

DETAILED BIODATA OF Dr. R.C. SOBTI

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| 1. Name and Date of Birth | Dr. Ranbir Chander Sobti
FNASC. FZS FSCG FPAS
(19-08-1948) |
| 2. Designation and Department | Vice Chancellor,
Professor, Deptt. of Biotechnology,
Panjab University,
Chandigarh - 160014 |
| 3. Highest Degree obtained | Ph.D. Panjab University,
Chandigarh. |



DEGREE	YEAR	UNIVERSITY	DIVISION	POSITION
B.Sc (Hons. School)	1969	Pb. University	1 st	2 nd
M.Sc. (Hons. School)	1970	Pb. University	1 st	1 st
Ph.D	1974	Pb. University		
Certificate Course in German	1971	Pb. University	1 st	
MSPH	1983	University of Miami, Florida (USA)		Have cleared 33/36 credit With A Grade

4. POSITION HELD:

POSITION	DATES	UNIVERSITY	
Teaching Assistant	4.2.74 to 31.3.75	Panjab University	
Curator	31.5.75 to 9.2.76	Panjab University	
Lecturer	30.6.76 to 10.2.85	Panjab University	
Reader	31.7.85 to 26.7.94	Panjab University	
Res. Associate Professor	12.5.80 to 28.2.83	University of Miami, Florida, USA	Whaxaleont period lecturer 2/76 to 4/80 and 2/83 to 5/85
Professor in Cell Biology	27.7.94 onwards	Panjab University	Upto 28.2.95 in Zoology Dept. and w.e.f. 1.3.95 in Dept. of Biotechnology
Vice-Chancellor	July 2006 onward	Panjab University	

Transferred alongwith the post of Professor of Cell Biology from Department of Zoology to the Department of Biotechnology w.e.f. 01-03-1995 and allowed to act as Chairman/Head of the Department of Biotechnology w.e.f. 01-03-1995 for a term of three years and again designated as Chairperson/Head of the Department of Biotechnology for a further period of three years w.e.f. 01-03-1998 to 28-02-2001. Designated as Professor of Biotechnology in Cell Biology, Department of Biotechnology. Again designated as Chairperson of the Department of Biotechnology for a period of three years w.e.f., 06-09-2002 to 07-09-2005.

5. ACADEMIC DISTINCTIONS

- i. Young Scientist Medal – INSA 1977.
- ii. Science Award of the Kothari Scientific and Research Commission, 1977.
- iii. Young Scientist Exchange Award between India and U.K. 1978.

- iv. INDO-FRG Exchange Programme, 1986.
- v. INSA – Royal Society Exchange Programme, 1988.
- vi. Career Award, UGC, 1998.
- vii. INSA – Japan Society Exchange Award, 1994.
- viii. Lady Tata Memorial Fellowship – 1972.
- ix. Fellowship of National Academy of Sciences (FNA Sc.) 1992.
- x. Fellowship of Zoological Society of India (1992).
- xi. Fellowship of Society of Cytologists and Geneticists, India (1994).
- xii. Indo – German INSA Exchange programme 1998.
- xiii. INSA – JSPS Exchange Programme 2001-2002
- xiv. ICRET Fellowship of UICC Geneva 2001, 2005
- xv. Fellowship of UICC, Geneva, 2002

6. ADMINISTRATIVE RESPONSIBILITY (Total Administrative Experience . 17 years)

Founder Coordinator	Centre for Biotechnology	22.1.1989 to 28.2.95
Chairman	Department of Biotechnology	1.3.95 to 28.2.01
		6.9.02 to 5.9.05
Dean, Alumni Relations	Panjab University	1998-99
Coordinator	Univ. Industry Interaction cell	Nov. 1997 to July 2000
Coordinator	Centre for Vocational Studies	July 1998 to July 2001
Dean	Foreign Students	August 2001 to July 2004
Hony. Director	UGC Academic Staff College, PU	August 2004-2006
Member	Senate (PU)	2004 to 2008
Member	Syndicate (PU)	Jan. 1, 2006-31Dec. 2006
Convener,	Board of Studies in Bioinformatics	Since Academic Session of 2004

7. NUMBER OF DESSERTATIONS/THESIS SUPERVISED

	M.Sc.	M.Phil	Ph.D
Direct	12	3	10
Indirect *	9	9	32
Currently working		-	8

(* as co-investigator of the Research Projects or otherwise)

8. NUMBER OF RESEARCH PROJECTS

(Independent -Joint)

i)	In hand independent	:	2
	In hand joint	:	0
ii)	Completed Independent	:	10
	Completed (joint)	:	7
iii)	Pending Independent	:	2

9. BOOKS PUBLISHED

- i. **Eukaryotic Chromosomes: Structural and Functional Aspects** with Prof. G.Obe, Director Institute of Genetics, University of Essen. Published by M/s Narosa Publishers and Springer Verlag, Heidelberg.
- ii. **Medical Zoology** published by S.L. Nagin and Co., India.
- iii. **Some Assays on Cytogenetical Research** M/s Narendra Publishers, New Delhi

