Discovery of laws of heredity—by Gregor Mendel**

Mendel Gregor born July 22, 1822 Heingendorf Austria died Jan. 6, 1884. Brunn Austria Hungary (now Brno, Cyzech republic original name until 1843). Johan Mendal Austrian botanist and plant experimenter, the first to lay the mathematical foundation of the science of genetics, in what came to the called mendelism.

Mendel crossed varieties of the garden pea that had maintained under his observation, constant differences in such single alternative characters as tallness and dwarfishness, presence or absence of colour in the blossoms and axils of the leaves, and similar alternative differences in seed colour, seed shape, position of the flowers on the stem and form of the pods. He theorized that the occurrence of the visible alternative characters of the plant, in the constant varieties and in their descendant is due to the occurrence of paired elementary units of heredity, now known as *genes*. The novel features of Mendel's interpretation of his data, amply confirmed by subsequent observations on other organisms including man is that these units obey simple statistical laws. The principle of those laws is that in the reproductive cells of the hybrids, half transmit one parental unit and the other half transmit the other. This separation of alternative characters in the

reproductive cells, now known as Mendel's first law or the principle of segregation, adequately accounts for the results when single pairs of alternative characters are observed through? Several generations and serve reliably as a basis of predication. Mendel showed, moreover, that when several pairs of alternative characters are observed the several pairs of elements enter into all possible combinations in the progeny. In pea varieties at his disposal he observed that the seven pairs differentiating characters recombined at random, according to the law or principle of independent assortment, and he worked out the statistical consequences of this principle and confirmed them by experiment.<sup>102</sup>

### **Relation of Genetics with Evolution**

Theory of evolution is related to the science of genetics. Theory in biology postulating that the various types of the animals and plants have their origin in other pre-existing types are that the distinguishable differences are due to modifications in successive generations. The theory of evolution is one of the fundamental keystones of modern biological theory.

The 19<sup>th</sup> century English naturalist Charles Darwin argued that organisms come about by evolution and he proved a scientific explanation, essentially correct but incomplete, of how evolution occurs and why it is that organisms have features—such as wings, eyes and kidneys—clearly structured to serve specific functions. Natural selection was the fundamental concept in his explanation. Genetics, a science born in the 20<sup>th</sup> century, reveals in detail how natural selection works and led to the development of the modern theory of evolution. Since the 1960s a related scientific discipline, molecular biology, has advanced enormously knowledge of biological evolution and has made it possible to investigate detailed problems that seemed completely out of reach a few years earlier, for example, how similar the *genes* of humans and chimpanzees might be (they differ in about for 2% of the units that make up the *genes*).

The virtually infinite variations on life are the fruit of the evolutionary process. All living creatures are related by descent from common ancestors, humans and other mammals are descended from shrew like creatures that lived more than 150 lac years ago is mammals, birds, reptiles, amphibians

and fishes share as ancestors aquatic worms that lived 600 lacs years ago, all plants and animals are derived from bacteria like micro organism that originated more than 3000 lacs years ago. Biological evolution is a process of descent with modifications. Lineages of organisms change through generations, diversity arises because the fine ages that descent from common ancestors diverge through time.<sup>103</sup>

The diversity of the living world is staggering. More than 2 lac existing species of plants and animals have been named and described, many more remain to be discovered from 10 lacs to 30 lacs according to some estimates. What is impressive is not just the numbers but also the incredible heterogeneity in size, shape and way of life from lowly bacteria, measuring less than 1000<sup>th</sup> of a millimeter in diameter, to the stately squoias of California, rising 300 ft (100 meters) above the ground and weighing several thousand tons, from bacteria living in the host springs of Yellow Stone national park at temperatures near the boiling point of water to fungi and algae thriving on the ice masses of Antarctica and in saline pools at 9<sup>0</sup>f (-23<sup>0</sup>c) and from the strange and larkspur plants existing on Mount Everest more than 19868 feet above sea level. (Britanica Encyclopaedia 2005, deluxe edition).

## **CHARACTERISTICS OF *GENES***

Now the characteristics of *genes* are being studied.

### **What is *gene*?**

*Gene* is a unit of inheritance, a piece of genetic material that determines the inheritance of a particular characteristic, or group of characteristics. *Genes* are carried by chromosomes in the cell nucleus and are arranged in a line along each chromosome. Every *gene* occupies a place or locus on the chromosome. Consequently, the word locus has become loosely interchangeable with the word *gene*.

The genetic material is deoxyribonucleic acid or DNA, a molecule that forms the backbone of the chromosomes. Because DNA in each chromosome is a single, long, thin continuous molecule the *genes* must be parts of that molecule and because DNA is a chain of minute sub units

known as nucleotide bases, each *gene* includes many bases. Four different kinds of bases exist in the chain :

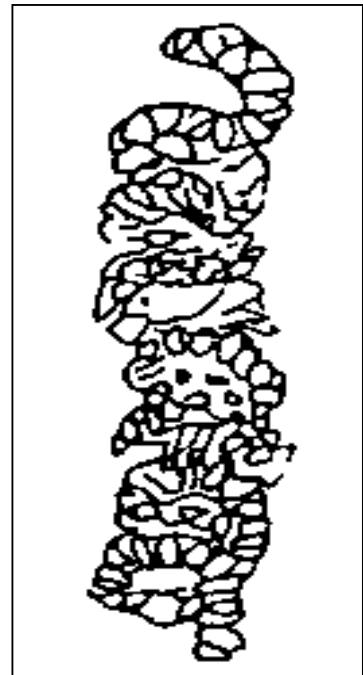
- (1) adenine (A)
- (2) guanine (G)
- (3) cytosine (C)
- (4) thymine (T).

and their sequence in a *gene* determines its properties.<sup>104</sup>

### **Genes—Software of heredity**

As a result of decades of observations and breeding experiments. We now know that the nuclear material of the cell is organized in the form of minute rod-like structures (see fig. 1). These minute structures in thin tissue slices can be seen by staining them with certain dyes which they take up more readily than the rest of the cell. It is this property of becoming visible by means of dyes which gave them the name "chromosome" (chroma = colour, soma = body).

