The 13th International Chromosome Conference, Ancona, Numana, Italy, 8-12 September, 1998

The meeting was well organized by Prof. Ettore Olmo and his colleagues at the Institute of Biology and Genetics of the University of Ancona in a friendly and informal atmosphere. The International Chromosome Conferences, held once in 3 years provide a forum for a representative group of researchers engaged in the diverse aspects of chromosome studies in a wide variety of organisms, to meet and exchange information and experience. This year the conference was held at the University of Ancona and at the Club Santa Cristiana in Marcelli di Numano. Opening ceremony and scientific programme were held at the University public hall on 9th September and at the Club Santa Cristiana congress centre from 10 to 12 September. The Conference was attended by 400 delegates from all over the world. There were only two delegates from India, including me.

The scientific programme of the conference comprised of 25 plenary lectures on the more recent and relevant aspects of chromosome research covered in 8 sessions held from 9-12 September. 240 Poster presentations in 7 sessions held on 9 and 10 September, 21-30 to 23-30 hrs covered all aspects of basic, evolutionary, medical cytogenetics and mutagenesis. In the 7 workshops (namely chromosome function, Evolutionary cytogenetics, Cultivated plants cytogenetics, chromosome structure and composition, Medical and Cancer cytogenetics, Domestic animal cytogenetics, Mutagenesis) subsequently held on 10th and 11th September, 18-20-30 hrs., 70 selected posters were presented and discussed. Our paper titled "Quinacrine induces dicentrics, rings and marker chromosomes in human peripheral blood lymphocytes *in vitro*" (A.P. Krishnaja and P.S. Chauhan), presented in the poster session as well as the oral workshop on Mutagenesis was well received. A number of exhibitors and demonstrations put up at the conference venue brought out the latest applications in imaging systems, including novel instrumentation and accurate software analysis in cytogenetics. This included well known names like Applied spectral imaging, Applied imaging international, Metasystems, Leica Microsystems, Zeiss and Nikon etc. and impressive demonstrations were given on software systems analysis for G-banding, FISH and SKY (Spectral Karyotying). The abstracts of the conference were published in the journal "Cytogenetics and Cell Genetics, Vol. 81, No. 2, (91-168), 1998."

The most exciting developments of "high tech" and colourful cytogenetic technology was extensively covered in the plenary lectures, presentations as well as by the demonstrations at the exhibition by well known firms in the field. Integration of conventional cytogenetics with Fluorescence In Situ Hybridization (FISH) and in few cases with molecular biological data was the major theme of many of the papers covered in different sessions. FISH methodology is important for chromosome and genome research and its potential is far from exhausted was amply evidenced in the plenary lectures and papers presented at the Conference.

Today, the method of Spectral Karyotying (SKY) or multiple colour FISH (mFISH) approaches, based on chromosome painting

probes that are combinatorially labelled to distinguish all 24 chromosomes in the human karyotype by the unique spectral signatures, provides a powerful tool to detect rearrangements between different chromosome classes. The importance of accurate delienation of chromosome alterations and the powerful role of SKY technology in assisting in the cytogenetic analysis of neuroblastomas was demonstrated by Trakhtenbrot et. al. (Israel) in an interesting presentation. Again numerical chromosome aberrations in human sperm was analysed by multicolour FISH by Egozcue et. al. (Spain).

Chudoba (Germany) spoke at length about the novel high resolution colour banding technique based on a probe set that was developed at the Institute of Human Genetics in Jena and on Metasystems ISIS FISH solution for colour ratio labelling analysis. Microdissected chromsome region specific DNA libraries and different fluorochrome labelling enabled one to characterise chromosome rearrangements in finer detail. This was well illustrated with the example of an interstitial deletion of the long arm of chromosome 5 in a case of Acute myeloid leukemia.