- iv. **Trends in Environmental Muta genesis**
Tausco Publishers,New Delhi
- v. **New Biology: 1**, Pb. Univ., Chandigarh.
- vi. **Fundamentals of Biotechnology**, Pb. Univ. Chandigarh.
- vii. **Advances in Life Sciences**, Pb. Univ. Chandigarh
- viii. **Functional Aspects of Chordates**, Published by S.L. Nagin Chand and Co., India
- ix. **Environment: Components, Problems and Conservation**, Published by Narendra Publishers, New Delhi.
- x. **Animal Physiology** (M/s Narosa Publication: In press)
- xi. **An Insight of the Insects** published by M/s Tausco Publishers, New Delhi.
- xii. **Some aspects of structure and Function of chromosomes** Published by, M/s Kluwers
- xiii. **Basics of Biotechnology Vol 1 Introduction to Life Sciences** Published by M/s Vishal
- xiv. **Basics of Biotechnology Vol II: Concepts,Tools and Applications**, M/s Vishal Publishers
- xv. **Medical Zoology and Medical Technology** published by M/s Shobhan Lal and Co
- xvi. **Medical Zoology: An introduction to Parasitology** published by M/s Shobhan Lal and Company
- xvii. **Foundations of Advanced Biology** Published by M/s Ane Publishers (in press) New Delhi
- xviii. **Pathological Zoology** Published by M/s Shobhan Lal and Company (in Press)
- xix. **Elements of Biotechnology** Published by M/s Ane Publishers, New Delhi
- xx. **Elements of Life Sciences** published by M/s Ane, New Delhi

10. COURSES TAUGHT (Abroad)

Taught Advance Cytogenetics to the staff and students of the Department of Oncology, University of Miami, Florida, U.S.A.

Environmental Health (EPH 681) to MSPH students of the Department of Epidemiology, University of Miami, Florida, U.S.A.

11. OTHER INFORMATION SOCIETY MEMBERSHIP AND OFFICES.

Member	:	American Society of Human Genetics.
Active Member	:	American Association of Cancer
Member	:	Cell Kinetics Society, USA.
Member	:	Canadian Society of Genetics.
Member	:	Genetic Society of America

Life Member	:	Environmental Mutagen Society of India and Executive Member, 1979-80, 1993-94.
Life Member	:	Indian Society of Human Genetics.
Member	:	Indian Society of Cell Biology.
Life Member	:	Indian Science Congress Association. (Convener, Local Chapter since (1994)
Life Member	:	Society of Cytologists and Geneticists, India.
Member	:	Society of Cell and Chromosome Research, Japan.
Member	:	Task Force Manpower Planning of the Department of Biotechnology, Govt. of India. (1992-1996).
Advisory Committee Membrane	:	Indian Journal of Human Genetics.
Advisory Committee on Waste Management	:	Govt. of Haryana, Chandigarh (1997).
Advisory Committee member,	:	Rajasthan Agriculture Univ. Jodhpur Dictionary of Biotechnology
Member	:	High Powered 'TOKTEN Committee of CSIR
Vice President	:	Panjab Academy of Science (1999-2000)
President	:	Panjab Academy of Science (2000-2002)
Member Board of Directors		Rayat Institute of Engineering
Chairman, Board of Examinations		DOEACC, Govt of India
Member Advisory Council S&T		Govt of Haryana

12. OTHER RESPONSIBILITIES

- a. Editor, Hippocampus, Department of Zoology, Panjab Univ. Chandigarh. (upto 1994)
- b. Editor, Biotech Bulletin, Deptt. of Biotechnology. Panjab Univ. Chandigarh, Since 1999.
- c. Editor, Res Bull (Sci), Panjab Univ. Since 1991.
- d. Chief Editor, Journal of Pb. Academy of Sciences, 1999.
- e. Supervisor Nude Mice colony and Maintenance of Tumor Xenographs: 1981-1983, Dept. of Oncology, Univ. of Miami, Florida, U.S.A.
- f. Experience in Flow cytometry, Tissue Culture, Preparation of Monoclonal Antibodies.
- g. Experience with *in situ* nick translation. DNA isolation, Southern blot Hybridization, PCR etc.
- h. Co-Editor, Journal of Cytology and Genetics.

13. CONFERENCES ATTENDED

Have attended more than 10 Conferences/Symposia in India and abroad, Presented papers/chaired sessions.

International conferences attended (Abroad)

Somatic Cell Genetics Conference, Reno. U.S.A.

Gene to Man. Chicago. USA.

American Association of Cancer Res., Washington
 International Conf. on human Genetics, Berlin
 Symposium on Occupational Carcinogenesis, Berlin
 Symposium on Molecular Genetics and Cytogenetics of Cancer, Berlin.
 International Conf. on Molecular Medicine Berlin 1998.
 Molecular Cytogenetics Natarajan Farewell Symp, Leiden, 1999.
 Conference of Pathology, Japan 2000

14. COUNTRIES VISITED

UK	1979	Under Indo – UK Exchange Programme
USA	1980-83	As Research Associate Professor
FRG	1986	Under Indo – FRG Exchange Programme
UK	1989	Under INSA – Royal Society Exchange Programme
FRG	1989	Invited at Munich
USA	1989	Miami – Comprehensive Cancer Center’s invitation (delivered lectures and performed collaborative experiments).
Germany	1998	Under the INSA-Germany Exchange Programme
USA	1998	NIH/NCI Visiting Scientist Programme (Miami and Philadelphia)
Netherlands	1998	To attend an international Conference.
USA	2001	To avail ICRETT fellowship.
Japan	2002	To visit Japan under INSA - JAPAN Academy of Sciences Exchange Programme
USA	2006	Visited USA under ICRETT fellowship UICC Geneva