Chromosomes in turn are not homogeneous compositions nor single constituents. They are strings of those particles of heredity we earlier called *genes*, whose existence had been inferred from numerous breeding experiments, like those of Mandela. Such experiments had clearly shown that all the heritable characteristics of organisms are transmitted unchanged without "dilution or blending" because they are carried by distinct indivisible particles of heredity Mendel called factors and which we know call *genes*. Although *genes* have since been found to be actually very complex structures, being ultra-microscopic specks of nucleic acid which can reproduce themselves by copying, they are transmitted from parent to progeny as indivisible units of heredity so that they behave very much like atoms in chemistry. These 'atoms' of heredity, the *genes* are arranged in a



**Fig. 1 :**  
**Chromosome with dot-like thickenings which indicate the positions of genes.**

very precise way in the nucleus of the cells of the organism. Literally hundreds or thousands of them are wrapped together linearly in microscopic packets we have called chromosomes. Thus if *genes* are atoms of heredity, chromosomes are its macro molecules. **The study of heredity is, therefore, the study of *genes* and chromosomes.**

As already mentioned, each chromosome carries hundreds or thousands of *genes*. The human cell, for example, has been estimated to carry at least 40,000 *genes*, possible twice as many. This number may seem large. But it is not so large when we consider the complexity of development activities that the *genes* have to monitor. **For it is the *genes* that are responsible for all that is inborn and inherited in us.** Thus, it is the type of *genes* we inherit that determines our sex, blood group, vision (whether normal or colour blind) eye and skin colours, metabolic propensities, mental powers and thousand other traits that make up our physical and mental personalities.

Such similarities between parents and progeny as that of eye and skin colour of type of blood group are not the kind of stuff that can be packed in *genes* for onward 'transmission'. What is transmitted is a set of blue print "instructions" that determine broadly the course of development, and growth from conception to birth, then to adulthood senility and death. These instructions are embodied in the *genes* and chromosomes, in a code we have yet to decipher fully, but in principle it is analogous to a program tape of a computer which carries the 'instructions' for making it work in the desired way. Chromosomes and *genes* are thus in a manner of speaking micro miniaturized 'tapes' of heredity, the software of heredity that activates the computer hardware of environment.<sup>105</sup>

## **Gene Action**

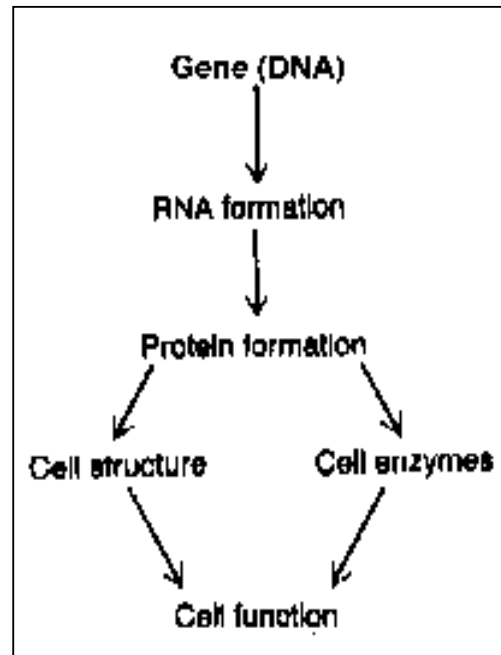
Genetics may be defined as the study of the ways in which *genes* operate and the way in which they are transmitted from parents to offsprings. Modern genetics involves study of the mechanism of *gene* action—the way in which the genetic material (de-oxyribonucleic acid or DNA) affects physiological reactions within the Cell. Although *genes* determine the features an individual may develop, the features that actually

develop depend upon the complex interaction between *genes* and their environment. Normal green plants, for examples have *genes* containing the information necessary to synthesize the chlorophyll that gives them their green colour and chlorophyll is synthesized in an environment containing light i.e. the *gene* for chlorophyll is expressed. If the plant is placed in a dark environment chlorophyll synthesis stops i.e. the *gene* is no longer expressed.<sup>106</sup>

### The arrangement of *Genes*

In most of the *eukaryotic* organism each cell may contain more than one DNA molecule and these together are known as chromosomes. The DNA is packaged and each DNA molecule may carry thousand of the *genes*. Therefore, on each DNA molecule thousands of *genes* are found in apparently random manner. The *genes* may be grouped into clusters of related *genes*, while in prokaryotes (bacteria) it is not unusual to have the need to express several *genes*, which are not the same but are related, in that the proteins, which are encoded by the *genes* are required along a common metabolic pathways.<sup>107</sup> The clusters of *genes*, which either encodes for the same protein or very similar proteins are called homologous. Their nucleotide sequences are very similar, clusters of similar *genes* are called multi *gene* families.

Virtually every one knows that the *genes* control heredity from parents to children, but most persons do not realize that same *genes* control the reproduction of and the day-to-day function of all cells. The *genes* control cell function by determining what substances will be synthesized with in the cell what structure, what enzymes, what chemicals. Fig. 2 illustrates the general scheme of genetic control. Each *gene*, which is a nucleic acid called de-oxy-ribonucleic acid (DNA)

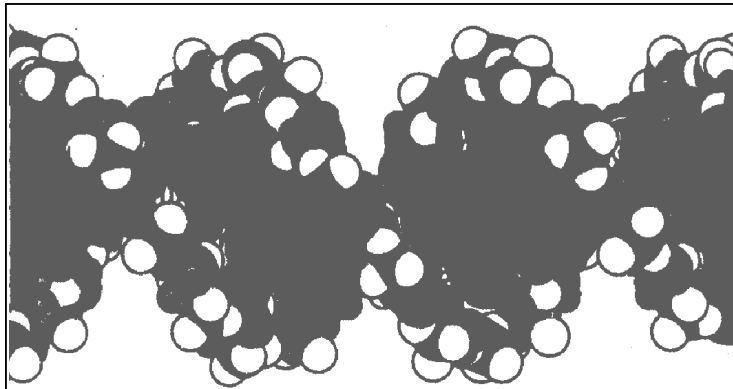


**Fig. 2 : General schema by which the *genes* control cell function.**

automatically controls the formation of another nucleic acid, ribonucleic acid (RNA) which spreads throughout the cell and controls the formation of a specific protein. Some proteins are structural proteins, which in association with various lipids and carbohydrates, form the structure of various organelles. By far the majority of the proteins are enzymes that catalyze the different chemical reactions in the cells. For instance, enzymes promote all the oxidative reactions that supply energy to the cell, and they promote the synthesis of various chemicals, such as lipids, glycogen, adenosine triphosphate (ATP) and so on.

