

THE X-CHROMOSOME EVOLUTION IN DOMESTIC BOVIDS AS REVEALED BY COMPARATIVE FISH-MAPPING OF CATTLE, SHEEP, RIVER BUFFALO AND HUMAN X-CHROMOSOMES

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X-chromosomes of cattle, river buffalo and sheep summarize the three main types of X-chromosomes present in bovids (123 species). Indeed, this chromosome is submetacentric in cattle, acrocentric in river buffalo and acrocentric with distinct p-arms in sheep. C-banding technique revealed that while cattle and sheep X-chromosomes are C-band negative, the river buffalo X-chromosome shows a prominent C-band at the centromere and a proximal additional C-band. Detailed cytogenetic maps have revealed that complex chromosome rearrangements differentiated the evolution of this chromosome in bovids.

In this study 15 animals from cattle (Agerolese breed), river buffalo (Italian Mediterranean breed) and sheep (Laticauda breed) were used to perform blood cell cultures to obtain R-banding chromosome preparations to be used for FISH-mapping applications. BAC-clones from both ovine and bovine libraries were used for the FISH. At least 30 metaphases for animal and probe were studied under a fluorescence microscope connected with a digital camera. Twenty-one new loci were assigned to the X-chromosome of these bovid species, noticeably extending the cytogenetic map in this chromosome. This allowed us to show the most advanced and detailed physical maps today available in this chromosome species. A direct comparison among X-chromosome of cattle (BTA-X), river buffalo (BBU-X), sheep (OAR-X) and humans (HSA-X) was performed revealing that: (a) BTA-X and BBU-X have the same gene order and differentiated by a centromere transposition or centromere repositioning with loss of constitutive heterochromatin (from buffalo to cattle); (b) OAR-X differentiated from BTA-X/BBU-X by at least four transpositions including a centromere transposition or repositioning; (c) a large and distal chromosome segment of BTA-Xq has been conserved entirely during the evolution not only in bovids but also in humans, excluding a centromere repositioning present in both sheep and human Xs.