

## 6. NEW PROPOSALS FOR 11<sup>TH</sup> PLAN

---

The Eleventh Plan proposal has three components:

1. *Critical-on-going activities*
  - a. Intramural research programme
  - b. Extramural research programme
2. *One time upgradation package*
  - a. Infrastructure
  - b. Staff
3. *New activities*
  - a. Intramural research programme
  - b. Extramural research programme

### Critical-on-going

#### INTRAMURAL (Rs.794.78 Cr)

Critical research programmes which are to be continued in the 10<sup>th</sup> Plan are those which are addressing to crucial issues, be it in quest for new knowledge, developing and evaluating a new tool or taking research results from laboratory to land.

**Fundamental Research** on cell ultra structure, cell and vector biology, pathogenesis and patho-physiology, cell and population genetics, host-response would be continued.

**Strategic Research** on identification of immuno-dominant antigens; genotyping, fingerprinting, sibling species differentiation based on cytogenetics, outbreak investigations, disease surveillance and monitoring antibiotic and insecticide resistance, vector surveillance, biology, biodiversity, bionomics and transmission dynamics; molecular taxonomy and phylogeny; host-parasite interaction, disease predisposing factors, identification of novel targets towards and development of insecticides.

**Development and evaluation of newer** tools such as diagnostics, drugs, vaccines, devices, testing and evaluation of new drug regimens, treatment algorithms and mathematical models would be continued and strengthened. Development of diagnostic/monitoring tools; development of intervention strategies; cost-effectiveness of various intervention; socio-economic research; determinants of diseases; management of insecticide/drug resistance; application of geographical information system and remote sensing for epidemiology and control of diseases; drug development; field and hospital-based trials; epidemiological investigations.

**Operational Research areas** would include demonstration of feasibility of interventions in different geo-ecological sites under programme conditions. Development of operational modules; disease modeling and operationalisation; morbidity management; development of early/advance-warning system; rapid response/preparedness for epidemic; health information management system; establishment of linkages; partnerships.

### **EXTRAMURAL (Rs.69.39 Cr)**

Included under this head are projects which are long-term studies and are undertaking relevant and essential activities. There are likely to be continued in present form or converted into permanent activities.

Following is the list of such projects:

- Integrated Diseases Vector Control of Malaria, Filariasis and other Vector Borne Diseases
- Human Reproduction Research Centres
- National Nutrition Monitoring Bureau
- National Cancer Registry Programme
- Studies of Entomology and Sero-Epidemiology of *Japanese encephalitis* at Vridhachalam, South Arcot District of Tamil Nadu
- Malaria Parasite Bank Project
- *Jai Vigyan* Mission-mode Project on control of Rheumatic Fever/Rheumatic Heart Disease
- *Jai Vigyan* Mission-mode project on community Control of Thalassemia Syndromes – Awareness, Screening, genetic, Counselling and Prevention.
- ICMR-NIC Centre for Biomedical Information

Majority of projects are sanctioned for duration of three years. The studies which are on-going in the last year of the 10<sup>th</sup> Plan would be in various phases progress and is expected that by the second year of the 11<sup>th</sup> Plan almost all would be completed.

### **ONE TIME-UPGRADATION PACKAGE (Rs.409.28 Cr)**

#### *Infrastructure Upgradation*

The Performance Appraisal Board had observed that the ICMR needs to be modernized and restructured if it is to be at the forefront of health research. The infrastructure needs of the ICMR have been examined in the context of modernization and up-gradation especially at the level of the institutes. To achieve this modernization plan has been developed after assessing the current infrastructure and outlining the future needs. This is resonant with the projected activities of the ICMR over the next Plan period. To cater to the needs for immediate future a modernization package has been developed for a one-time grant of Rs.300 crores. (*Details may be seen in Annex-2*)

#### *Staff requirements*

Current recruitment policies of the ICMR preclude staffing changes that will be conducive to the conduct of research at the cutting edge of science. A

recruitment policy would be developed to attract and retain the right caliber of staff to meet the country's evolving needs. The aim would be to create an enabling environment to employ highly qualified staff to deliver outstanding results. The career opportunities would be made more attractive not only for current employees but also for scientists abroad. It would be necessary to restructure the compensation package offered to scientists to very generous levels by adopting an aggressive approach. At the minimum, the pay structure would be on par with those of other S&T organizations in the country such as the CSIR and DBT, including introduction of appropriate number of positions at Scientist G and H levels. To retain distinguished scientists a scale of Rs. 26,000 has been planned. Similarly, the career opportunities and compensation packages of technical staff would also be reexamined. Separate documents have been prepared and these issues are already under consideration of the Ministry of Health. *(Details may be seen in Annex-3)*

### **Priority Areas of Health Research**

#### **Good governance of health research**

The ICMR would promote and provide guidelines on research governance issues, including good research practice, ethics and scientific probity. Thinking has to be reviewed within a continuously developing social and legislative context, and must respond to the moral and ethical questions that new scientific developments sometimes raise. One of the important tenants of good governance of health research is to promote the use of best available scientific evidence and results of research. The knowledge must be leveraged effectively to achieve better health. The generation, sharing and management of knowledge are necessary for its effective application. The ICMR would give high priority to knowledge management. Consensus would be achieved through a continuing dialogue with the public, users of health research, government, industry, the funding agencies, scientists and health service professionals. The ICMR would take a lead in ensuring accreditation of certain facilities like the IVF clinics, research centres and clinics, stem cell research and therapy, clinical trial centres etc.

