Review Article

Science of breeding and heredity from ancient Persia to modern Iran

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About 1700 years BC, the prophet Zoroaster declared equal right for women and men to choose their "own ways." There is much evidence that ancient Persians believed in the equal contribution of women and men toward producing a child, and all its hereditary characteristics.

Even more surprising are the phrases in Vandidad book, which were gathered by Mobedans in the Mad dynasty about egg extraction (gametes) from animal reproductive organs (gonads) and their storage for future conception.

Centuries later, Western philosopher beliefs in regard to reproduction were contrary to Persian knowledge. The Greek philosophers believed that man's water (semen) contains all human characteristics, and the female uterus is only responsible for nurturing and development of fetus. After detection of the ovum (de Graaf 2nd half 17 century) Malpigy proposed the preformation theory (ovist) which means there is a miniature human inside ovum, that grows after Semen has entered the uterus and grow into a well-developed fetus. This hypothesis was later delegated to spermatozoa. These contradictory and inappropriate beliefs were subject to discussions and dispute, until C.E. Wolf demonstrated that the embryo is a product of the fertilization of ovum by spermatozoa.

800 years prior this the sage Ferdowsi "The Great Iranian Poet" explains nicely the equal participation of man and woman in the production of the fetus and transmission of characters.

After the renaissance and especially in recent years, tremendous achievements have been made in unraveling biological secrets of reproduction. There was no work o n genetics in Iran until 1936, when a genetic course was added to the biology curriculum in related colleges and universities; Iranian Genetics Society was founded in 1966, initiating a steady movement in this field.

Although there was an inevitable gap during the revolution and war in our country, now there is great effort by researchers to eliminate the gap and bring us into the mainstream of world science, and development in biomedical sciences in the third millennium.

Key words: Breeding, heredity, genetics history, pangenesis and preformation hypothesis

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Introduction

About 1738 BC, the ancient Iranian prophet, Zarathushtra talked about the equality of men and women and their right to choose their path.(Gatah, Yasna, 3rd hat, 2nd band)[1,2] Following the spread of Zoroastrianism in Achaemenid Persia, about 2600 years ago (550–330 BCE), Cyrus the Great, manifested the first version of human rights charter and implemented equality of all human beings and prohibition of slavery.[3] To prove his righteous claim to the throne, Darius the Great, the son-in-law of the Achaemenid Emperor of Persia - Cyrus the Great - and a great follower of his doctrines, indicated his direct maternal and paternal descent from the "Achaemenian"- Cyrus' great ancestor.[4] Based on the archives of Persepolis, and according to Haid Mary Kokh, German anthropologist/historian/in her book "Dariush speaks," there were many women in positions of leadership and management in Persepolis. These women were treated equal to men and were given paid leave 1 month before and 2 months after labor, in addition to insurance and retirement benefits.[5] "Artemis," a female leader of the naval force of Xerxes,[6,7] conquered the Greek in the battle in the Mediterranean sea. The

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presence of a woman in this capacity demonstrates not only the independence and skill of Iranian women but also the level of respect for females that allows a male military to accept the authority of a woman and to obey her.

In the Persian language, the word "zan" (woman) means birth and fertility; a wife is commonly called "hamsar," which means equal in head and leadership and a housewife is called "kadbanu" - meaning chief of the home, all terms reflecting the merit and respect due to women in Persian culture. In ancient Iran, women were placed in powerful positions such as leaders and judges. Wealth and inheritance were equally distributed among children regardless of gender and upon death of the father, the mother was granted custody of the children.[8]

During the Sassanid Empire, society was divided into four groups by occupation.

1. The "Atarvan" or mobed, the Zoroastrian clerics who were responsible for the holy fire, the national and religious symbol of Zoroastrianism.
2. The "Razmjuyan" or members of the military in charge of the protection of the empire and nation.
3. The "Vastariushan" or farmers who were the producers of food.
4. The "Hutakhshian" or the professionals who were formerly before the Sassanids a subgroup of the Vastariushan.[9,10]

These professions were restricted by birth and were passed down within families during King "Anushirvan's" time. Mobed or religious leader was limited to both male and female descendants of Zarathushtra. Descendants of either gender, male or female, could qualify as Mobed once they had fulfilled the academic and religious requirements, and once qualified could pass on the profession to their offspring.

Varjamkard, the Mobed of the Mad Empire, documented the beliefs of the Zoroastrians about inheritance and genetics in some parts of "Avesta" called "vendidad" and much of it is truly remarkable in view of our present day knowledge. History of the great ice age is more ancient than the same stories of other races like Noah's ship. It clearly demonstrated that Iranians were aware of separate male and female "gamete" in men and women.