For the formation of each cellular protein there is usually only a single *gene* pair in each cell. It is estimated that cells of the human being have over 1.0 lac such *gene* pairs, which means that as many as 1.0 lac different proteins are formed in different cells, though not all of these in the same cell.

Large number of *genes* attached end on end are contained in extremely long double stranded, helical molecules of DNA having molecular weights measured in the billions. A very short segment of such a molecule is illustrated in Fig. 3.<sup>108</sup>



**Fig. 3 : The helical, double-stranded structure of the *gene*. The outside strands are composed of phosphoric acid and the sugar deoxyribose. The internal molecules connecting the two strands of the helix are purine and pyrimidine bases; these determine the "code" of the *gene*.**

### ***Gene*—the constituent element in body and personality**

One of the most significant discoveries in the world is the discovery of the structure of *gene*. *Gene* will not only bring a radical change in the medical field but also unravel a lot of mysteries about life which are closely guarded by nature till now. Man has ever been curious to know about himself and his life mysteries, ever since human life took off on the earth. The nature is so mysterious that to fathom the mysteries of its structure is

almost impossible, similarly, human life is also a wonderful mystery, the changes occurring in life have always given challenges to scientists. A team of British scientists led by Dr. Francis Collis, have succeeded in finding answers for some of the mysteries of human life after extensive research and experiments carried under Human genome project.

### ***Genes*—the life motivator component**

**We know that all beings without exception are assemblage of cells.**

We find that in all organisms, from the bacterium to man, the chemical machinery of all the cell is essentially the same in both its structure and functioning. Since Angles wrote the primary role of proteins in living processes, it has been further emphasized by the discovery that all these chemical reactions are catalyzed by enzymes which are themselves proteins. By means of 'instructions' embodied in the genetic material, DNA, according to the genetic code that is universal in that the DNA-RNA protein system or some variant of it, is operative in all living organisms. But the 'instructions' or information on the basis of which a new living being arises is always contained in the genome, the *genes* and chromosomes, of another structurally similar being, its parent(s). Description of functioning of a living organism may be recorded not merely on a paper, tape or punch card but also in the genetic material (DNA) of which *genes* and chromosomes are made. The real marvel is rather how this colossal information is locked in tiny DNA macro molecules, the *genes*.

Consider first the cell structure. All living beings, without exception, are made up of the same two principal classes of micro-molecules—protein and nucleic acids. The nucleotides of the nucleic acids on the same hand and amino acids of proteins, on the other. More importantly, these macro molecules are made up in all living beings by the assembly of the same residues, 20 L type amino acids for the proteins and nucleotides for nucleic acids. As for its functioning the same reactions or rather sequences of reactions we earlier called metabolic pathways are used in all organisms for the essential chemical operations, namely the mobilization and storing of chemical potential and the bio synthesis of cellular components.

If the new born infant is brought up in a jungle environment where there is no human language, he remains speechless for whole life. If during critical period of his development the environment provides no opportunity for the practice of knowledge, the individual never acquires the gift of speech. He remains a sort of speechless humanoid. Since the precise cortical organization of human cerebral cortex that enables him first learn to speak and thus armed to familiarize himself, with the world of objective knowledge depends greatly on appropriate neonatal environment, the old debate about the relative contribution of heredity (*genes*) and environment (nature) in making the mind of man.

It has been estimated that while the cerebral capacity of the gorilla brain is  $10^{14}$  bits, that of human brain is  $10^{15}$  bits. Assuming that  $10^{14}$  bits is the minimum threshold for information required for self maintenance and reproduction of an organization as complex as a gorilla or man, there is in a man a vast reservoir  $(10^{15} - 10^{14}) = 9 \times 10^{14}$  bits of cerebral power available for this practice of language, science, technology, spirituality and other cultural pursuits. If thus happens that while only 10% of this cerebral capacity suffices to perform all the physiological functions of his animal existence, the remainder 90% enables him to become what he is, namely homo sapien—man the wise.<sup>109</sup>

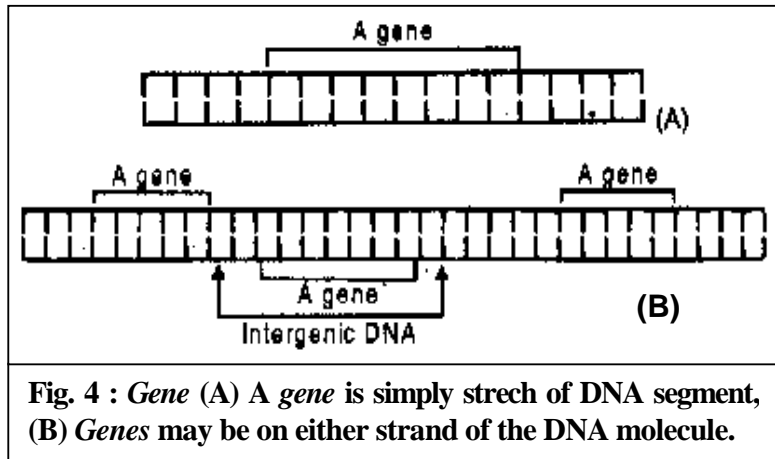
### **Products of *genes***

*Gene* exert their effects through the molecules they produce. The immediate products of a *gene* are molecules of ribonucleic acid (RNA), these are copies of DNA, except the RNA has the base uracil(C) instead of thiamine. The RNA molecules from some *genes* lay a direct part in the metabolism of the organism, but most of them are used to make protein. Proteins are chains of subunits known as amino acids, and the sequence of bases in the RNA determines the sequence of amino acids in the protein by means of the genetic code. The sequence of amino acids in a protein dictates whether it will become part of the structure of the organism or whether it will become an enzyme for promoting a particular chemical reaction. Thus change in DNA can produce changes that effect the structure or the chemistry of an organism.