#### **ICMR's Health Research Policy**

A clearly defined Health Research Policy on the lines of Science & Technology Policy is the basis for maximising the return on investment in health research.

This policy would aim to generate the evidence-base for Health Systems and Services, so that they will be significant promoters of equity and contribute to National Development; establish linkages between health research and national health programs to facilitate the operationalisation of evidence based programs and to obtain feedback for the optimisation of Health Research; encourage the development of fundamental research in areas relevant to health to ensure that a national critical mass of scientists who can contribute the benefits of modern technology to health research is developed. The proposed Policy would also ensure that the optimum benefits of modern technology are harnessed to promote national health;

build and integrate capacity for research in National Health Programs, research institutions and in the private sector (profit and non-profit organisations) utilising as far as possible areas of excellence already available in the country. The Policy would facilitate optimal use of information, communication and networking technology to ensure that the global knowledge base is available for national programs, and that research is channelled in relevant directions without unnecessary duplication; manage global resources and transactional collaborations optimally to ensure that collaborative health research primarily facilitates the development of national health systems and services. It would also ensure that health research is truly intersectoral and can harness the resources in areas such as social sciences, economics and traditional systems of medicine; optimum harmonisation of National Policies is essential to facilitate intersectoral collaboration and partnership, so that maximum developmental returns can occur from health research.

### **Health Research System**

Health Research in the country would be developed into a Health Research System (HRS) wherein all research agencies, cutting across ministries and sectors identify priority areas of research and coordinate with each other to avoid duplication, fragmentation, redundancy and gaps in knowledge, in order to enable the results of research to transform health as a major driving force for development. The HRS would generate and communicate knowledge that helps to form the national health plan and guides its implementation, and thus contributes, directly or indirectly, to equitable health development in the country; adapt and apply knowledge generated elsewhere to national health development; and contribute to the global knowledge base on issues relevant to the country.

### **Health Systems Research**

A high priority would be accorded to support health systems research to generate the evidence for health policy to enable informed decisions for improved health service delivery. This would include assessing health needs of the country, the availability, acceptability and accessibility of health interventions, health technology assessments such as cost effectiveness of interventions, the tracking of resources for health (including for health research) as part of the National Health Accounts, the availability and means of financing of health interventions. An interdisciplinary team would be set up to identify priorities for health systems research.

Recent studies of the economic impact of health research suggest that the health and wealth dividends from investment in research far outweigh the costs of the research. In partnership with other organizations, new concepts of both financial and non-financial benefits should be applied in the Indian context, to help build the evidence base and give a clear picture of the broad-ranging impact of health research.

Research which focuses on improving the health status of vulnerable populations, particularly Indians living in poverty; residents of rural areas; tribal populations; immigrants and refugees; people facing gender



inequities; the homeless; children; the elderly; the disabled and chronically ill; and victims of violence; on improving access to effective delivery of health services for these vulnerable populations would be supported. Research that emphasizes the following would be encouraged:

- access to and equity in health services for vulnerable populations;
- biological, social, economic, cultural, and structural/environmental factors that influence vulnerability and disparities;
- identification, description and analyses of health disparities at the population level;
- Intervention research that informs the development of responsive programmes, policies, and practices.

Research would also be supported on how social disadvantage is mediated by and interacts with other determinants of inequality, including poverty, social cohesion, gender and ethnicity, and how such factors influence health. There is a continued need for research that will help to develop and evaluate ways to reduce social and health inequalities and to inform public health and social policy. A particular priority would be on the impact of inequalities on women and children, rural populations, those belonging to underprivileged sections of society (like the SC, ST, and the OBC) their development and their long-term health.

The health systems research is a multi-disciplinary social science, public health and policy research. There is a need to recognize (a) contribution of the social scientists and public health specialists in the research; (b) involve health system researchers before undertaking biomedical research and clinical trials to ensure that there would be possibility of such research reaching to the people of the country and would not become only preserve of few; and (c) sponsor multi-disciplinary intervention research to understand how the system can be improved and the new biomedical research could be disseminated.

Priority areas for the health systems research include:

- Intervention research for seeking evidence useful for policy making
- Creating good evidence based on impact of public-private partnerships on the public health services, and whether they really bring about the equity in health access.
- Studies on health insurance
- Urban health
- Violence and health care in conflict situations
- Health care in disaster situation
- Gender and health
- Studies on the use and misuse of medical technologies: While more and more health care technologies are being introduced in health care services, particularly in private sector, there is very little research on their relevance or appropriateness, misuse and irrational use, the additional financial burden on the users due to misuse etc. Such studies should cover prescription practices to the new medical

technologies such as genetics, assisted reproduction, life prolonging technologies, organ donation and transplantations etc.