15. THESIS HELPED/SUPERVISED BY DR. R.C. SBOTI (DIRECTLY OR INDIRECTLY)

A. M.Sc.

- 1971 Analysis of Chromosomes in the primates from India – Chander Mohini
- 1972 Chromosome studies on Indian Deer Mutiacus Muntjak and Black buck, Antilop cervicapra – Neeru Berri.
- 1973 Cytogenetical, cytochemical and experimental studies on the nuclear behaviour of some hypotrichous and holotrichous ciliates – Jasmit
- 1974 Cytogenetical studies on some cestodes – Harvinder Luthra
- 1974 Cytogenetical studies on Indian donkey, Equus asinus
Rajesh Anand
Chromosomes in 2 ungulates form India – Bhag Singh
- 1975 Cytogenetical and cytochemical studies on certain holotrichous ciliates – ChandanBhai
- 1976 On the cytochronological behaviour of some hypotrichous and peritrichous ciliates from the polluted waters – Neelam Kathuria

- 1978 Chromosome studies on 20 species of ants (Hymenoptera: Formicidae) from Chandigarh and its adjoining areas and analysis of free amino acids during the development stages of some of them – Rajiv P. Mahna.
- 1979 Cytogenetics of the Indian cattle leech *Hirudinaria granulosa* (Annelida) - Vijay
- 1979 An attempt to study the alterations in tumour cells and blood of cancer patients through lectinology and electrophoretic analysis – Aloka Mehndiratt.
- 1979 Action of plant lectins on the blood of normal and diseased human beings and evaluation of serum proteins by electrophoretic analysis – Madhu Bala
- 1980 Studies on haemagglutination haemolytic and precipitation reactions of the plant lectins with mammalian blood to evaluate their specificity – Suman Chugh
- Studies on haemagglutination, haemolytic and precipitating reactions of the plant lectins with avian blood – Madhurima Sharma
- 1984 Mutagenic/carcinogenic studies on agricultural chemicals, Thiram and Linuron – B.Kang
- Determination of mutagenic potential of possible metabolites of O – toluidine using multiple parameters – Preeti
- 1985 Studies on the genotoxicity of certain agricultural chemicals – Harjit
- 1986 Structure – activity correlation: metabolites of hydroxylamine with their clastogenic potential – Jaskirat
- 1987 Probing of herbal principles as detoxifying agents for the carcinogens, ethylene dibromide and methane sulphonate – S.S. Mangat
- 1988 Preliminary studies on the prophylactic behaviour of essential oil of *Apium graveolens* towards the xenobiotic hepato – and geno – toxicity using in vivo and in vitro models – Anupinder
- 1994 Chromium induced mutagenicity in prokaryotic and eukaryotic systems – Meenu Kausha
- 1992 onward – M.Sc. project report of 10 student in Biotechnology every years.1992 onwards Every year projects in Biotechnology are supervised
- 1993 Since 1992 Guiding MSc research projects of MSc Students in Biotechnology

B. M.Phil

- 1979 Genetic (Cytogenetical, Biochemical) studies on mammals from North India with particular Reference to the population survey of black rat from Punjab – Sikander
- 1980 Lectinological and electrophoretic studies with blood of the diseased and normal human beings – Madhu Bala
- 1984 Biochemical and enzymological studies in certain fresh water fishes – Jyotsna Singh
- 1986 Studies on two antihepatotoxic drugs – Richa
- 1987 Genotoxic effects of agricultural chemicals – Preeti
- 1988 Prophylactic behaviour of *Astriacantha* towards the hepatotoxicity in rats – Bhagat Deep
- 1989 Toxicological Investigation of two carbamate pesticides Ziram and Thiram on common carp, *Cyprinus* – Anupinder
- 1990 Structural activity relationship of chemicals - Sandeep
- 1991 Do the textile dyes cause mutations in pro - and eu-karyotic systems? – Anju Kaushal

C. MD. Cytogenetics of couples with fetal wastage – Aarti Khurana,

D. Ph. D.

- 1975 Effects of certain chemicals on the chromosomes of some of the mammals – Chander Mohini
- 1978 Assessment of chromosome and biochemical mutagenicity of certain carcinogens – Rajesh Anad
- 1978* The mutagenic evaluation of certain carcinogens on the rodent haemopoietic tissues – Komal Sahi
- 1978* Influence of certain industrial effluents on the mammalian genetic components – Bhag singh
- 1979* Cytogenetical studies on some amphibians from the Indian Subcontinent – Enayetur Rahman
- 1979* Cytogenetical studies in anaemias – Geeta Verma
- 1983* Cytogenetic effects of solar eclipse on the mice of Lacca strain – Aparna Saxena
- 1984* Biochemical and cytogenetical studies on some mosquito species – Achla Safaya
- 1985 Characterization of certain bird species using lectins and isozymes as parameters – Madhurima Sharma
- 1986* Cytogenetics of Curculionids from India – Pushpa Singla
- 1986 Response of mouse genome on its exposure to certain agricultural chemicals and heavy metal compounds – Rajwant Kaur

