Changing chromosome numbers

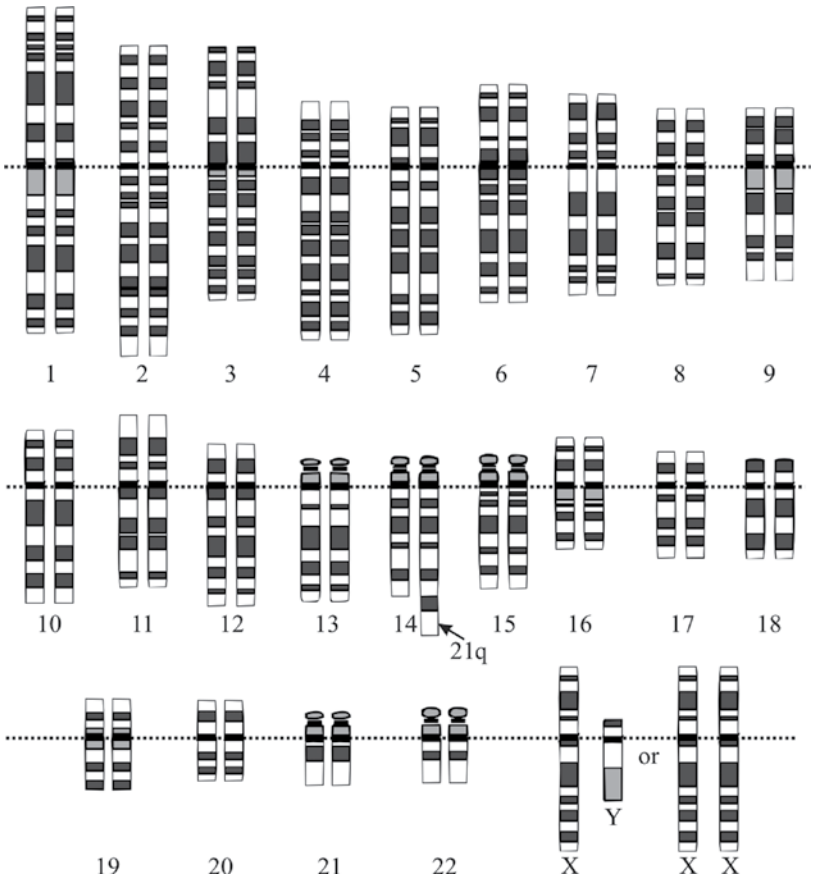
Jean K. Lightner

Many people regard chromosome numbers in animals as being essentially fixed. While it is true that chromosome numbers are generally fairly stable within a population of animals, they are by no means completely static.

The most common and best known chromosomal rearrangement affecting chromosome number is the Robertsonian translocation (ROB). It is named after the American geneticist W.R.B. Robertson, who first described this chromosomal rearrangement in grasshoppers in 1916. It occurs when the long arms of two acrocentric chromosomes (chromosomes with the centromere very near one end) fuse to form one metacentric chromosome (a chromosome with the centromere near the middle). The short arms of the original chromosomes are generally lost with no obvious adverse consequences.[1]

ROBs can be associated with problems. In humans, approximately one in 1,000 babies is born with this form of translocation.[2] Most appear normal, though they may experience fertility problems later in life. Fertility problems can arise when gametes (egg or sperm) are formed that are missing or have extra chromosomes. Gametes from ROB carriers may be normal, with one of each chromosome or balanced, with the translocated chromosome but neither of the acrocentric homologues. However, on occasion unbalanced gametes may be formed that are either missing a chromosome or have the translocated chromosome with one of its acrocentric homologues. Unbalanced gametes can give rise to embryos which fail to develop or develop with abnormalities such as Down's syndrome. It is estimated that 5% of Down's syndrome cases are the result of an ROB.