### **Strengthening health research in medical colleges and other institutes**

The ICMR, as a major funding agency of health research, would commit itself to strengthen India's health research communities by broadening, deepening and sustaining health research excellence. A skillful cadre of researchers working in state-of-the-art facilities with adequate and appropriate equipments and committed trainees, is the best strategy to ensure that India has the capacity and expertise to address important health issues.

The best ideas of the researchers across the full spectrum of health research should be funded allowing them to pursue their own creative ideas for novel and significant research projects. At the same time, build on this foundation of research excellence through targeted research investments focused on emerging opportunities and challenges. The ICMR would invest in strategic research initiatives designed to take advantage of new knowledge flowing from scientific progress, and to respond to the challenge of the health research priorities.

The convergence of disciplines would be encouraged that underlie the most exciting and important discoveries in health research, and to resolve ever-more complex health problems. Thus, the support for multidisciplinary and multi-sectoral teams of researchers as well as individual researchers working in medical colleges, universities and research institutes would be increased.

The right balance and mix of health researchers would be supported to realize its mandate and strategic objectives. The ICMR would continue to reach out through its extramural research programs and activities to those research communities that can contribute to health research. New investigators bring new ideas and ways of thinking and the energy of youth to health research. The ICMR would explore mechanisms to attract and encourage new investigators to establish themselves in health research.

Attracting and mentoring the young to the exciting, relevant and important career in health research is key to ensuring the strength and vitality of India's health research system in the coming decades. This would involve creating a critical number of health researcher and positions in medical colleges. The ICMR would develop, in partnership with relevant stakeholders, a national initiative that reaches out to young students. Progress in research requires that the best researchers should be supported, work in stimulating and supportive environments. It may be necessary to set-up new departments like that of molecular medicine in medical institutes. Research would be given top priority in medical education. In consultation with the Medical Council of India, a formal programme of medical research would be introduced in undergraduate and postgraduate level curriculum. Research would be made a core requirement for career advancement. To encourage research an appropriate infrastructure would be put in place to reward researchers. This would require a substantial allocation of funds. As

recommended by the PAB of ICMR, the allocation for the extramural research programme is being stepped up in phases to reach about 50% of the research budget by the end of the 11<sup>th</sup> Plan period.

### **Creation of an independent Division at the ICMR Hqrs. for promoting Extramural Research**

In view of the proposed expansion of extramural research programme within ICMR, it would be essential to establish a new Division.

The Division of Extramural Research (DER) would serve as the focal point for policies and guidelines for extramural research grants administration. It would have primary responsibility for the development and implementation of ICMR Grants Policy, monitoring of compliance with ICMR's policy on Humane Use and Care of Laboratory Animals, coordination of program guidelines, and development and maintenance of the information systems for grants administration.

The staff would have expertise in the complete range of issues associated with the programme, funds management, and review. The staff would be knowledgeable about ICMR's policies for data sharing, clinical research and clinical trials including policies related to data and safety monitoring and protection of human subjects, and bioethics.

The Division would also coordinate communications with the extramural research communities. For example, the ICMR Guide for Extramural Research Program Announcements, and Requests for Application.

### **Strengthening ICMR Networks**

Undoubtedly, there are areas that have enormous potential in upstream research markets and need to be exploited utilizing both the vast geographical reach and the pool of talent available within the ICMR. In order to gainfully exploit these emerging areas in a sustainable fashion the ICMR proposes to launch network projects. The focus is on adding value through sharing of resources and the expertise of individual institutes in multi-disciplinary projects. These projects have been developed recognizing the potential of ICMR to make significant contributions in these areas. Some examples of proposed networks are

- ICMR Schools of Public Health (details are given in section on new institutes),
- Virology laboratories,
- Public Health laboratories,
- Reference Laboratories,
- Epidemiological and virological surveillance for measles, influenza, rota virus,
- Drug resistance,
- Tuberculosis Network,
- HIV Network and
- Vector borne diseases Network.

## Example of ICMR Network

### HIV Network

HIV infection was first detected in India in the commercial sex workers in Chennai. Subsequently ICMR took lead in setting up network of surveillance centers for HIV diagnosis. The data arising out of this network provided very valuable data that paved way of formulation of the National AIDS Control Programme. Simultaneously ICMR established an Institute solely devoted to research on HIV and AIDS, National AIDS Research Institute, in Pune in October 1992. This Institute carried out pioneering work in the descriptive epidemiology of HIV in STD clinic attendees. The Institute also established virology, immunology and microbiology laboratories. Besides NARI, other ICMR Institutes started HIV research in different areas. The National Institute of Cholera and Enteric Diseases conducted epidemiological and virological studies to unravel IVDU driven HIV epidemic in the North Eastern state of Manipur. The Tuberculosis Research Center too initiated studies in HIV and described higher risk of developing pulmonary tuberculosis in HIV infected persons. Presently many ICMR Institutes are active in HIV research giving an opportunity to establish HIV network.