- 1987 Toxicity of carbamate pesticides – Subroto Biswas
- 1988 Search for ultimate carcinogens of 0 – toluidine and PABA – Abdul Mannan
- 1989 Cytogenetical studies on congenital disorders – Mehmood Fazal
- 1991 Characterization of possible anti-hepatotoxicity of Swercia – Jasminder Sahi
- 1992 Incidence of variation of heterochromatic patterns of normal and diseased human beings and those under environmental stress-Dinesh K. Bhardwaj
- 1992 Cytogenetic studies in populations occupationally exposed to pollutants and the modulation of aberrations with herbal drugs - Sandeep
- 1994 Detection of molecular and cytogenetic markers for the diagnosis of cervix cancer – Neena Capalash
- 1995 Development and evaluation of a specific immunodiagnostic test for amoebiasis employing monoclonal antibodies – Vandana Kaushal.
- 1995 Assessment of cytogenetic damage in petrochemical workers and cancer patients before and after treatment – Sat Dev Batish
- 1996 Immunochemical characterization and immunoprotective behaviour of major cell associated molecules of promastigotes of *L. donovani* identified by employing monoclonal antibodies - Deepika
- 1998 Molecular studies of gastrointestinal Cancers – Kamana Parashar
- 1998 Genesis of Cervix cancer – Ravinder Kaur
- 1998 Microbial degradation of polycyclic aromatic hydrocarbons (Naphthalene/Phenanthrene) and construction of genetically manipulated strains – Mamta Rani.
- 1999 Studies on cholesterol-dependent regulation of proto-oncogene expression in human lymphocytes – Manjeet Kaur
- 2000 Characterization & Purification of the thermophilic β -galactosidase - S. Chakrabarti
- 2000 Studies on the toxin of *Shigella flexneri* - Deepa
- 2000 Characterization of lectins from the Jackfruit - Seema
- 2001 Microbial transformation of ferulic acid to vanillin and related compounds – Bimal Karmakar
- 2002 Optimization of Process Parameters for the production of alkaline CMCase – Jagtar Singh
- 2003 Optimization of Process Parameters for the Conversion of Lactose using Thermostable β -galactosidase – Navneet Batra
- 2004 Detection of possible novel tumour markers in the early diagnosis of small cell and non small cell lung carcinomas in patients – Sidharth Sharma
- 2004 Studies on the molecular alterations in the pathogenesis of gastrointestinal tract cancers. –Jaspreet Kochar
- 2004 Multiparametric approach to carcinogenesis of nickel - Khalid
- 2005 Molecular genetics of Bladder cancer – Adnan
- 2005 Molecular biology of prostate cancer – Arezoo
- 2006 Polymorphism in DNA repair and metabolic genes in lung cancer - Suparna
- 2006 Single nucleotide polymorphism in lung cancer –Pushpinder
- 2006 Molecular epidemiology of oesophageal cancer - Jagmohan Singh
- 2006 Identification of Molecular alteration as risk factor (s) for cancers of upper aero digestive tract (UAT) – Amit Joshi
2006. Studies on Gene Expression Profile of Mammary Gland through Characterization of Tissue specific Expressed Sequence Tags of Buffalo (*Bubalus bubalis*) Genome - Manishi Mukesh

Submitted

1. Polymorphism in DNA repair and cytokine genes in cervical cancer – Satinder

Continuing

2. Single nucleotide polymorphism in cytokine genes in GI tract cancers - Jasbir
3. Molecular epidemiology of Bladder Cancer- Kiyanoosh
4. Molecular studies on COPD - Hitender
5. Molecular studies on prostate cancer – Lipsy

16. RESEARCH PROJECTS

A. JOINT PROJECTS

	PROJECT	AGENCY	YEAR (S)
1.	Cytogenetical and Biochemical Prognosis of Myeloproliferative Disorders in Human Beings.	CSIR	1975-78
2.	Lateral Asymmetry of Hetrochromatin in Human Cancers	CSIR	July 1981-Nov. 1982
3.	Studies on the Cytogenetics of Persons exposed to Anaesthesia	American Cancer Society, USA	1985-1989
4.	Investigations on Antihepatotoxic Drugs of Indian origin	ICMR	1984-1990
5.	Projects with Prof. G.P. Sharma on Environmental Mutagenesis	DOE	1985-1989
6.	Pre-Natal diagnosis of Genetic disorders	ICMR	1993