There is a description of the ice age in the second "farvand" of "vendidad," the Zoroastrian holy book. The account goes that when the ice age happened in the land of Iran many human beings, animal, and plant species perished. Jamshidshah, the great king of Persia, ordered his men to build four shelters and to choose from among all species, be it man, animal, or plant, the healthiest and strongest, in couples, as they will endure and survive the hardships. More interesting is the fact that they refer to what we know today as the "gamete" and the possibility of separating it from the organism to maintain for later conjugation. There is also mention of the unwanted features that are present in these male and female gametes, and there is reference to mating with a healthy partner for the purpose of having healthy and strong children.[9,10]

Science of breeding and heredity in Greece and western parts

In contrast to the beliefs and ideas in ancient Iran, some of which are so close to the facts that science consequently brought to light, contemporary Western philosophy and the theories of its scientists in regard to breeding and heredity were closer to superstitions or myths.[11,12]

Historians have documented theories including the belief that women are men's soil and they will nurture the seed of the male without actually contributing to the reproductive process.[13]

Anaxagoras (428–500 BC), the ancient Greek philosopher, believed that semen contains all invisible miniature of all human organs, including hair, eyes, nails, etc., which planted in the uterus, will grow and form a well-developed human fetus.

The oldest western theory attributed to Hippocrates (370–460 BC), possibly based on Anaxagoras' teachings, indicates that semen contains all parts of a human body, both soft and hard, and is secreted from the father's healthy and unhealthy organs to produce likewise healthy or unhealthy parts in the child. A bald man would produce bald offspring, and a man with blue eyes or myopia would produce blue-eyed children or with myopia, and so on for other characteristics.[14]

This theory is called "pangenesis" and describes the inheritance of traits through information transferred by semen.[11,12,14]

Aristotle (322–384 BC) believed that semen is a secretion of blood, which will bring life to the coagulated menstrual blood in a woman's uterus. He believed that fort (strong) semen would create a male fetus, and weak semen, a female fetus.

This belief was generally accepted for about two millenniums from 300 BC until 17th century AD until William Harvey (1578–1657 A.D.) discovered blood circulation. He showed that there is no clot in the uterus of hunted pregnant deer and Aristotle's theory was annulled.[11-14]

Following the discovery of ovarian follicles by Regner de Graaf, Dutch anatomist, and physician,[15] in the second half of 17th century, Malpighi proposed the preformation theory[16] suggesting that there is a miniature human being in the ovum that transforms into a fetus upon the entrance of semen. After the identification of the spermatozoid by Nicolaas Hartsoeker (1656–1725) and Antony van Leeuwenhoek (1632–1723), the miniature human being was attributed to the sperm [Figure 1].[17]

The general concept was that the male component is the contributor of complete human features. The female component is the uterus that will nurture the seed from the father's semen to fruition granting the seed all the hereditary features and the woman none.[11-13]

Although ancient Iranian history is rich in highly accurate arguments about breeding and reproduction, the burning of books and libraries after the invasion of first the Arabs and then the Mongols leaves a dark gap where the unique assessment of ancestry by Hakim Abol-Ghassem Ferdowsi Toossi (940–1020 AD), the Iranian historical and epic poet, shines through.[18]

The equal maternal and paternal role in reproduction

Ovistis and spermatistis theory was accepted in western parts of world until the fertilization of female ovum and male spermatozoa was demonstrated by C.E. Wolf. Just about 2800 years ago and 800 years before Wolf's discovery in ancient Iran,[1,2] Ferdowsi the great Iranian poet of 10th century described Keykhosrow, Iranian prince, as "This fair child has the royal characteristics of two kingdoms, from Afrasiab, the king of Turan, his maternal grandfather, and Keykavus, the emperor of Iran, his paternal grandfather." It is noteworthy that the maternal ancestor is mentioned before that of the paternal,[18] for the sake of rhyme or consequence, to be wondered. He refers directly to the line of descent on both sides and the inheritance of traits from ancestors [Figure 2].

Notes about spermatozoa

In the thirteenth century, it is written that "It is said that God does not create man from semen, but from the particles that come from within the semen, when there is one particle one child is produced, where there is two, two children are produced and when there are three; three children are begotten. Whenever, a man copulates

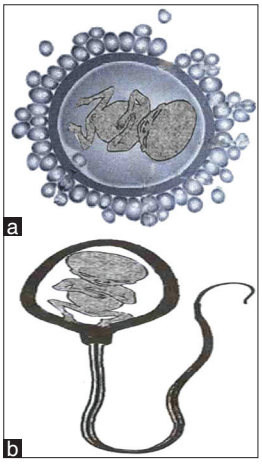

Figure 1: (a) Diagram representing the ovist hypothesis, (b) Miniature human in the head of spermatozoa (spermatic hypothesis)

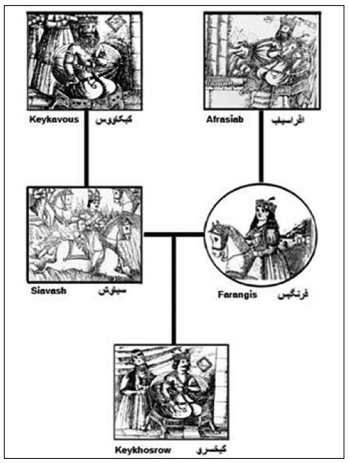

Figure 2: Flowchart revealing the inheritance of characteristics from both parents (mother and father)

with a sterile woman, the particles are wasted, and vice versa when a woman copulates with a sterile man".[19]

Attention to dominant inheritance of polycystic kidney

"Muhammad ibn Zakariya al-Razi" (865–925 AD), the great Iranian chemist and physician, was accustomed to taking and writing the history of his patients, very similar to present time medical practice. Among his reports,[19,20] there is a clear referral to the family history of kidney abscess in the father of his patient with renal pelvic abscess. He says "I was not aware that the father of my patient was affected with a urinary truck problem complained of the pain even when healthy."