### Studies Taken up as a part of ICMR- HIV Network

#### *Integrated Behavioural and Biological Assessment: IBBA*

Five ICMR Institutes conducted this study with NARI coordinating the study. As a preparatory aspect Laboratory capacity building was carried out in two Institutes. Field experience of the Institutes was shared. The project has so far generated data on more than 20000 participants collected from different High risk populations from six high HIV prevalence states. This has resulted in the generation of repository of valuable samples and first field based prevalence and incidence data.

#### *HIV Vaccine Research*

- MVA Vaccine Trial
  - ▶ NARI isolated viruses and provided sequences
  - ▶ NICED was instrumental in preparing the vaccine construct
  - ▶ TRC conducted Phase I trial
  - ▶ Sharing of experience between NARI and TRC
- NARI conducted Phase I vaccine trial for AAV based HIV vaccine
- NIV Scientist prepared SFV vaccine construct

#### *Strengths of ICMR HIV Network*

- Country-wide reach
- Expertise in diverse areas
- Rich experience in Clinical Trials
- Institutes with strong basic science base
- Strong linkages with International Agencies such as IAVI, WHO, FHI and National Agencies such as DBT and NACO

*The different priority projects that ICMR HIV network is best placed to undertake*

- Tracking the epidemic: Estimation of HIV Disease burden, incidence estimates in different geographical locations and different risk groups
- Molecular epidemiology of HIV infection with special reference to surveillance for recombinant strains
- Multi-site clinical trials of HIV vaccines, microbicides and anti-retroviral therapies
- Studies in nutrition and HIV
- Role of traditional medicines
- HIV Database: There is need of a National data base on HIV infected persons. Such a database is required to obtain the information on the clinical presentation of HIV infection, disease progression, profile of opportunistic infections; treatment of HIV infected and drug resistance. This data base is vital for developing evidence based policies for HIV management
- Surveillance for HIV drug resistance mutations

*The Gaps in the Knowledge that the ICMR HIV network can address*

- In depth research on immunological aspects of HIV infection especially host genetics
- Development of new vector system for vaccine design
- Structure-function relationship of HIV proteins
- Newer intervention strategies including nutrition
- Designing of new antiretroviral drugs
- Cohorts of Long Term Non-Progressors
- Studies on acute primary HIV infection

There is need for strengthening of ICMR HIV Network with more interaction between the researchers of all ICMR Institutes through combined HIV SAC, establishment of platforms for continuing interaction. NARI with mandate to undertake HIV/AIDS research would form the nodal point of the network and ECD division would facilitate the network activities.

### **Emergency Outbreak / Disaster Response Fund**

A rapid outbreak/disaster response fund to strengthen ICMR's response to infectious disease outbreaks or a natural or man made disaster is proposed to be established. The Fund would ensure rapid mobilization of response. At times crucial days are lost in trying to mobilize funds for sending teams, purchase of diagnostics kits or reagents or vaccines or a piece of equipment. It becomes difficult to divert funds from already committed resources. Rapid detection, identification and response are key to saving lives. This delay could mean the difference between a limited number of affected population or a major epidemic with large casualties. Outbreak of plague in Surat and later Bhopal gas tragedy or the Gujarat earthquake or more recently the Tsunami waves. This Rs.25 crores revolving fund would remove the immediate financial barriers to an urgent response.

### **New emerging and re-emerging infectious diseases**

Research plays a critical role in dealing with emerging and re-emerging diseases. It could help to identify the agent, develop diagnostic tests,



formulate case management modules and preventive strategies. Knowledge needs to be generated through research and interpreted, evaluated and transferred to improve practices for prevention and control of emerging infectious diseases. Most research is incremental, building on existing knowledge to find useful advances. Entire range of emerging infectious diseases and factors influencing them need to be understood in the Indian perspective by understanding:

- ▶ *environmental factors* which facilitate emergence, maintenance and transmission of these diseases especially the vector borne and zoonotic infections;
- ▶ *evolution of pathogenic infectious agents* resulting in changes in infectivity, virulence, transmissibility and adaptations based upon identification of changes at molecular level especially in genetic composition of the organisms;
- ▶ *host factors* that facilitate emergence of infections and their spread include use of antimicrobial and immuno-suppression drugs and that of protective factors in a host;
- ▶ *social inequalities and behavioural factors* that influence distribution of emerging diseases, their course and populations that are affected most ; and
- ▶ *impact of environmental changes* and climatic variability on the emergence of microbes.

A chain of laboratories with appropriate levels of biosafety would be set-up so that new, exotic and dangerous organisms could be handled without posing threat to the scientists, technicians and the environment. This would be needed for animal studies and development of diagnostic tools which can support rapid and accurate diagnosis even in field conditions. To tackle this threat it would be necessary to enhance biomedical applications of new technology such as remote sensing and GIS to improve ability to predict future infectious diseases outbreaks; mathematical models that can facilitate transmission dynamics and vaccines and other interventional tools.

### Databases

In addition, to strengthen and expand the existing databases (like cancer registry, Rheumatic fever/Rheumatic heart disease registry, repositories of malaria parasites, viruses, HIV, cholera, nutritional status etc) new databases would be created. For example, evidence based decisions registries, morbidity and mortality data, prevalence of diseases, adverse drug reactions, clinical trial registry, genomic database, phenotype database, database of opportunistic infections in HIV, genetic disorders.