The nucleotide bases in DNA that code the structure of RNAs and proteins are not the only components of *genes*, group of bases adjacent to the coding sequences affect the quantities and disposition of *gene* products. In higher organisms (animals and plants, rather than bacteria and viruses) the non coding sequence outnumber the coding ones by a factor of ten or more and the function of these non coding regions are largely unknown. This means that geneticists cannot yet prescribed limits to the size of animal and plant *genes*.

The genetic information is stored in packages, on *genes* where one *gene* holds the information for the production of polypeptide sequence. This

idea was first hypothesized by Beadle the Tatum in 1941. *Gene* is a presumed unit of heredity. It is defined as a discrete sequences of DNA which code for given biological molecules



**Fig. 4 : Gene (A) A gene is simply stretch of DNA segment, (B) Genes may be on either strand of the DNA molecule.**

such as a structural proteins and enzymes. Thus a *gene* might be defined as a polynucleotide tRNA, rRNA. As the information is in the form of a series of bases along the DNA molecule, a *gene* is simply a stretch of DNA, with a defined start site and a defined end. It can then be processed as a unit and the information passed on to the machinery, which will made the protein.

Not all the DNA in a cell are used for the storage of information therefore not all the DNA is used as a part of a *gene*. The stretches of DNA that lie between *genes* are known as intergenic DNA.<sup>110</sup>

## Reading of *Gene* Sequences

All human beings have fundamentally the same anatomical structure and operate through the same bio-chemical and physiological processes and are driven by similar biological urges. Yet no two human beings are alike. **What is more important is that any individual living now is entirely**

**different from anyone who has ever lived in the past or will live in future.** Each person is unique, unprecedented and unrepeatable. Leonardo do Vince the great sculptor, painter, philosopher all rolled into a great creative genius was the so-called illegitimate son of a half witted woman who spent a night with an itinerant soldier at the wayside inn. That was the clicking of the *genes*. The biological mechanisms through which each person develops his own behavioural singularity are two fold—the evolution part and genetic endowment.<sup>111</sup>

There is now overwhelming evidence that man's body and brain have not changed significantly during the past 10,000 years. The same set of *genes* that governed man's life when he was Paleolithic hunter or a Neolithic farmer still governs his anatomical development, physiological needs and emotional drives.<sup>112</sup>

Any stretch of DNA has two strands and therefore the capacity for holding two different sequences of bases, depending on which strand is read. That is not to say though that both strands are not used. Some *genes* will be on one stand while others will be of the other strand. Therefore, varied terms have been coined to refer to the strand, which hold sequence information and those which do not, such as sense and anti-sense, coding and non-coding. A *gene* sequence is always read from the 3' end to 5' end, and therefore *genes*, which reside on different strands are read in opposite directions, again a fact that needs consideration when a researcher is trying to decipher the *gene* sequence.

3' end to the 5' end.

## CHARACTERISTICS OF GENOME

Understanding the information contained in genome sequence was the major challenge of the early 21<sup>st</sup> century. **The genome is the entire DNA content of a cell, including all the *genes* and all of the intergenic regions.** Prokaryotic genomes are small with very little space between *genes*. The yeast genome contains 6000 *genes* and has a more compact organization.

Every organism is specified by genomes, which contain the biological information needed to construct and maintain a living organism. Most genomes, including those for all cellular life forms, are made of DNA

(deoxyribonucleic Acid) but a few viruses have RNA (ribonucleic Acid) genomes. DNA and RNA are polymeric molecules made up of linear, unbranched chain of monomeric subunits called nucleotides.

The biological information contained in a genome is encoded in the nucleotide sequence of its DNA or RNA molecules and is divided into discrete units called *genes*. The information in a *gene* is read by proteins attached to the genome at the appropriate positions and initiate a series of biochemical reactions referred to *gene* expression.

For organisms with DNA genomes this process was originally looked on as comprising following two stages :

- (i) **Transcription** : first producing an RNA copy of *gene*.
- (ii) **Translation** : resulting in synthesis of protein whose amino acid sequence is determined, via the genetic code, by the nucleotide sequence of the RNA transcript.

This is still an accurate description of *gene* expression in simple organisms such as bacteria, but it gives an incomplete picture of events involved in conversion of genomic.<sup>113</sup>

## **Complete copy of genome**

A complete copy of the genome must be made every time when a cell divides. DNA replication has to be extremely accurate in order to avoid the introduction of mutations into the genome copies. Some mutations do, however, occur either as errors in replication. It may be due to effects of chemical and physical mutagens that directly alter the chemical structure of DNA. DNA repair enzymes. These enzymes correct many of these errors. Those that escape the repair processes become permanent feature of the lineage descending from the original mutated genome. These events, along with genome rearrangement resulting from recombination, underlie molecular evolution, the driving force behind the evolution of living organisms.

## **DNA and genome**

The cell is the fundamental structural and functional unit of all living beings (organisms). There are certain differences between the cells of different living organisms as well as the cells in the different part of the

living organisms. All cells contain a fluid called cytoplasm and a nucleus and are enclosed in a cell membrane. Operations within the cells and coordination among various cells make the being live. **The life of all the living beings is, therefore, based upon the working of the cells.**

The nucleus of a cell contains a chemical DNA (Deoxyribonucleic Acid). All the instructions needed to direct the activity of cell are contained within the DNA. DNA is a polymer. The monomer units of DNA are nucleotides and the polymer is known as a "polynucleotide". There are four different types of nucleotides found in DNA, differing only in the nitrogenous base. The four nucleotides are :

- (i) Adenine (A)
- (ii) Guanine (G)
- (iii) Cytosine (C)
- (iv) Thymine (T)

DNA of all the organisms is made up of the same chemical and physical components. **The DNA sequence is the particular side-by-side arrangement of bases along the DNA strand.**

ATTCCGGA

This order spells out the exact instructions required to create a particular organism with its own unique traits. The DNA is normally the form of a double strand (double helix). Where the second strand is complementary to the first strand. That is, in the second strand a sequence such as AGGTTT is replaced by TCGAAA which carries the same information.