B. INDEPENDENT PROJECTS

1.	Evaluation of Mutagenicity of Environmental Pollutants Hazardous to Human Health	UGC	1979-80
2.	Cytogenetic Monitoring of Some Suspect Chemicals <i>in vivo</i>	American Cancer Society	1980-81
3.	Cytogenetic and Cytokinetic effects of some Environmental Pollutants	National Cancer Institute U.S.A.	1980-83
4.	Genetic Markers with Reference to their Role in the Diagnosis, Prognosis and Therapeutics of Cancers	Indian National Science Academy	1980-82
5.	Heterochromatin Polymorphism and its Relationship with the Risk of Cancers	University Grants Commission sanctioned in 1980, but could not avail due to being on leave.	
6.	Determination of Cacinogenicity/Mutagenicity of Environmental Pollutants	CSIR	1985-1988
7.	Toxicity Profiles of Bisthiocarbamate Pesticides	CSIR	1988-1991
8.	Metastatic Potential of Cancer Cells	UGC	1988-1992
9.	Replication Pattern of Chromosomes	CSIR	1992-1996
10.	Cytogenetics and Molecular Markers in the Genesis of Cervical Cancer.	UGC	1993-1997
11.	Biology of Shigella Toxin	CSIR	1997-2000
12.	Role of onco-antioncongenes in the genesis of oesophageal cancers	UGC	2001-2004
13.	Detection of Novel markers for the diagnosis of lung cancer	ICMR	2002-2005

14.	Molecular studies on Prostate Cancer	ICMR	2005-2008
15.	Cytokine gene polymorphism in HPV induced cervical cancer	DBT	2005-2008
16.	Hormone receptor gene polymorphism and risk of Prostate cancer	ICMR	2006-2009

17. A Brief Summary of Research Work Done by Dr. R.C. SOBTI

Dr. R.C. Sobti, Professor, Department of Biotechnology (formerly in the Dept. of Zoology), Panjab University, Chandigarh has worked on the various aspects of Cell Biology and published as many as 159 papers in the Journals of International repute.

A. CANCER CELL BIOLOGY AND ENVIRONMENTAL CARCINOGENESIS (including anticarcinogenicity)

a) *Genesis and risk of Cervix Tumors*

Extensive studies have been carried out to understand the genesis of cervix cancer using molecular techniques. The studies have clearly indicated that HPV is a prerequisite for the causation of most of the cervical cancer in North Indian patients (Capalash and Sobti, 1999) and the genome of such patients is quite fragile (Sobti *et al.*, 1999). It has recently been observed that passive smoking is a significant risk factor for cervical cancer (Sobti *et al.*, 2005). Attempts are being made to associate polymorphism in various metabolic cytokine and DNA repair genes with the risk of cervical cancer.

b) *Genesis and risk of GI Tract Cancer*

The highest prevalence of stage II of oesophageal cancer has observed in the age of 40-60 years. In the North India, Punjab shows the maximum percentage. HPV has been found to be significantly associated with the risk of oesophageal cancer. Our study has demonstrated that HPV alters the p53 expression. The TRAP (Telomeric Repeat Amplification Protocol) assay has revealed that 70% of the patients to be having very high telomerase activity in the biopsies taken from the growth area (Sobti *et al.*, 2002). The cytogenetic analyses (sister chromatid exchanges and chromosomal aberrations) in the lymphocytes of these patients reveal a higher base level of SCEs and chromosome aberrations as compared to the controls. The studies of polymorphism in metabolic DNA repair and cytokine genes have shown certain genotypes to be risk factor for oesophageal cancer (Sobti *et al.*, 2005).

c) *Lung Cancer*

CYP1A1, CYP2E1, CYP2D6 GSTM1 and GSTT1 polymorphisms were evaluated in north Indian lung cancer patients and controls. A case control study has revealed that relative risk for lung cancer associated with the CYP1A1 Val/Val allele is 2.68, and is four-fold when cases with small cell lung cancer (SCLC) are considered alone. With regard to the metabolism of debrisoquine, no poor metabolizers have been found amongst the subjects. The odds ratio of risk with the heterozygous extensive metabolizer (HEM) genotype is 1.5. However, in the presence of at least a single copy of the variant CYP1A1 MspI allele and the CYP2D6 HEM genotype, the risk is two-fold for squamous cell carcinoma (SQCC). When the CYP1A1 Val/Val and CYP2D6 HEM genotypes are taken together, the risk for SCLC is four-fold. Stratified analysis has indicated an interaction between bidi smoking and variant CYP1A1 genotypes on the risk for SQCC and SCLC. Heavy smokers (Brinkman index>400) with Val/Val genotypes are at a very high risk of developing lung cancer (OR 29.30, 95% 2.42-355, p=0.008). Heavy smokers with CYP1A1 MspI (CYP1A1*1/2A or CYP1A1*2A/*2A) genotype have a seven-fold risk for SCLC compared with non-smokers. Apart from the CYP1A1*2C genotype, there is no attributable risk in relation to other genotypes when analyzed singly. However, in the presence of a single copy of the variant CYP1A1 (CYP1A1*1/2A) and null GSTT1 genes, there is a three-fold increased risk for lung cancer; when stratified histologically the relative risk increases to 3.7 in case of SQCC. Similarly individuals carrying the mutant CYP1A1*2C genotype and single copy of the variant CYP1A1 MspI allele, have a relative risk of 2.85 for lung cancer. In case of the GSTM1 and CYP1A1 genotypes, null GSTM1 and variant MspI alleles had two-fold elevated risk for SQCC. On the other hand CYP1A1*2C and null GSTM1 genotype has a 3.5-fold elevated risk for SCLC. Stratified analysis has indicated a multiplicative interaction between tobacco smoking and variant CYP1A1 genotypes on the risk for SQCC and SCLC. Beside combined GSTT1, GSTM1 and CYP1A1 polymorphisms could be susceptible to lung cancer induced by bidi (an Indian cigarette) smoking.