### Translational research

The ICMR would develop evidence-based medicine and healthcare by translating basic research outcomes into clinical evaluation and ultimately into health policy and practice in the national health systems. The ICMR would work with other research funders, industry and healthcare providers to develop a new initiative in clinical research. This will enable a better assessment of the impact of research and the outcomes for patients. Such

considerations will become integral to the research from the outset, and will ensure timely and effective implementation of new policy and practice.

Promising ideas for novel therapeutic interventions may encounter roadblocks in bench-to-bedside testing. While translation is sometimes facilitated by public-private partnerships, high-risk ideas or therapies for uncommon disorders frequently do not attract private sector investment. Where private sector capacity is limited or not available the ICMR would step in to bridge the gap between discovery and clinical testing so that more efficient translation of promising discoveries may take place.

The ICMR would launch an initiative to create a virtual entity to catalyze the development of translational science. This would be done through the network of its Institutes which can provide validation platforms (for diarrhoeal diseases: National Institute of Cholera and Enteric Diseases, Kolkata; viral diseases: National Institute of Virology, Pune; HIV/AIDS: National AIDS Research Institute, Pune; Malaria: National Institute of Malaria Research, Delhi etc.); expertise in various related issues like IPR, ethics, clinical research etc; products for blood and blood safety, cancer, emerging and re-emerging infections; and hubs of state-of-art laboratories.

### **In-country Partnerships**

Partnerships are integral to the health research. They are about shared vision, common objectives and alignment of priorities and programs. As the challenges facing health sciences have become more complex and multi-disciplinary, the need for organizations to pool resources and expertise becomes increasingly important. Partnerships would be designed to meet the needs of a jointly agreed initiative whilst respecting the autonomy of individual participants. By building partnerships amongst its stakeholders – those that have an interest and stake in health, the health system, and health research - ICMR will be better positioned to support stronger research initiatives that produce quality results more quickly for the benefit of Indians. Partnerships are critical in setting research agenda, share best practices in research, build research capacity, make more effective use of resources for research and eliminate redundancy in research activities and funding. Finally, partnerships are key to any successful knowledge translation strategy. The ongoing partnerships would be strengthened (like these with DBT, CSIR, CCRUS) and new ones would be established like these with ICAR, MCI, Department of space, Disaster Management Authority, DRDO etc.

### **Mission-mode Projects**

The ICMR has demonstrated leadership in several emerging areas of modern biology such as stem cell research and has clearly proven its abilities setting the research agenda in fields such as HIV research. In order to sustain its leadership and ensure impact in these areas the Council would undertake large scale mission projects akin to those seen in other sectors such as agriculture, atomic energy and aerospace. These mission projects would be identified with care taking into account ICMR's core competencies,

its comparative advantages, the strength of its national and international linkages and finally sustainability.

Planning and conduct of missions would be driven by a national core team and will also involve all key institutes and other partners. The institutes and regional medical research centres could provide necessary support for the successful conduct of the missions, including providing high-level participation, relevant technical input, depending on project needs and funding. The composition of the mission teams will ensure a skills mix that is appropriate to the project context, drawn from the Council and relevant partners.

Examples of Mission mode projects planned

- Capacity building for epidemic forecasting and investigations
- Diagnostics for viral diseases
- Stem cell research
- Development of predictive markers for diseases
- Use of Nanotechnology in health research
- Development of clinical trial sites

### **International collaborations**

As globalization increases, international collaborative research will also increase. The Council has played an important role in ensuring that exchange research in an ethically acceptable manner. Currently the Council is concentrating on bringing expertise and resources through foreign collaborations ultimately raising the standards of research to international levels. International collaborative health research must extend beyond clinical trials. The current limited approach does not allow ICMR to fully exploit the benefits of international collaborative efforts that include the sharing of international health experiences. The current mandate of the ICMR also limits it from carrying out research in foreign soil where it can utilize its expertise on common diseases.

The ICMR recognizes that the creation of new cutting-edge health knowledge and its translation into real world applications cannot take place in isolation. Without effective international cooperation there would be limited access to breakthrough scientific knowledge generated by researchers in other countries; the quality of the scientific knowledge generated locally would decline and; industries would not be able to obtain innovative technological information needed to maintain their competitive edge. The future of the health system depends on having a critical mass of health scientists with the international knowledge and intercultural skills necessary to meet globalization's challenges.

The ICMR is actively involved in governance of a number of international organizations whereby it can influence international science: for example it represents India in the TDR Joint Coordination Board, Board of Directors of Drugs for Neglected Diseases Initiative, Scientific Advisory Committee of Bill & Mellinda Gates Foundation.

One of the more significant achievements in the 10<sup>th</sup> Plan period has been expanded opportunities available for scientists to pursue their research interests through large number of international partnerships that have been forged. Earlier international collaborations have been solely aimed at strengthening research capacity of individuals and institutions and transfer of technology. Many of the new initiatives have been based on equal footings. Peer-level relationships and complimentary skills have produced synergism.