### **Genome—Complete set of DNA**

The genome is an organism's complete set of DNA. Genomes vary widely in size, the smallest known genome for a free living organism (a bacterium) contains about 6000 DNA base pairs, while human and mouse genomes have some 3.0 billion bases. Except for mature red blood cells, all human cells contain a complete genome.

DNA in the human genome is arranged into 24 distinct chromosomes, physically separated molecules that range in length from about 50 million to 250 million base pairs. Each chromosome contains many *genes*, the basic

physic and functional limits of heredity. Gregor Mendel was the first to realize through extensive experiments with breeding of peas at lowest level of inheritance which is now known as a '*gene*'. *Genes* are specific sequences of bases that encode instructions as to how to make proteins. *Genes* comprise only about 2% of human genome, the remainder consists of non-coding regions, whose functions may include providing chromosomal structural integrity and regulating where, when and in what quantity proteins are made. The human genome is estimated to contain 30,000 to 40,000 *genes*.

### **Heredity carrier—the *genes***

Gregor Mendel showed that the characteristics of parents are passed on to offspring through *genes*. These *genes* might produce visible characteristics in offsprings, or might be carried for possible transmission to another generation. The children of one set of parents do not inherit all the same characteristics. The union of two productive cells, the egg from mother and the sperm from the father is the beginning of new individual. These two cells like all other carry with in them material that forms a definite number of chromosomes are pairs and each chromosome contain 1000 or so *genes* that also occur in pairs.

The process of inheritance is based upon the process in which the offsprings receives one of each *gene* pair from each parent. Some *genes* are dominant and some are recessive. An individual with dominant *gene*, for a particular characteristic displays that characteristic whether only one or both *genes* in the pair are dominant. If a *gene* is recessive, however, the characteristic associated with it does not show up unless both *genes* in the *gene* pair are recessive. In case only one *gene* in a pair is recessive, its effect will be marked by its dominant partner, but the recessive *gene* may still be passed on to the individual's offspring. Some characteristics are produced by a single *gene* or *gene* pair. Whereas multiple factor inheritance involves the action of several *genes*.

### ***Genes*—sequence of genetic code**

*Genes* are now known to be implemented as sequence of genetic code that direct specific cells to produce a particular protein at a particular time.

An essentially infinite number of possible different protein molecules can be produced depending on the particular order of amino acid molecules used in their construction. The code for protein production has been "broken" so that we now know that a three letter sequence (a codon) is used to specify a particular amino acid (there are 20 amino acids). For instance the sequence GGC specific that the amino acid glycine is to be added to a protein molecule. Start and stop codon mark the beginning and end of protein coding sequence in a manner startlingly like modern data communications schemes. **There are 64 possible codons and only 20 possible amino acids.** So some redundancy and error correction exist. The regulatory code sequences in *genes* that specify in which parts of the body and/or at what times a protein will be produced are more complex and less understood.

### **Genetic code—a blue print**

The genetic code (codon) has been compared to a blue print specifying the design of the organism that provides for the mechanisms needed to "read" the code and manufacture the components of the organisms as well as specifying the procedures needed for the life processes of the finished organisms. Simple organisms are completely defined genetically. Each tiny nematode worm has exactly 958 cells. Humans on other hand, have trillions of cells and 30 to 40000 *genes* so the genetic code is more of a general plan. For example major blood vessels are genetically specified. Everybody has an aorta. But minor blood vessels grow where needed according to genetically defined rules.

Although all the somatic cells in an organism contain the complete code, in any given cell only a relatively few *genes* are active. The difference in the *genes* that are active determines the difference between, say, liver and brain cells. A complete *gene* logic determines when and where a particular *gene* will be "turned on". The *gene* logic can accommodate varying amounts of positional detail. The eye which is complex requires less genetic information. The *gene* logic also controls when various activities take place. Cells divide rapidly in growing organisms but do not divide in adults unless needed to replace dead or discarded cells. Cancer involves a major breakdown in the *gene* logic in which cells grow in both an inappropriate

time. Cancer is thought to require multiple mutations, some of which can be inherited.

### **Effect of genetics and environment on human behaviour**

Studies in behavioural genetics have shown that both genetic and environmental factors influence the normal and deviant behaviour of human beings. Only a few decades ago, psychologists believed that characteristic of human behaviour were almost entirely the result of environmental influences. These characteristics now are known to be genetically influenced, in many cases to a substantial degree. Intelligence and memory, novelty seeking and activity level, shyness and sociability all show some degree of genetic influence.<sup>114</sup>

### **What are *genes* for?**

Somebody is naturally shy because of his *genes*, but *genes* are not the switches that indicate ones qualities. *Genes* are simply chemicals that direct the combination of more chemicals. The chemicals that make up *genes* is called deoxyribonucleic acid or DNA. It comprises simple building blocks called bases, of which there are four different varieties A, G, T and C. The bases come together in long strings, and each DNA molecule consists of two of these strings paired according to the rule that A matches T and G matches C. DNA stores information in the order of bases. The DNA sequence 'AGCT' means one thing and the sequence 'TCGA' means something else, as difference in meaning 'taps' and 'spat'.

The information in DNA is converted into proteins, which are made of amino acids. Proteins are where, where there the action is. The most important function of proteins is to act as enzymes that change one chemical into another. For example, it is an enzyme that converts tyrosene, as amino acid found in many foods, into dopamine, a brain chemical that can make you feel active and excited. A different enzyme breaks down the dopamine into smaller molecules and there by leaves you feeling more relaxed or even lazy. Different enzymes make and degrade the more than 300 brain chemicals that influence thinking, acting and feeling.