d) *Risk of bladder Cancer*

The prevalence of genetic polymorphism in the CYP2D6, GSTM1, and GSTT1 genes has been investigated to find their association with risk of bladder cancer. While there is no association between the heterozygous (HEM) genotype of the CYP2D6 gene with the risk of bladder cancer [odds ratio (OR)=1.00; 95% confidence interval

(CI)=0.46-2.16], it is 1.5-fold with poor metabolizer (PM) genotype. When stratified according to different grades of bladder cancer, a significant association has been found with an OR=3.54 (95% CI=0.89-13.98) in grade II, 3.3 (95% CI=0.12-20.6) in grade III, and 1.67 (95% CI=0.15-18.45) in grade IV. When stratified in relation to smoking status, significant association of the disease has been found in heavy smokers with an OR=2.13 (95% CI=0.71-6.43). Subjects with the null genotype for *GSTM1* have a slightly significant association with the bladder cancer risk and the risk increases to 2-fold with the *GSTT1* null genotype. Smoking status also revealed an impact on the prevalence of bladder cancer in the individuals with *GSTM1* and *GSTT1* null genotypes. The results have indicated that there is a 3-fold increase in risk of developing this cancer in the presence of one copy of the variant CYP2D6 (HEM) allele and null *GSTT1* (Sobti *et al.*, 2005). To look for composite genotype for risk of bladder cancer further studies are carried out on other metabolic cytokine and DNA repair genes.

e) The Risk of Prostate Cancer

Excepting two cases, there is no mutation either in DNA-binding (exons 2 and 3) or in hormone-binding (exons 4-8) domains of the *AR* in Indian prostate cancer patients. On sequencing these are found to be non-sense mutations. The incidence of the genotypes containing –/– allele of *ERα* gene is higher in prostate cancer patients and this association is statistically significant (OR, 2.70; 95% CI, 1.08-6.70, *P*=0.032). The prevalence of Rr genotype in *ERβ* gene is higher in prostate cancer patients, but the association is not statistically significant (OR, 1.65; 95% CI, 0.52-5.23, *P*=0.394). Compared with the wild-type *A1/A1* homozygotes in *PR* gene, the odds ratio for *A1/A2* heterozygotes is 1.71 (95% CI, 0.73-3.98; *P*=0.211). The Cys allele-containing genotype *Arg264Cys* substitution of *CYP19* gene appears to be associated with an increased risk of prostate cancer and the results are statistically significant (OR; 2.28, 95% CI; 1.20-4.35, *P*=0.012). Determination of the TaqI-RFLP at codon 352 (genotype tt) of *VDR* gene shows an OR of 0.43 for the men with tt genotype (95% CI; 0.13-1.39, *P*=0.160), and an OR of 0.65 (95% CI; 0.36-1.16, *P*=0.147) for heterozygous (Tt) for t genotype. In the gene-gene interaction studies, a significant association with risk has been found when *ERα* +/+ is combined with *ERβ* Rr genotype (OR, 2.15; 95% CI, 1.07-4.32; *P*=0.032). A 5-fold higher risk has been observed when *ERα* mutant allele is combined with *PR* *A1/A2* (OR, 4.84; 95% CI, 1.43-16.42; *P*=0.011). No association has been found with risk when other genes are combined together (Sobti *et al.*, in press, Ansori *et al.*, in press). Studies are continuing on methylation and gene expression patterns in prostate cancer tissues to look for prostate cancer gene and its expression pattern.

d) Mode of Drug Action

It has been seen that the non-proteinaceous chromophore is responsible for the activity of anti-tumour drugs, neocarzinostatin and auromomycin (Sobti, 1984). None of the analogs of adriamycin, an antitumour antibiotic so far developed is non-mutagenic/carcinogenic. The observations are based on the data on sensitive test systems (Sobti, 1989 a,b).

e) Mutagenicity Carcinogenicity and Structure Activity Relationship of Chemicals

The toxicity profiles of more than 100 suspect compounds, using multiple parameters *i.e.*, teratogenicity, cytotoxicity, mutagenicity and carcinogenicity have been worked out. It is being tried to detect the ultimate mutagen/carcinogen of o-toluidine and PABA (Sobti, 1997). It has been shown that 4 nitrodiphenyl and 4 – nitrosodiphenyl ethers are quite toxic to mice at higher dose levels. The toxicity is probably due to their methaemoglobinemic property and, thus, the low clastogenicity can be ascribed to the fact that these compounds probably react with the erythrocytes and, thus, fail to attack the DNA for causing mutations. (Sobti *et al.*, 1992) This is probably the reason that despite their being direct mutagens (as seen in Ames test), they are unable to cause chromosomal damage to a great extent. The frequency of chromosome aberrations and sister chromatid exchanges in persons occupationally exposed to petroleum vapours, anaesthetics, paints, stone dust *etc.*, indicated them to be at greater risk of developing disorders including cancers (Sobti and Bhardwaj, 1992, 1993, Sobti *et al.*, 1999).