Recent interest in promoting private-public partnerships has led to the expansion of linkages between scientists in research institutions and pharmaceutical companies. These projects are aimed at accelerating the translation of research in to usable products through innovative partnerships, clinical trial of new drugs (like miltefosine) and vaccines (for example HPV) are classical examples of projects involving pharmaceutical companies.

Institution to institution collaboration involves long term linkages between two institutions, characterized by multidisciplinary involvement and providing opportunities for development of variety of projects, e.g. with University of Minnesota, USA and Helmholtz Association, Germany.

The linkages provide extraordinary opportunities and experience for scientists of both countries to enrich their skills. Some of these relationships have been very successful as shown by the productivity of the joint research projects and by the more confident, more competent and more self-reliant institutions that develop due to these linkages. The outcome is very much influenced by leadership in corresponding institution.

More recently, collaborations developed through international network or global consortium have also been encouraged. Groups of scientists having a common interest in a specific research area (e.g. diabetes) are brought together through these networks. They are helpful in providing access to scientific information, and data bases mutual support technical assistance.

Multi-centric studies have been used extensively in clinical research especially trials of new drugs (Labetolol in pre-eclampsia). Useful data is generated for international comparisons, looking for differences and similarities from which to generate and/or test hypotheses.

A number of outstanding ICMR Institutes have achieved international stature on the basis of their research and training capacity and (TRC & EVRC), several have also been identified as WHO Collaborating Centers.

International research collaboration presents health researchers with opportunities to share experiences, data and methods that can provide basis for new and important perspectives on existing practices.

In the 11<sup>th</sup> Plan period the ICMR would try to achieve high quality of international research through:

- building on opportunities provided by India;

- increasing the number of health researchers, especially from low and middle-income countries, who have received training in India and therefore have strong connections with the Indian health research community; and
- enhancing relations with established leaders in health research such as USA, Canada, France, Germany etc and building on the already close connection between health researchers from emerging leaders such as Brazil and South Africa

In recent years there has been an increasing number of new international partnerships in health research as organisations have come together to tackle some of the main scientific and medical issues of modern time. Initiatives would include partnerships with international research funders. National and international partnerships would be facilitated and nurtured in a variety of ways: through scientific workshops and meetings, bilateral interactions at agency level, and participation in consortia and other collaborations. Efforts would be made to

- encourage and foster International collaborations based on equal partnerships, with mutual technology transfer, wherever appropriate;
- steer international collaborative health research to ensure that the country derives maximum benefit and the global goals are attained;
- consider the possibility of extending resources and expertise to help other developing countries in their research efforts;
- generate more financial resources as additionality to core funding to be used in research from various international agencies like BMGF, global fund for its TB and Malaria IAVI, GAVI and others; and
- set up North-South and South-South Global partnership by enhancing India's role in international health and by becoming an innovator and motivator for neighboring countries. South-South interactions should be made seamless and sufficient funds should be allocated for the purpose.

### **Environment and Health**

Human health risk assessment is essential to provide a qualitative and quantitative characterization of the relationship between environmental exposures and effects observed in exposed individuals. Research to improve human health risk assessment is based on the assumption that major uncertainties in risk assessment can be reduced by understanding and elucidating the fundamental determinants of exposure and dose and the basic biological changes that follow exposure to pollutants leading to a toxic response. Research within this strategic theme will focus on three objectives

- including harmonizing human health risk assessments,
- predicting aggregate/ cumulative risk, and
- protecting populations.

ICMR's environment and human health research program will address disparate approaches for the risk assessment of cancer and noncancer health effects. This program will develop the scientific support for decisions concerning exposure to a pollutant by multiple routes of exposure or to



multiple pollutants having a similar mode or mechanism of action. The research efforts will focus on developing a scientific understanding of the biological basis for differing responsiveness of subpopulations within the general populations, including factors associated with their differential exposures. In addition it would also develop tools for evaluating the effectiveness of interventions resulting from risk management decisions.

### **Human Resources Development for Health Research**

The human resources capacity for health research is a measure of country's capacity and capability to effectively address to existing and emerging health concerns of the country. Further strengthening of efforts is required to bridge the existing gap in the availability of trained human resource in health research not only within India but also for the South Asia region and beyond. It is important to select appropriate analytical method that would best identify current and future needs. The policy goals should be laid down clearly in the order of priority. The strategies that will support their realizations would be identified.

The ICMR would formulate a HRD development plan which would focus on developing policies, procedures, and partnerships to ensure the competitiveness of Indian science in health research. Skilled and talented people are undoubtedly the most important resource for the delivery of high quality science and its translation for the public's health. There would be an organized and focused effort towards formulation of a long term comprehensive human resource development policy and plan to address wide range of related issues.

**Quantity.** For almost twenty years, many Institutes/Organizations in social sector like the ICMR have had a ban on creation of new positions which is continuing. Only openings available have been on superannuation or resignation of staff. It has not been possible to address cutting-edge areas of modern science adequately. Retraining and re-deployment has helped but not much. Consequently several Institutes of ICMR are sub-critically staffed. Many of them like the National AIDS Research Institute were created by transferring staff from other Institutes/Centres. These do not have a complement of staff that an institute would normally have. Even when their EFCs were approved, a very small number-disproportionate to the Institute's mandate – were approved at a much later date. The critical requirement has been carefully assessed and a proposal has been prepared for creation of an adequate number of new positions (500 scientists). The Performance Appraisal Board of ICMR has also recommended creations of these new scientific positions. The details are given in the Annex-3.