The brain and body are built by DNA and everyone's DNA is pretty much the same, we have 99.9% the same DNA as Michael Jordan, Albert Einstein, Elizabeth Taylor, Charles Manson, Julius Caesar, Julia Child and Jules Verne. All of them and every one who has ever lived have the same 1.0 lac or so *genes*, which are organized into the same 23 chromosomes.

But pretty much the same is not exactly the same. There are differences in D.N.A. about 0.1% or one bit out of every 1000. Considering that there are 3 billion chemical based in question, the differences matter, where Michael-Jordan's DNA says "G", Michael Jackson's may say "C" and Andrew Jackson's said "T", while Jack the Ripper's said "A". **There are roughly 3 million such differences between individual, and these differences are responsible for all the inherited aspects the variations among people from eye color to height to personality and intelligence.** It is hard to believe that such a tiny difference—one tenth of one percent could make such a great difference in how people vary from each other. Many of the 3 million variations do not mean anything as far as we know, so there are even fewer differences that matter.

If we do not believe that 0.1% of DNA could be responsible for so many differences, consider the fact that human DNA differs from chimpanzee DNA by only 1 to 2%; Your DNA and a chimp's at least 98% the same. Yet this seemingly "fine print" of DNA instructions is the reason human can do calculus, compose poetry and build cathedrals, while chimps pick bugs off each other and eat them. Humans have pretty much the same DNA as a chimp because that is where we came from, and the chimp is close to the ape because that is where he came from, and so down the line fish and reptiles and even up to single cell organism such as yeast. This evolutionary conservation has a beneficial side effect : we can often figure out what a human *gene* does by looking at a similar *gene* in simpler organisms.

One of the most common misconception about genetics is that there are *genes* 'for' things. Some people have the *genes* for breast cancer, shyness, blue eyes so they must have the disease, condition or trait. This is what people tend to think when they hear about a *gene* 'for' depression, or a 'gay *gene*' or 'obesity *gene*'. If that were true, it would be easily enough to undergo testing to see what *genes* you have, and therefore what you ought to

worry about. That is not the way it works. Everyone has a "mood *gene*" and a "sexual orientation *gene*" and a *gene* that regulates body weight. The difference is that the *genes* come in different varieties or flavors.

For example may be the "mood *gene*" which every one has a receptor that responds to the hormones related under stress. May be the only difference between two people is that one has a *gene* with T at position 4,356 where as the other person has a C at the same spot. That might be enough to affect the strength of the electrical current flowing through the cells, so the same amount of hormone produces a gentle buzz in one person and a walloping jolt in another. That single detail—1 letter out of 3 billion—could mean the difference between a mostly cheerful person and one, who is easily depressed. Both people have the same *gene*, but the fine print makes all the difference. Imagine a room filled with 30,000 books. Here the difference would be the equivalent of a single letter in a single book.<sup>115</sup>

### **Modern concept in *gene***

Mendel while explaining the result of his breeding experiment pointed out that hereditary characters were governed by some particular genetic determines present in the germ cells. These genetic determines of hereditary character are now called "*genes*". The term *gene* was coined by Prominent Geneticist Johansen Dauries (1990) used the term 'pangen' and perhaps from this word the term '*gene*' was derived. In old books of genetics the term '*gene*' is treated as merely something which effects the phenotype and behaves as a particle. It should be noted here that nothing was said about the size, shape and chemical constitution of *gene* in old definition :

As per 'Morgan' theory of *gene* it is stated that :

- (i) chromosomes are bearers of hereditary units and each chromosome carries hundreds or thousands of *genes*.
- (ii) The *genes* are arranged on the chromosomes in linear order and on specific region or loci.

*Gene* can be defined best in terms of its effects. The *gene* is a unit of function. *Gene* is a unit of recombination. The *gene* is a unit of mutation. From the source of Scientist Limba Defira and Moses, 1966 it is established that DNA is the essential genetic material. Here everybody seems generally

agreed as the fact that the genetic material (*genes*) of lower organisms are similar to those of higher ones. Munteing (1961) defines a *gene* as small segment of chromosome having an unitary bio-chemical function and specific step on the properties of individual.<sup>116</sup>

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- <sup>1</sup> *Sam̐skṛta-Hindi dictionary*, V.C. Apte, p. 253.
- <sup>2</sup> *Brahma Sūtra* with the commentary of Śanker 2.1.14) Saṁkhya thought calls it *prakṛti* (the nature) or *Sam̐skār* [(a) *Sam̐khyakāritā* (b) *Sam̐khya tattva kaumudi*
- <sup>3</sup> *Yoga darśana* with commentary of Vyāsa (1.5, 2.12, 2.13, 2.3).
- <sup>4</sup> *Abhidharma kośa* section 4.
- <sup>5</sup> *Nyāyamañjarī*, p. 472.
- <sup>6</sup> (a) *Mīmāṁsā Sūtra* śabar's commentary 2.1.5, (b) *Śāstra dīpikā* 2.1.5, p. 80.
- <sup>7</sup> (a) *Śāstra Vārta Samucchaya*, 107 : *Adṛṣṭam̐ karmasam̐skārāḥ puṇyāpuṇye śubhāśbhau dharmādharma tathā paśaḥ paryāyāstasya kīrtitāḥ,*  
 (b) *Daśvaiāliyam* 4.2 : *Tathā Ghuṇae Kammarayam̐* 10, Ibid, 7.57 *sa niddhuṇe dhutamalam̐ pūre kaṁḍa*
- <sup>8</sup> *Nyāyasūtra* 4/1 : *īswara karṇam̐ puruṣakarmā—phalasya darśanāt.*
- <sup>9</sup> *Karma ki hindu avdhārṇā*—Dr. Ravindranātha Miśra, Kala prakāśana, Vārāṇasī, first edition, 1996
- <sup>10</sup> *Dharma śāstra ka itihāsa*, part-V, p. 370—Bhārata Ratna Dr. Panduram̐ga Vamana Kāṇe
- <sup>11</sup> *Śwe. Upan.* 1.2.
- <sup>12</sup> Ibid, 1.2.
- <sup>13</sup> *Nyāya Sūtra* 4.1.22.
- <sup>14</sup> *Studies in Jaina Philosophy* by Dr. N.M. Tāntiyā, p. 220.
- <sup>15</sup> *Vaiśeṣika darśana* 5.1.1.150 : *Ātmā sam̐yoga prayatnā bhuyām̐ haste karma.*
- <sup>16</sup> Ibid, 1.117 : *Eka dravya guṇam̐ sam̐yoga vibhagevanpekṣaka kārṇam̐iti karma lakṣṇam̐ karma.*
- <sup>17</sup> *Nyāya Siddhānta Muktāwalī* : 6—*Utkṣepaṇam̐ tatoavakṣepaṇam̐akum̐canam̐ tathā prasāraṇam̐ ca gamanam̐ karmāvyetāni paṁca ca.*
- <sup>18</sup> *Rites enjoined by the sm̐rtis, Gītā rahasya*, p. 56-56.
- <sup>19</sup> *Gītā* 5-8-11.
- <sup>20</sup> Ibid, 8/23, 5/14, 9/8, 18/61.
- <sup>21</sup> (a) Ibid, 17.19 (b) Ibid, 18.19.
- <sup>22</sup> Ibid, 3.10.
- <sup>23</sup> *Manusm̐rti* 12/57.
- <sup>24</sup> *Gītā* 6/32.
- <sup>25</sup> Ibid, 9/28.
- <sup>26</sup> Ibid, 2/50.