The negative clastogenicity of 2 – hydroxy – 4 phenoxy – acetanilide can be ascribed to the presence of –OH group, ortho-to amino which probably inhibits further activation of the latter or the –OH group may be getting metabolized to more polar derivatives with the use of phase II enzymes, thus get excreted. Two schemes for describing the high clastogenicity of 2 – acetamino – 5, 6 phenoxyphenyl acetate have been proposed. The first one is comparable to that given for phenacetin, whereas the other is similar to the one given for paracetamol. In both the schemes, this metabolite may generate highly reactive electrophiles for producing mutagenic lesions after reacting with DNA.

f) Antimutagenicity/Anticarcinogenicity

Antihepatotoxic herbal drugs, Livergen and Liv 52 have been seen to be antagonistics to the carcinogens especially methyl methane sulphonate and ethyl ethane sulphonate (Sobti *et al.*, 1989, 1991). The studies on the constitutive plants have revealed *Apium* and *Picorrhiza* to be prospective candidates in this regard.

Our recent studies have clearly evidenced the modulatory role of turmeric in the cadmium induced toxicity (Sobti *et al.*, 2005).

We have also tried to look for the role of black tea extract in protection against oxidative damage induced in mice by a subacute oral dose of a combination of pesticides. Following exposure to pesticides, lipid peroxidation is increased compared to that in the control [0.50+/-0.083 (mean+/-S.E.) vs. 0.21+/-0.02 micromol/mg protein, *p*<0.001]. Moreover, levels of antioxidants like GSH and total thiol are also significantly decreased in comparison to control, *e.g.*,

GSH [5.16±0.78 vs. 6.96±1.35 micromol/mg protein, p<0.001] and total thiol [19.3±2.74 vs. 26.15±2.8 micromol/mg protein, p<0.001]. In addition, the activities of antioxidant enzymes like GPx, GST, GR, SOD and catalase are also likewise diminished by oxidant damage. Treatment with aqueous black tea extract significantly protects the liver tissue from the oxidative damage and shifts the trend towards amelioration and replenishment of the antioxidant status. It is apparent that the active components present in natural extracts like that of black tea can be very effective in perhaps reducing the extent of injury and in overcoming oxidant damage caused by exposure to environmental agents like pesticides (Khan *et al.*, 2005).

g) Receptor Ck dependent Regulation of Genes Involved in the Cell Cycle

It has been clearly shown that the phosphatidic acid (generated through the activation of receptor Ck by cholesterol) regulates mevalonate pathway, DNA synthesis as well as expression of genes coding for *c Fos*, *c myc*, and *cyclin D* (Kaur *et al.*, 1998)

h) Use of Jackalin for Detecting Tumor Cells

The use of lectines for the characterization of congeneric species may prove to be a tool to explain the hitherto complex systematic problems. This has been evidenced from the data so collected by us. Extract of Jackfruit has been purified for Jackalin lectin.

Specificity of lectin is conventionally defined on the basis of haptenic inhibition assay in which various sugars are tested for their capacity to inhibit haemagglutination of red blood cells. The sugars that inhibit haemagglutination presumably do so as a result of interaction with protein-carbohydrate binding sites. Seeds of *A. heterophyllum* were used for the production of lectin as they are abundant, economical and stable. Among the various batches, CHD.GUR.B-1 was selected for further analysis. The seed extracts have been seen to be rich in agglutinating activity, when tested with red blood cells of animal and human origin. The haemagglutination inhibition data has indicated that binding specificity is directed towards the units of anomers such as α-D-Galactopyranoside and D-Melibiose than β-anomers as lactose. An N-Acetylamine group in C-2 as in N-Acetylgalactosamine (-GalNAc) increases the inhibition and is two times more effective inhibitor than galactose. D-Mannose and D-Glucose (both isomers of D-Galactose), D-Mannose with alternate -OH groups at C-2 and C-4 and D-Glucose with alternate-OH groups at C-4 with respect to D-Galactose, were used to be non-inhibitory in action. Besides these sugars, D-Fucose is also isomeric with D-Galactose at C-2, C-3 and C-4 position, but has no -OH groups at C-6 position, hence non-inhibitory in action. Thus, it seems that hydroxyl groups at C-2, C-4 and C-6 configuration of galactose are important loci for the interaction with lectin.

B. THERMOSTABLE MICROBES

Thermostable strains of bacteria for β galactosidase, protease and CMCCase have been isolated and characterized (Singh *et al.*, 1999, 2004; Batra *et al.*, 2001, 2004). Glucose, cellobiose, and cellotriose are the products of hydrolysis. Gelatin (0.5% w/v) has been optimized as the best protein source for enzyme production (Singh *et al.*, 2004).

A thermophilic *Bacillus coagulans* RCS3 produces extracellular β-galactosidase (EC. 3.2.1.23). It shows growth in wide range of pH (5-12), produces significant activity at 10 days of growth in the shaking flask. The optimum operating temperature of β-galactosidase activity is 65°C, although half life at that temperature is 120 minutes. The enzyme is strongly and competitively inhibited by galactose (K_i=7.0x10.3 mM). The divalent cations (Cu²⁺, Ni²⁺, Hg²⁺) in concentration range of 0.5-0.2 mM inhibit the enzyme activity. The thermostability and pH makes the enzyme useful for lactose hydrolysis in dairy industries (Batra *et al.*, 2000; 2004).