### **Strengthening research capacity**

The human resource and skills required for meeting the current demands and future challenges is abysmally low. In a population of a billion, only a very small number is engaged in health research. The ICMR plans to liberalize its policy of institutional fellowships like SRFs and RAs. These Fellows could be mentored by senior scientists. As happens in other

international research agencies, like the NIH, those who do good work could compete for regular positions as and when advertised.

ICMR already has a large number of schemes which are currently in operation like the ICMR Fellowship Programme for Sr. Research Fellow and Research Associate, Jr. Research Fellowship Programme in collaboration with PGIMER, Chandigarh, MD, Ph.D. programme in collaboration with Sanjay Gandhi Institute of Post-Graduate Institute, Lucknow. It supports Indian scientists (Jr. and Senior) for training abroad, as well as scientists from developing countries to come to India.

The ICMR also offers some regular training courses for example Super-Specialization (DM in Haematology); Post Graduate Courses (Masters in Applied Epidemiology; M.Sc. - Applied nutrition, Virology, Entomology; Diploma - Occupational Health; Certificate course (Nutrition). In addition short term training courses in nutrition, virology, animal sciences, epidemiologic technique, outbreak response, transfusion medicine, vector control, occupational health, genetics, ethics etc. are also offered.

### **Specific disciplines for human resource development**

One of the important areas in which there is an acute shortage of human resource is social scientists to work on social determinants of health. Social scientist would be able to bring a social science perspective to practice of medicine, making doctors socially responsible, sensitize them about the role of culture and social relationship in causing and treating disease. Well trained social scientists are needed who can undertake researches in an interdisciplinary perspective to contribute to the social science of medicine and health and assist in improving health people of the community. To make further progress in controlling major human diseases, initiatives would be launched to cultivate and train a cadre of clinical researchers with skills that match the increasing complexity and needs of the research enterprise. Some of the other areas in which human resource is needed include Epidemiology, Public Health; Clinical trials, Toxicology, animal technologies, GCP, GLP, Quality control and Quality assurance, Genomics and gene therapy, Bioinformatics, Health information technology, Geriatrics, Health economics, Socio-behavioural sciences, Bio-ethics, Biotechnology, Molecular Biology, Stem Cells research and stem cell therapy, Genetics, Drug Chemistry etc.

### **Investing in interventions with high cost-benefit ratio cost-effective interventions**

In a developing country like India, where a significant proportion of population is poor, a conscious decision has to be taken on the areas of investments in health research. It is important to keep in mind that key interventions that would yield the maximum improvements in population health outcomes should have the highest cost benefit ratio. According to a study, a worldwide demographic epidemiological advance between 1990 and 2020 would result in substantial decline in communicable diseases in importance among the poor and in relative terms, the significance of non-communicable disease would increase.

Modelling exercises have compared the impacts of interventions aimed at accelerated decline in communicable diseases with those targeting faster reduction in death and disability from non-communicable diseases. Such calculations indicate that an acceleration in overall progress against communicable diseases would bring about a significantly larger gain for the poor than would an acceleration of comparable magnitude achieved against non-communicable conditions. The additional 4.1 years of life expectancy that faster progress against communicable ailments would generate (compared to the base-line scenario) is almost 3 times as great as 1.4 year increase that faster decline in non-communicable diseases would produce.

### **Critical Infrastructure Protection**

Prior to the recent focus on bio-terrorist attacks, little thought has been given to the protection of critical health research infrastructure. Previously the only threat facing infrastructure came from natural disasters, and malfunctioning of appliances. To adequately address infrastructure protection an analytical process has to be implemented to identify vulnerabilities. As not all critical infrastructure can be protected from all threats appropriate risk management techniques would be used to determine relative duration, and the level of protective security. The facilities, systems and functions that comprise ICMR's critical infrastructure are highly complex and sophisticated. To mitigate these growing risks, the ICMR develop an effective preparedness, awareness and response strategy. At the moment none of the ICMR's permanent facilities are equipped to successfully handle a bioterrorist attack. As bioterrorism preparedness is expensive, the ICMR would need to set priorities for allocation of resources and the application of the best mitigation strategies.

### **Balanced Research portfolio for the 11<sup>th</sup> Plan**

The potential to improve human health in areas where the burden of disease is most significant should be encouraged. Health needs influence the decisions about what research to support. However, the right balance has to be struck between short-term 'pay-offs' and promoting the longer-term development of fundamental science that will in time lead to improvements in health.

A number of health priorities have been identified in which new research is especially needed and where India can expect to make an impact, both socially and economically, in the years ahead. These range from well-known and long-standing causes of death and debilitation such as tuberculosis, malaria, HIV, cancer and heart disease, to problems that are on the increase, such as obesity, diabetes and respiratory problems including asthma. Infectious diseases continue to be a challenge, for example with the emergence of problems such as severe acute respiratory syndrome (SARS) and the ability of well-known viruses such as influenza to emerge in newly dangerous forms.