Comparative Genomic Hybridization (CGH) is another molecular cytogenetic approach with the potential of detecting chromosomal imbalances, without any previous knowledge. It is a sensitive FISH technique used to study relative copy number of test tumor DNA compared to a reference sample, demanding highly accurate image analysis measurements. Two differently labelled tumor DNA and normal DNA, when hybridised to normal metaphases show up as colour shifts of the chromosomes. The colour ratio profile along each chromosome forms the basis of quantitative analysis. An important clinical application of CGH as a prognosticator in the analysis and characterisation of clonal unbalanced chromosomal changes in childhood acute leukemias and leiomyosarcomas was presented by Jarosova (Czech Republic) and El-Rifan (USA) respectively.

Advanced developments in molecular plant cytogenetics have made this research field of plant chromosomes most appropriate to crosslink the results of genetic and molecular genome studies. There was a very good exposition by Dr. Heslop-Harisson (UK) on plant genes, genomes and chromosomes. He also showed that there are funtamental differences between plant, fungal and mammalian genomes in the evolution and organisation of repetitive sequences. As example, polyploidy giving evolutionary or phylogenetic networks is universal among plants, but plays no significant part in vertebrate evolution with branching trees. Many FISH methodologies have been used extensively in plant chromosome studies due to the difficulty of banding plant chromosomes. Specifically the use of FISH for painting whole genomes, individual chromosomes and even DNA sequences of less than few Kbs. as probes has become a routine practice. Thus, Genomic In Situ hybridisation (GISH) has been used in alloploidy studies to paint chromosomes and simultaneously discriminate between different genomes providing new opportunities to test genome relationships and their evolution. Introgression of Allium fistulosum genes in to A. cepa mediated by A. roylei was analysed by Khurustaleva and Kik (Netherlands) by this technique.

The generally recognised drawback of limited accuracy in resolution and detection of FISH in mitotic metaphase chromosomes was circumvented with a FISH strategy using concurrent hybridisation to Pachytene compli-

ments and extended DNA fibres as illustrated in the plenary lecture by de Jong (Netherlands) titled "High resolution FISH reveals molecular and chromosomal origin of repetitive sequences in tomato." Even higher resolution and detection values have been achieved with FISH to stretched individual DNA fibres from isolated leaf nuclei. Development of quantitative chromosome maps based on condensation pattern analysis (CP) and utilisation of the CP in mapping genes by FISH in small plant chromosomes was the theme of the lecture by Fukui (Japan) titled "Smallness: gain and loss in chromosome research."

In the "Domestic animals cytogenetics" session Gustavasson (Sweden) in his paper titled "Time for preventive chromosome investigation of domestic animals used for artificial insemination" gave an overview of the field of Domestic animals cytogenetics. The development of cytogenetics in Domestic animals started in the Sixties by the description of chromosome aberrations in relation to fertility problems and malformations. Easily identifiable aberrations such as 1/29 centric fusion translocations in cattle were irradicated. Later many reciprocal translocations could be identified in pigs. Preventive investigation of boars used for artificial insemination has been now introduced in France. Since artificial insemination to a very large extent is used in farm animals like cattle and pigs, preventive chrosome analysis of bulls and boars by use of current techniques is probably economically motivated, The first case of sex chromosome monosomy (2n = 49,X), Turners syndrome in river buffallo was reported by Iannuzzi et al. (Italy). Numerical chromosome aberrations are very rare in domestic animals especially in those of economic importance. Such abnormalities, when present, are phenotypically visible and easily eliminated by breeders, especially when a good collaboration among breeders, veterinary doctors and cytogenetic laboratories is established.