A novel strain of *Bacillus sphaericus* JS1 producing thermostable alkaline carboxymethyl cellulase (CMCase; endo-1,4-beta-glucanase, E.C. 3.2.1.4) purified by 192 fold reveals it is a multimeric protein with a molecular weight estimated by native-PAGE of 183 kDa, but the single peptide is 42 kDa. This suggests presence of four homogeneous polypeptides, which would differentiate this enzyme from other known alkaline cellulases. The activity of the enzyme is significantly inhibited by bivalent cations (Fe³⁺ and Hg²⁺, 1.0 mM each) and activated by Co²⁺, K⁺ and Na⁺. The purified enzyme revealed the products of carboxymethyl cellulose (CMC) hydrolysis to be CM glucose, cellobiose and cellotriose. Thermostability, pH stability, good hydrolytic capability, and stability in the presence of detergents, surfactants, chelators and commercial proteases make this enzyme potentially useful in laundry detergents.

C. ANTIHEPATOTOXIC DRUGS

A project sanctioned by ICMR, New Delhi was undertaken to work out the Indian herbs with regard to their antihepatotoxic activity. For this, *in vitro* models were modified/simplified. The biochemical and ultramicroscopical parameters were used. On the basis of data collected so far, the herbs *Swerchia*, *Apium* and *Achelia* have shown quite promising results.

D. DISEASE DIAGNOSIS

a. The evaluation of Specific Immunodiagnostic Test for Amoebiasis using Monoclonal and CAE Antibodies

We have isolated and characterized a 58 kd antigen (a glycoprotein) and raised the monoclonal antibody against it. The monoclonal antibody has been tested for its use as diagnostic molecule in circulation. Our data has indicated that ELISA for the detection of amoebic antigen in circulation using anti-CAE antibodies as detector molecules, is better than using monoclonal antibody (Kaushal *et al.*, 1997)

b. Characterization of Shiga Toxin

Shiga toxin from *Shigella flexneri* has been purified and has been characterized (Sobti *et al.*, 1999)

c. Survey of *M. tuberculosis* Genome for Immunodominant Polypeptides

An enzyme linked immunoassay as well as a simple rapid liposomal agglutination base diagnosis for tuberculosis has been devised by resorting to a shotgun immunoexpression library in gt11 vector. This agglutination test module provides a reliable, rapid, simple and cost effective diagnostic tool for detecting tuberculosis monster.

E. POPULATION GENETICS

Some important clues towards the genetic set-up of six endogamous castes have been provided. Our studies have indicated that there is a marked similarity among them with respect to five genetic markers (ABO, HP, TF, LDH and MDH) (Sharma *et al.*, 1985, 1986).

There is, however, genetic apartness, though not so significant in castes/tribes. These findings substantiate the premise that if the cast system had been rigidly in operation since ancient times, there would presumably be considerable variations among the groups due to genetic drift and isolation and the other factors responsible for this, micromutational forces acting in the case of a particular caste group. It is apparent that the different castes show more inclination towards the correlation than differentiation. A possible explanation for these affinities might be that besides the rigid caste system in this region, these endogenous groups had ample chance to mix. The historical evidence also points towards this possibility (Sharma *et al.*, 1985).

F. ANIMAL AND HUMAN CYTOGENETICS AND MOLECULAR GENETICS

Cytogenetics of a large number of animals right from protozoans to mammals has been worked out and the work has been extensively quoted. The animal species and human populations on the basis of electrophoretic markers have been characterized. Quite a few papers on the cytogenetic markers in congenital anomalies and cancers have been published.

Recently, molecular techniques of RAPD/RFLP have been used to characterize various insects such as bruchids, curculionids and lepidopterans (Sharma *et al.*, 2003; 2005 a, b). The DNA sequencing data have enabled us to generate dendrograms indicating relationship of various lepidopterans (Sobti *et al.*, 2005). We have been able to characterize complex species of termites on the basis of study of mitochondrial genes (Sobti *et al.*, 2005).

For CO-II gene, one individual from each of the species of odontotermes and microtermes have been subjected to sequencing and for 16 S since three variable has been observed in SSCP gels, their sequencing has been done. Chromatograms of these genes have been edited by inbuilt sequence analysis software in applied biosystems sequencing systems. Related sequences have been identified by using basic local alignment search tool (BLAST) from national centre for biotechnology information (<http://www.ncbi.nlm.nih.gov>).

For cytochrome oxidase gene (CO II), both *Odontotermes bhagwati* and *Odontotermes obesus* show 94% similarity with *Odontotermes sp.* of Japan, while Indian *Odontotermes sp.* and *Microtermes obesi* show 95% similarity each with *Microtermes obesi* of Japan. While *Odontotermes horni* is 95% related to *Odontotermes longignathus*. No relevant observation has yet been inferred in case of 16S rRNA mtDNA gene since, two individuals of the same species but different locality have shown 92% similarity each with two different species of *Odontotermes i.e., O.zambesiensis* and *O.formosanus*, while *O. horni* is strongly related to *O. formosanus* (96%).

To characterize the buffalo and goat genomes, we have developed EST and microsatellite maps, which are bound to go a long way in genome sequencing of the Indian species (Manishi *et al.*, 2005; Sodhi *et al.*, 2005 a, b, c). More than 1000 accession numbers for ESTs of goats have been obtained (See accession number data).