- <sup>27</sup> *Gītā* 12/16.
- <sup>28</sup> *Bhagawat Gītā* (ra), p. 56.
- <sup>29</sup> *Gītā* 7/28.
- <sup>30</sup> *Val. Ram.* 7/15/25 : *Kasyacinna hi durbuddesýandato jāpate matiḥ. Ya drśam kurute karma tadṛśam phalamaswute.*
- <sup>31</sup> *Sam. Ma. Bha.* 12/8/5/7.
- <sup>32</sup> *Ibid*, 12/8/492.
- <sup>33</sup> *Mahābhārata śāntiparva*, 258/21.
- <sup>34</sup> *Mahābhārata anuśāsana parva*, 113/6-10.
- <sup>35</sup> *Vah. bha. anu.* p. 113/6-10.
- <sup>36</sup> Quoted from *subhāṣit saṁgraha*.
- <sup>37</sup> *Isibha Sayam Sūtra* 9/2.
- <sup>38</sup> *Anguttara Nikāya*—excerpt from Buddhist Philosophy and other Indian Philosophies, p. 463.
- <sup>39</sup> *Boddha dharma darśana*, p. 249.
- <sup>40</sup> *Boddha darśana and anya Bhārtīya darśana*, part I, p. 480.
- <sup>41</sup> *Abhidhammatya Saṁgrah*, p. 19-20.
- <sup>42</sup> *Ethical studies*, p. 314.
- <sup>43</sup> *Ibid*, p. 342.
- <sup>44</sup> *Pātañjala Yoga darśan* 2.12 : *Kleśamūla karmāśayo dr̥ṣṭā dr̥stajanma Vedaniyaḥ.*
- <sup>45</sup> *Ibid*, *halādapatitāpaphalāḥ puṇyāpuṇyahetutvāt.*
- <sup>46</sup> *Vide SV up I.2, SVS, II*, p. 52-64.
- <sup>47</sup> *Cf. stp III 53; sus. II*, 79-81.
- <sup>48</sup> *Karmavāda*—*Yuvacārya* (presently *Ācārya*) *Mahaprajña*.
- <sup>49</sup> *Karma vipāka karma granth* first; 1.
- <sup>50</sup> *Darśana aur cintana*, p. 225.
- <sup>51</sup> (a) *Prmātma prakāśa* 1.62 : *Visaya kasāyahim raṁgiyahaṁ je aṇuyā laggamti. Jīva paesahaṁ mohiyahaṁ jiṇa kammaṁ bhaṇṇamti.*
- (b) *Jaina siddhānta dīpika*, 4.1, *Acarya Tulasi*, *Atmanah sadasatpravṛtyā kṛṣṭāstaprāyogya pudgalāḥ karma*
- <sup>52</sup> *Jaina lakṣaṇāvali* II, p. 319 *karma prakṛti, curṇi* 1, p. 2, *Amjana cuṇṇapuṇṇa samuggagotva suhamthūlādi aṇegaviha poggalā kamma-pariṇamaṇajogā bandhamāṇa jīva pariṇāma paccaeṇa baddhā ṇāṇā diladdhighātiṇo suhadukkha suhāsuhāunāmucāṇi yogāyantarāya poggalā kammaṁ ti buccati.*
- <sup>53</sup> *Jīva-ajīva*—*Ācārya Mahāprajña*, 12<sup>th</sup> edition, 1998, Jaina Viśva Bhārati, Ladnun.