Description of alport syndrome

"Avecina" (980–1037) described Alport Syndrome for the first time in medical history in his well-known book "The Canon of Medicine." He explained "If the dark urine becomes clear and precipitation becomes evident in layers of urine, one can predict nacturia, deafness, and psychosis".[21]

Origin of the tooth

Hakim Jorjani (1055–1152 AD) in his book says that "The origin of tooth is not from food; actually it is from parents seeds, embedded in the jaw before sprouting."

Genetics in Iran today

Historical documents clearly show that the Iranian ancestors' concept of breeding and heredity was more accurate and logical in comparison to their contemporaries; and remarkably close to our present day understanding of inheritance. This advanced knowledge can be traced up to the 13th century AD, after which we were unable to find any document on this subject in our country. Meanwhile, in the Western world, the stream of science was fast developing into a roaring river whose flow increased specially through the last three decades building into the great reservoir of knowledge we see in the world today.

There was almost no work on genetics in Iran until 1936. Addition of a Genetics course to the curriculum of studies in the faculties of Agriculture, Veterinary Medicine, Medicine, Science and the related major fields was an initial step. Iranian Genetics Society (IGS) was founded jointly by the four faculties of sciences, veterinary, agriculture, and medicine by attempts of Dr Pezeshk-Poor Mostashfi in 1966. Initially, first meeting of IGS was held as a satellite of the Annual Pediatrics Congress, and later seven independent scientific congresses were held in Tehran, Mashhad, Esfahan, Tabriz, Shiraz, and Ahvaz.

After the revolution in 1979, and as a result of the imposed Iran–Iraq war, there was no chance of government support, IGS became inactive and remained so for 25 years. Despite this fact, parallel to the great progress of science in the world, there were some rare steadily activities by some enthusiasts in Iran. Thanks to the efforts of scientists in private sector, many genetic counselors have been trained and are actively working all over the country. Genetics is no longer the orphan science in Iran. Developing facilities in Tehran University of Medical Sciences, University of Social Welfare and Rehabilitation Sciences, the National Institute for Genetic Engineering and Biotechnology (NIGEB), Azad University, and Tarbiat Modaress University made it possible to train many M.Sc. and Ph.D. students. We are proud that precise diagnosis and prevention of many hereditary diseases such as thalassemia, fragile X syndrome, myopathies of anterior horn of spine, Duchenne muscular dystrophy, all detectable chromosomal aberration using (FISH) and comparative genetic hybridization/ MLPA, metabolic disorders, and mitochondrial diseases are now possible in the country. Iran is the first Islamic country where therapeutical abortion for special cases with certain limitations is applicable. In rare cases where testing is not available in Iran, it is possible to perform the tests with the cooperation of international centers. The most significant problem is the high cost of tests being unaffordable for many of the families. Moreover, there is still lack of funds and infrastructure for proper practice of this pivotal science.

Although there was an inevitable gap through the revolution and war in Iran, now some great efforts are performing by researchers. Advanced stem cell research and biotechnology expertise has allowed us to clone genetically modified animals for research and healthcare purposes.[22,23]

After many unsuccessful attempts, Iranian researchers

Figure 3: (a) Photograph of the first cloned sheep (Royana) born on September 30, 2006 in Iran. (b) Picture of Saeed Kazemi-Kashani, MD, pioneer of cloning in our country

at the Royan Institute were witness to the tremendous birth of the first cloned sheep born in Iran in 2006 [Figure 3].[24,25]

Unfortunately he didn't see the result of his effect in cloning project.

Interestingly, stem cell research in Iran has also led to the generation of novel human embryonic stem cells (hES).[26,27] Regardless of all difficulties such as inconsistent funding opportunities and sanctions which prevent the import of materials and supplies, Iranian scientists continue their efforts and move to the cutting edge of science. Some successful attempts in the field of cell therapy by applying liver and cardiac cell lines are being made.[28-31] hES has been successfully used in the treatment of chronic liver disease and end-stage cirrhotic patients in Iran.[32-36]

Comparable to progress of medical genetics in diagnosis, prevention, and treatment of diseases, there are many steps forward in pharmacological aspects. Another main prospect and practice of our research centers is mass production of recombinant drugs and proteins. Diagnostic kits of HIV, HCV, HBS, HTLV-1 and the products such as recombinant hepatitis B vaccine, streptokinase, alpha and beta-interferon, human growth factor, and insulin are now available in the market.[37,38]

These major strides after the scientific gap in Iran following the revolution and war are bringing us into the mainstream of world science development in the biomedical sciences in the third millennium.

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