Preface

Over its 50-year history, domestic animal cytogenetics, or more recently modern Veterinary Cytogenetics as a discipline, has made key contributions to our understanding of various genetic diseases and variations in domestic animal productivity. The study of phylogenetic relationships among animal taxa has been explored using similarities and diversities of chromosome landmarks. Both classical and molecular cytogenetics have proven to be useful tools in evolutionary studies of animal populations. The emergence of the importance of tertiary chromosome structures in inheritance has provided the impetus for increased momentum in the study of animal chromosomes by coupling with genomic investigations to provide a detailed and mechanistic picture of chromosomes and genes in the main domesticated animal species. Molecular probes containing entire chromosome libraries (painting probes) or specific DNA sequences by using the fluorescence in situ hybridization (FISH) technique in metaphase and interphase cells (e.g. somatic cells, germ cells and embryos) and extended chromosome fibers (fiber-FISH) as well as application of comparative radiation hybrid (RH) mapping, have opened a new era for domestic animal cytogenetics and noticeably deepened our comprehension of animal genomes. Indeed, not only detailed conventional cytogenetic maps, but also RH maps have been constructed and used in clinical and evolutionary studies in domestic animals. Although the number is still comparatively small, there are some remarkable examples of the contribution of mammalian molecular genetics in domestic animal studies. It is anticipated that there will be a significant increase in investigations using sophisticated molecular approaches to identify, describe and elucidate the inheritance of aberrant animal phenotypes. This special-theme

issue focuses on molecular and evolutionary cytogenetics of domestic animals to create a current compendium of overview papers and original research articles in this area. These communications bring an up-to-date picture of research directed towards understanding animal chromosomes in relation to the genome and, ultimately, the phenotype of domestic animal species.

With this special-theme issue we would like to take the opportunity to modestly recognize the outstanding scientific careers of one of the prominent founders of Veterinary Cytogenetics, Professor Parvathi K. Basrur, who has developed techniques and described novel and fundamental observations that opened the way for the exploration of the biology of genes and chromosomes of domestic animals and lower organisms, starting during the 1950s and continuing to this day (see laudatio in this issue).

This themed issue begins with a review paper presented by Adegas et al., summarizing the state of our knowledge concerning the role of satellite DNA (satDNA) in the karyotype evolution of domestic animals, and noting the clinical implication of satDNA polymorphism in veterinary medicine. An extensive review article on the use of RH techniques for developing the RH maps of domestic animals is presented by Faraut et al., while Rubes et al. offer a comprehensive review of the use of the FISH technique in molecular cytogenetic studies of domestic animals. An up-to-date review on the karyotype evolution of domestic bovids with the development of a high-resolution RBA-banded karyotype of the 'bovidae ancestral karyotype' (BAK) is presented by Iannuzzi et al. Two extensive review papers take into consideration the analysis of the most advanced cytogenetic maps in both sheep (Goldammer et al.) and goat (Schibler et al.) species, fol-

lowed by an assessment of the comparative genomic approach that has been used to compare the domestic dog with farmed canids by Switonski et al. Consecutively, Riggs and Rønne present a review of the biological significance of fragile sites of domestic animal chromosomes which were first reported in domestic animals by Professor Basrur and Gilman in 1966. Then, Villagómez et al. conclude the series of review papers presenting a historical and state-of-the-art perspective of the classical and molecular cytogenetics of disorders of sex development in domestic mammalian species.

Original research articles here cover different species and topics representative of the current state of the art of domestic animal cytogenetics research. The first comparative RH map, anchored to the available cytogenetic map, is reported for the river buffalo Y chromosome by Stafuzza et al. Subsequently, Das et al. characterize the bovine pseudoautosomal region (PAR) of the sex chromosomes and compare their findings with sheep and goat and other mammalian PARs. Two novel reports in birds, the first dealing with the polymorphism of heterochromatin segments in Japanese quail, and the second providing an appraisal of nuclear organization in interphase embryonic fibroblasts of chicken, are reported by Krasikova et al. and Skinner et al., respectively. Phylogeny of horse chromosome 5q in the genus *Equus* and centromere repositioning of *E. asinus* 16 and *E. burchelli* 17 are presented by Piras et al. Then, Grzes et al. show comparative FISH-mapping of the myostatin gene in dog, red fox, arctic fox and Chinese raccoon dog. The DM domain genes, which are thought to be regulators during vertebrate sex development, are studied in pig and cattle using

comparative cytogenetic and molecular approaches by Bratus and Slota. The cattle oncosuppressor *WWOX* gene has been investigated using both comparative mapping and genomic annotation methodologies by Manera et al. Bonnet-Garnier et al. add information about the putative interchromosomal effects of reciprocal chromosome translocations in pigs by using the sperm-FISH technique. In the same vein, Revay et al. describe the association of nuclear vacuoles, diploidy and alteration of chromatic condensation with sperm macrocephaly in bulls. This themed issue closes with 2 more original complementary research papers, one by Hornak et al., which explores the application of comparative genomic hybridization to analyze the rate of chromosome aneuploidies in in vivo produced pig embryos, while the other by Nicodemo et al. presents a study on X-Y sperm aneuploidy in cattle by means of the FISH technique.

We believe that the collection of scientific manuscripts on animal cytogenetics presented here illustrates the renewed interest and importance of the discipline among a prestigious group of scientists working around the world. These contributions cover both basic and applied aspects of the study of animal chromosomes and genomes providing the scientific community a timely compendium in *Cytogenetic and Genome Research*. We are confident that the scientific community will welcome and enjoy reading this new issue on Veterinary Cytogenetics.

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