Although ROBs can be associated with problems, there are times where no adverse outcomes are observed. For example, they have been observed in Saanan goats with a normal phenotype and no reported fertility problems.[3] There are crossbreeding studies with sheep carrying up to three different translocations that showed no significant effect on phenotype or fertility for any of the combinations.[4] In fact, the normal chromosome number of domestic sheep (*Ovis aries*, 2n = 54) is inferred to be the result of three different translocations relative to domestic goats (*Capra hircus*, 2n = 60). The variation in chromosome number in the Bovidae family (including the tsoan[5] and cattle[6] monobaramins) appears to be mostly due to ROBs.



A karyotype from an individual with Down's syndrome that resulted from a Robertsonian translocation. One copy of chromosome 21 is attached to one of chromosome 14 (the translocated chromosome) and two additional copies of chromosome 21 are present. About 5% of Down's syndrome cases are the result of this type of translocation.

There are other types of chromosomal rearrangements that have contributed to the range of chromosome numbers in animals that are monobaraminic (known to be from the same created kind). Some of these rearrangements are quite unexpected. For example, the Indian muntjac (*Muntiacus muntjak*, 2n = 6 in females, 7 in males) has the x-chromosome fused with one of its autosomes. The y-chromosome is separate. The male will have one of this autosomal pair fused to an x, and the other without a fused sex chromosome and a separate y, giving it an extra chromosome compared to the female. It is interesting to note that viable hybrids have been formed between this species and Reeve's muntjac (*Muntiacus reevesi*, 2n = 46).[7] Some species of antelope have a fused y-chromosome.[8]

ROBs have been shown to be non-random and appear to have distinct mechanisms governing their formation.[9] They occur frequently enough without serious consequence to suggest that

they serve some useful purpose. Much is unknown; particularly what factors influence their occurrence and what important results they may have. They are believed to have played a role in speciation within the family Bovidae. As further research reveals more information, it is likely we will find still another designed mechanism within the genome that points to an all-wise Creator.

References

1. Definition of Robertsonian translocation, <www.medterms.com/script/main/art.asp?articlekey=5388>, 26 July 2006.
2. Robertsonian translocation resource page, <www.spokane.wsu.edu/research&service/HREC/medical_sciences/RobertsonianTranslocationResource.asp>, 25 July 2006.
3. Mota, L. and Silva, R., Centric fusion in goats (*Capra hircus*): identification of a 6/15 translocation by high resolution chromosome banding, *Genet. Mol. Biol.* **21**(1):71–76, 1998; <www.scielo.br/scielo.php?script=sci_arttext&pid=S1415-47571998000100012>, 26 July 2006.
4. Bruere, A.N. and Ellis, P.M., Cytogenetics and reproduction of sheep with multiple centric fusions (Robertsonian translocations), *J. Reprod. Fertil.* **57**(2):363–375, 1979.
5. Lightner, J.K., Identification of species within the sheep-goat kind (Tsoan monobaramin), *Journal of Creation* **20**(3):61–65, 2006.
6. Lightner, J.K., Identification of species within the cattle monobaramin (kind), *Journal of Creation* (in press), 2007.
7. Although the offspring are viable, the males at least are infertile. Fontana, F. and Rubini, M., Chromosomal evolution in Cervidae, *Biosystems* **24**(2):157–174, 1990.
8. For example, the bongo (Tragelaphus euryceros, 2n = 33 in males, 34 in females). This species has been crossed with the sitatunga (T. spekei, 2n = 30) to form a fertile offspring. Koulischer, L., Tijskens, J. and Mortelmans, J., Chromosome studies of a fertile mammalian hybrid: the offspring of the cross bongo x sitatunga (Bovoidea), *Chromosoma* **41**(3):265–270, 1973.
9. For example, in humans there are five acrocentrics chromosomes (13, 14, 15, 21, and 22). While any of these can be involved in a ROB, all combinations are rare except translocations between 13 and 14, and between 14 and 21. Bandyopadhyay, R., Heller, A., Knox-DuBois, C., McCaskill, C., Berend, S.A., Page, S.L. and Shaffer, L.G., Parental origin and timing of de novo Robertsonian translocation formation, *Am. J. Hum. Gen.* **71**(6):1456–1462, 2002.