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- <sup>54</sup> *Darśana aura cintana, Paṁdita Sukhalālaḥi*, p. 219.
- <sup>55</sup> *Ātma Mīmāṁṣā, Paṁdita Dalasukha Malavaṇīyā*, p. 80.
- <sup>56</sup> *Jaina dharmadarśana*, p. 445-455.
- <sup>57</sup> *Darśan aura cimtana*, p. 225.
- <sup>58</sup> *Jaina Siddhānta Dīpikā* 4-1.
- <sup>59</sup> *The Jaina doctrine of karma*—by Dr. N.L. Kachāra, p. 3.
- <sup>60</sup> *Ibid*, p. 5.
- <sup>61</sup> *Uttarajjhāyāṇi* 28, 10-11, Jaina Viśva Bhārāti, Ladnun.
- <sup>62</sup> *Dasweāliyam* 4.3, Jaina Viśva Bhārāti, Ladnun.
- <sup>63</sup> *Ibid*, 4.3.
- <sup>64</sup> *Thāṇaṁ* 2, Jaina Viśva Bhārāti, Ladnun.
- <sup>65</sup> *Bhagavatī* 7.8, Jaina Viśva Bhārāti, Ladnun.
- <sup>66</sup> *Ātma Siddhi śāstra, śrṁad Rājacandrajī*—publisher Bhagwāna Mahāvīra hospital, Siwāṇā.
- <sup>67</sup> *Uttarādhyayana* 20.36-37, Jaina Viśva Bhārāti, Ladnun.
- <sup>68</sup> *Jainendra Siddhānta Koṣa*, part-III, 67.
- <sup>69</sup> *Rajavārtika* 5.1.24, 26, 434-12.
- <sup>70</sup> *Abhayadevasūri—Purnād galnāccha wapurādīnāmiti pudgalāḥ*.
- <sup>71</sup> *Niyamsāra, Ta. Vṛti* 9 : *galanapūraṇa svabhāva samāthaḥ pudgalaḥ*.
- <sup>72</sup> *Tattvārtha Sūtra* 5.23.
- <sup>73</sup> *Bhagavatī* 25.33, Jaina Viśva Bhārāti, Ladnun.
- <sup>74</sup> *Thāṇaṁ*, 4.135 : *cauvihe poggal pariṇāme paṇṇatte te jahā. Vaṇṇa pariṇāme, gandha pariṇāme, rasa pariṇāme, phāsa pariṇāme*.
- <sup>75</sup> *Bhagavatī* 5.172, Jaina Viśva Bhārāti, Ladnun.
- <sup>76</sup> *Ibid*, 5.154.
- <sup>77</sup> *Anuyogadwara-pramāṇadwara-paramāṇu duvihe pannate tamjahā-suhume ya vavahāriye ya*.
- <sup>78</sup> *Anuyogadwāra-Aṇamtaṇaṁ suhuma paramāṇu puggalaṇaṁ samudaya samiti samagayeṇaṁ vavahāriye paramāṇu poggule viḥfajjanti*.
- <sup>79</sup> *Jaina-karmology*—by Dr. N.L. Jaina, publisher Parśvanātha Vidyāpitha, Vārānasī, p. 74, first edition, 1998.
- <sup>80</sup> *The key of knowledge* by C.R. Jaina, p. 876-77.
- <sup>81</sup> *Jaina-karmology* by Dr. N.L. Jaina publisher *Pārśvanātha Vidyāpītha Vārānasī*, first edition, 1998.

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- <sup>82</sup> *Studies in Jaina Philosophy*—By Nathmal Tāñtiyā, publisher P.V. research institute, Vārānasī, first edition.
- <sup>83</sup> *Pancāstikāya* 29.30.
- <sup>84</sup> *Britanica Encyclopaedia* 2005, deluxe edition.
- <sup>85</sup> *Tāmdula Veyālia* 6, p. 10.
- <sup>86</sup> *Bhagavatī* 1.7.61.
- <sup>87</sup> *Pañṇavaṇā Sūtra* 1.56-91.
- <sup>88</sup> *Ist karmagrantha*, p. 2, *Devendrasuri vircita*.
- <sup>89</sup> *Biology*, p. 452.
- <sup>90</sup> *Ibid*, p. 452.
- <sup>91</sup> *Bhagavatī Sūtra* 1.7.61, *Tāmdula Veyālia* 1,2.6.
- <sup>92</sup> *Tāmdula Veyāliya* 1, 2, 6.
- <sup>93</sup> *Ibid*, 1-2.
- <sup>94</sup> *Biology*, p. 453.
- <sup>95</sup> *Viseṣāvasyakabhāṣya gatha* 572, L.D. series, p. 119.
- <sup>96</sup> *Biology*, p. 506.
- <sup>97</sup> *Tāmdula veyaliyā*, p. 16.
- <sup>98</sup> *Khettaṁ kalaṁ bhavaṁ bhāvam ca sampappa vbha*, *Ga* 522, p. 119.
- <sup>99</sup> *First karmagrantha* with auto commentary *Devendrasūri*, p. 2, *Ksamabhvdai-kakuyormanisijadayoh.....karmanibandhanama*
- <sup>100</sup> *Biology*, p. 506.
- <sup>101</sup> *Genetics today*—by Jagjit Singh, publisher National book Trust, New Delhi, second edition, 1988, p. 17-22.
- <sup>102</sup> *Britanica Encyclopaedia* 2005, deluxe edition.
- <sup>103</sup> *Ibid*.
- <sup>104</sup> *Basic and molecular Genetics*—by Parihar, student edition, Jodhpur, edition 2004, p. 206.
- <sup>105</sup> *Genetics today*—by Jagjit Singh, publisher—National book trust, New Delhi, second edition, 1988.
- <sup>106</sup> *Britanica Encyclopaedia* 2005, deluxe edition.
- <sup>107</sup> *Genetic Engineering and its application*—by P. Joshi, second edition, Agrobios (India) Jodhpur.
- <sup>108</sup> *Medical physiology*—by Guyton, published by Prism books (P) Ltd., eighth edition, 1991, p. 23.
- <sup>109</sup> *Genetics today*—by Jagjit Singh, publisher—National book trust, New Delhi, second edition, 1988.

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- <sup>110</sup> *Basic and molecular genetics*—by Parihar—student edition, Jodhpur, 2004, p. 206-207.
- <sup>111</sup> *Understanding genetics*—by O.S. Reddi, Allied publication Ltd., New Delhi, first edition, p. 2
- <sup>112</sup> *Ibid*, p. 3
- <sup>113</sup> *Basic and molecular Genetics*—by Parihar, Student edition, Jodhpur, 2004, p. 249.
- <sup>114</sup> *The Jaina Doctrine of karma*—the religious and scientific dimensions by Dr. N.L. Kachara, p. 24-25.
- <sup>115</sup> Bouchard, Thomas J., Jr. "Genes, environment and personality" science 264, 1700-1, 1994.
- <sup>116</sup> *Cytogenetics Evolution and plant breeding*—by R.S. Shukla and P.S. Chandel, publisher—S. chand and co. Ltd. Ramnagar, New Delhi, 1998 edition.