Journal of Veterinary Science & Technology

Deb, J Vet Sci Technol 2012, 3:5
DOI: 10.4172/2157-7579.1000e108

Editorial Open Access

Molecular Markers and Their Application in Livestock Genomic Research

Rajib Deb[1]*, Sandip Chakraborty[2] and U. Singh[3]

[1]Scientist, Project Directorate on Cattle (ICAR), Meerut, Uttar Pradesh, India
[2]Post Graduate (Vet Microbiology), Veterinary College, Bengaluru, Karnataka, India
[3]Principal Scientist, Project Directorate on Cattle (ICAR), Meerut, Uttar Pradesh, India

Molecular markers are sites where differences in DNA sequences occur among members of the same species, revealing polymorphism at the DNA level. A molecular marker indicates a change in expression or state of a protein that correlates with the risk or progression of a disease, or with the susceptibility of the disease to a given treatment. These markers have characteristic biological properties that can be detected and measured in parts of the body like the blood or tissue that are indicative of either normal or diseased processes in the body.

The most widely used molecular markers in livestock genomic research include Restriction Fragment Length Polymorphism (RFLP) markers that recognise and cut DNA at specific sites, microsatellite markers that helps in scoring alleles and single Nucleotide Polymorphism (SNP) markers that recognises Single base change in DNA sequences.

The molecular markers associated with milk include leptin (that has role in lactogenesis, providing immunity and maintaining healthy udder in milch animals), lactoferrin (that regulates the immune response and provides protection against infection and septic shock), β lactoglobulin (presence or absence of which in milk and milk products is essential in quality control of such food products), β and κ caseins (that help in differentiating the healthy and mastitic animals) and prolactin (that has role in reproduction, maintaining hoemostatic processes apart from reducing the incidence of mastitis).

Specific markers associated with diseases like mastitis include osteopontin, β-defensin-5 (BNBD5) which has significant role in chronic subclinical mastitis, Toll-like receptors (TLRs) 2 & 5, Bovine Leukocytic Antigen (BLA) and Haptoglobin-Matrix Metalloproteinase 9 complex (Hp-MMP 9). Moreover, marker like Natural Resistance Associated Macrophage Protein 1 (NRAMP1) is associated with disease of economic importance like mastitis.

The important molecular markers associated with assessment of semen quality and fertility include Cation channel of sperm 1 (Catsper1), Sperm-specific NHE (Slc9a10), A kinase (PRKA) anchor protein 4 (Akap4), Pyruvate kinase (PKM2), Cytochrome oxidase (COX3), Reproductive homeobox 5 (Rhox5), CRISP2, PEBP1, Doppel, TIMP2 etc.

Current revolutionary developments in molecular biology relevant to livestock genomic research associated with detection of the above mentioned markers include establishment of the entire genome sequence of the most important livestock species, development of technology to measure polymorphisms at loci spread all over the genome that consists of direct sequencing, DNA chips (like SNP50 Bead Chips), Single Stranded Conformation Polymorphism (SSCP), primer extension and pyrosequencing all of which helps in typing SNPs along with development of micro array technology to measure gene transcription at a large scale. Furthermore, apart from such detecting systems, some of the technologies and assays used for detection of the markers associated with semen quality and fertility are global gene expression profile, Terminal deoxynucleotidyl transferase mediated dUTP nick-end-labeling (TUNEL) assay, Annexin V assay, Single Cell Gel Electrophoresis (SCGE) COMET assay, Sodium Dodecyl Sulphate-Polyacrylamide Gel Electrophoresis (SDS-PAGE) that helps in studying sperm proteomes etc.

A variety of molecular markers have also been applied widely to investigate population and evolutionary processes that include more specifically study of microarray and mtDNA evolution. The detection of such evolutionary mechanisms can be done by investigating the evolution of Copy Number Variations (CNVs) and applying new generation sequencing technologies like Solexa.

The study of all the above molecular markers and their detection methods ultimately proves to be beneficial to the farmers, livestock producers and breeders because of the significance of various genes as candidates for improving milk production and their association with disease, productive and reproductive traits which can be used efficiently in taking good managemental decisions as well as to understand the effect of domestication in shaping the genomes of most of the domesticated farm animals.

***Corresponding author:** Dr. Rajib Deb, Scientist, Project Directorate on Cattle, Department of Animal Genetics and Breeding, Indian Council of Agriculture Research, Meerut, Uttar Pradesh, India; E-mail: drrajibdeb@gmail.com

Received July 28, 2012; **Accepted** July 30, 2012; **Published** August 01, 2012

Citation: Deb R, Chakraborty S, Singh U (2012) Molecular Markers and Their Application in Livestock Genomic Research. J Vet Sci Technol 3:e108 doi:10.4172/2157-7579.1000e108