The big bang fails another test

John Hartnett

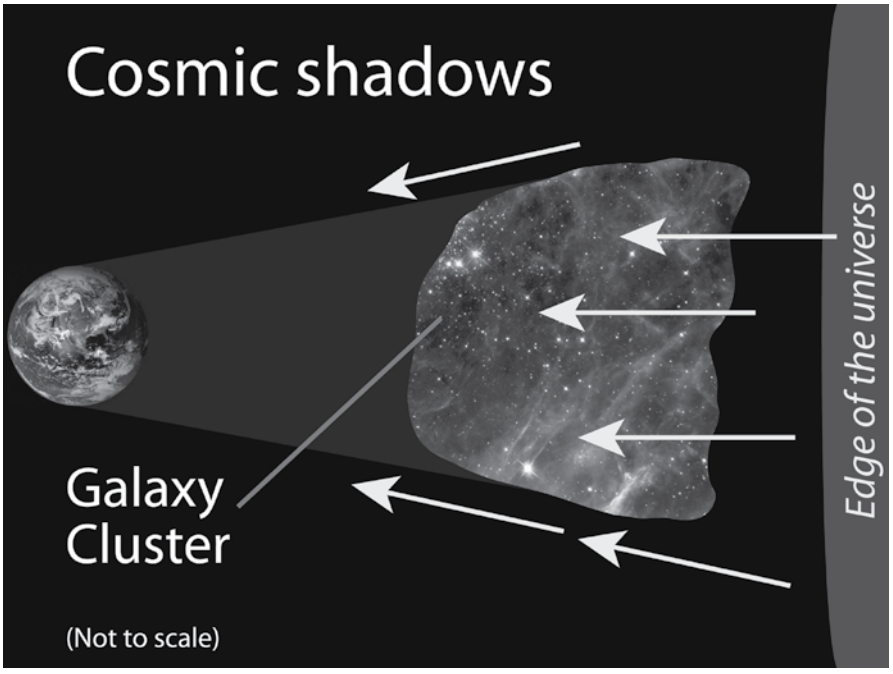
One of the alleged 'proofs' of the big bang model of origins is said to be the Cosmic Microwave Background (CMB). This is claimed to be the 'afterglow' of the original 'explosion'.

I previously reported[1] that there was found to be a correlation between the relatively cooler spots of the two-dimensional surface temperature maps of the CMB and the locations of galaxy clusters and superclusters. Since the source of the CMB radiation is supposed to be the putative big bang fireball, this correlation indicates that at least some of the important features of the CMB maps are related to the galaxy clusters themselves.

According to theory, the big bang fireball should be the most distant light source of all. Thus all galaxies would be in the foreground of this source. Therefore all CMB radiation must pass the intervening galaxies between the source and the observer, here on Earth. This radiation passes through the intergalactic medium, between the galaxies in a cluster, and is scattered by electrons, through inverse Compton scattering,[2]—the *Sunyaev–Zel'dovich effect* (SZE).[3] When this happens, the path of the CMB radiation is interrupted and distorted.

The previously reported (2004) analysis by Prof. Shanks of the University of Durham,[4] showed that there was such a strong correlation of this effect that it could be disputed that the CMB radiation contains any information at all from its distant source. This was because the alleged 70 μK anisotropies (unevennesses) that were claimed as a prediction of the big bang theory, and claimed to be the seeds of galaxies, could instead be attributed to this SZE. They also reported that if it could be shown that this SZE was indeed the cause of the cooler regions in the CMB temperature maps out to one degree from the centre of a cluster, and if it is also found that the effect applies to more distant clusters, then the contamination may be significantly greater, and that would be very damaging to the idea of the source being in the background.

Now (2006) it has been reported and published in the *Astrophysical*



If the source of the CMB radiation was in the background to the galaxy cluster shown it should cast a shadow as seen from Earth. (After ref. 6)