Fish cytogenetics was a major component of this conference. Almeida-Toledo (Brazil) gave a comprehensive review on "Karyotypic evolution in neotropical fresh water fish." The chromosome data now available for about 700 neotropical fresh water fishes which permit the identification of some characteristic trends of neotropical fresh water fish chromosome evolution was discussed. Groups engaged in chromosome studies in fishes from Italy, France, Hungary, Brazil and Argentina presented cytogenetics data obtained either by conventional karyotype analysis or using high resolution techniques such as R-bands obtained after 5-BrdU incorporation, flurochromes staining, restriction enzymes banding, in situ localisation of repetitive DNA probes and immunofluorescence. These studies disclosed certain unique characteristics of fish species like evolution of polyploidy in certain Genus, supernumerary B chromosomes and natural triploids, a rich variability of morphologically differentiated sex chromosome systems, involvement of both A+T and G+C rich heterochromatin in sex chromosome differentiation. Such studies may provide insights into genome evolution of diverse fishes. An interesting presentation (Porto-Foresti, Brazil) on possible lethal effect related to an inversion in the nucleolar organizer regions in rainbow trout also stressed the importance of cytogenetic identification of breeders in the genetic management of fish stocks.

In a paper titled "Many unusual cytogenetic findings in benign or manignant tumors be helpful for the clinician." Croce et. al. (Italy) confirmed the role of cytogenetics in the prognostic evaluation of brain tumors. Compared to different solid tumors cytogenetic studies

are still few on brain tumors. A study by Malet et. al. (France) pointed to the usefulness of numerical sex chromosomal aberrations in lymphocytes as a cytogenetic marker of major depressive disorders. The frequency of numerical sex chromosome aberrations was analysed by FISH in order to look for a possible association between mosaic dysgonosomia and recurrent major depressive disorders.

Recently a new topic in the field of cytogenetics, especially after the development of chromosome painting, is to evaluate the presence of chromosomes with a higher frequency of radiation exposure induced chromosome breakage. Some reports earlier have shown that human lymphocyte chromosomes do not seem to share, according to the DNA content, the same susceptibility to breakage after treatment in vitro with X-rays. Scarpato et. al. (Italy) presented data indicative of a higher fragility of chromosome 10 in children living in Chernobyl radio-contaminated areas (the most radionuclide contaminated area of Belarus). Chr. 10 was specially choosen because of a higher incidence of structural rearrangements observed in this chromosome in thyroid tumor cells of children from the Chernobyl polluted areas. This study offers further evidence for the possible presence of chromosome dependent radiosensitivity.

The exhibitions and impressive demonstrations held by many well known firms specialising in cytogenetic image analysis and automated scanning highlighted newer developments in this field. The applications software designed in close collaboration with leading cytogeneticists and researchers offer advanced imaging tools, both for routine karyotype analysis and the most sophisticated FISH applications. Powerful karyotyping packages that handles G-R-Q-banding, polyploid cells and markers are available now. Readily accessible from a microsoft window's environment, detailed analysis of the karyogram can be performed using ISCN templates, band comparison, statistical analysis or band enhancement. The biggest time saving results from use of automation is in the karyotyping steps, especially the production of a hard copy. The system combines an intuitive graphic user interphase with very high image resolution of up to 1100 x 900 pixels available for the most demanding applications. It also has the ability to learn by experience with the facility of creating new classifications from samples using neural net work technology.

Automatic metaphase finding for transmitted light and fluorescence increases the thoroughput significantly. The program scans the slides overnight and relocates the metaphase next morning for immediate analysis. Packages for cytogenetic laboratory data management includes patient and lab. data transfer to the karyotyping package as well as image import from the karyotyping package. Thus structured software application solutions designed with the closest possible integration of microscopes are available today. Most of these are based on the latest standard PC specifications and ideally placed to benefit from predicted developments in software and PC technology.

On the whole, the Conference was very informative and gave a better insight into some of the research problems at hand. This also afforded a rare opportunity to meet some of the leading cytogeneticists and discuss problems of mutual interest. This may pave way for better scientific co-operation and exchange of ideas among those working on similar fields in the years to come.

Dr. Mrs. A.P. Krishnaja
Cell Biology Division, B.A.R.C.