The research to be undertaken and supported would be relevant to health and disease, and have equal emphasis on translational approaches at the basic/clinical interface.

The ICMR would be committed to a research agenda that recognizes that future improvements in health and well-being will depend on research that

- increases understanding of both the molecular and biological mechanisms underlying diseases as well as the psychosocial, economic and environmental determinants of health;
- supports efforts to develop new vaccines, diagnostic tools and cost-effective therapies;
- allows to understand and prevent the underlying social and behavioral causes of injuries and lifestyle diseases;
- links health with Science & Technology, engineering and related disciplines; and
- promotes healthy living and reduces risk behaviours.

There is a need to encourage harnessing of new knowledge of gene and gene functions, expand capacity for structural biology (structures of proteins and how different proteins interact). The complexity of the systems would demand development of bio-informatics as a major discipline. While fundamental and strategic research is critical, clinical research and translation of results of research into action would also be promoted. Clinical research capacity would be strengthened through training programme. To promote evidence-based decision making, the linkages with other health research agencies, academia and the industry would be strengthened.

The health research domains would be in accordance with the national health priorities, and address to known and emerging causes of morbidity and mortality

- *Communicable diseases*
  - ▶ New and emerging diseases
- *Non-communicable diseases*
  - ▶ Life style diseases (cardiovascular diseases, diabetes, injuries etc.)
  - ▶ Maternal and child health
  - ▶ Reproductive health
  - ▶ Nutritional problems
  - ▶ Micronutrients deficiency
  - ▶ Environment and health
  - ▶ Urbanization
  - ▶ Climate change
  - ▶ Occupational exposures
  - ▶ Health issues of under privileged sections of society and tribal populations

To tackle problems in these priority areas, research approaches at many levels are needed molecules, cells and tissues, animal models, whole organs and systems, individuals and populations.

The current level of knowledge provides exciting opportunities for multidisciplinary approaches. Many diseases have complex causes involving the interaction between genes and environmental factors, including, for

example, exposure to chemicals, physical effects such as ultra-violet radiation, socio-economic status and lifestyle factors including diet, smoking and use of alcohol.

Development and use of modern biology tools (for example the micro-array, cryo-electron microscope, X-ray crystallography, magnetic resonance spectroscopy etc) and disciplines (like structural biology, stem cell research, computational biology, nanotechnology, nano-medicine, bio-informatics, genomics and gene therapy) would be facilitated for a better understanding of the biology of health and disease and devise interventions. The wealth of knowledge in traditional systems of medicine would be tapped. Comparative therapeutic trials of traditional medicines with allopathic drugs would be undertaken.

Research is a dynamic process. Development of new technologies necessitates abandoning of old approaches and utilizing the new technologies for research. The ICMR's review mechanism also implies that while several priority areas have been identified for research, the actual funding depends on recommendations of different committees for specific extramural and intramural projects. To this extent therefore, the projects indicated give a general direction of our activities based on national priorities and current level of knowledge and new projects may have to be carried out depending upon need and urgency in the 11<sup>th</sup> Plan.

### **PROPOSED NEW INSTITUTES (Rs. 708 Cr)**

*Centre for Policy Research for Non Communicable Diseases, New Delhi  
(Rs.100 Cr)*

This Centre will target to systematically synthesize information relevant to comprehensive health care models and apply this knowledge in the Indian context. It would provide leadership in development and integration of policies and programs for prevention and control of non communicable diseases through partnership with relevant stakeholders at national level”.

The Centre for Policy Research for Non Communicable Disease will use innovative processes to obtain authoritative, objective and scientifically balanced answers to unique problems in NCDs in India and translate this knowledge effectively into products of healthcare system so as to improve the health of Indians. The Centre would *inter alia* identify the NCD research needs of the country and obtain new knowledge, knowledge translation into products and action, supporting and developing measures for integrated surveillance of NCDs, developing a mechanism for incorporating NCD prevention in health care system, building research capacity manpower in the country establish centers for molecular medicine and creating partnership between medical institutes and universities.



*National Centre for Cardiovascular Diseases, Diabetes and Stroke, Chandigarh (Rs. 100 Cr)*

This center will work out multi-pronged strategies to bring down the morbidity and mortality due to the cardiovascular diseases, diabetes and stroke, thus making a significant dent in the emerging epidemic in the region. The Centre will support research efforts to promote new discoveries and enhance scientific progress through support of cutting edge basic and clinical research related to cardiovascular diseases, diabetes and stroke, with a goal of rapidly translating research findings into novel strategies for prevention, treatment and cure of these diseases.

The Centre would among other objectives help to generate new knowledge by stimulating and sustaining interdisciplinary research for resolving complex issues in CVDs, diabetes and stroke, to undertake research activities which accelerate the translation of health research into action develop national clinical guidelines for prevention, management and control of CVDs, diabetes and stroke, create database of information on cardiovascular diseases, diabetes and stroke so as to act as national referral centre for these diseases. The Centre would be located at Chandigarh.

*National Center for Disease Informatics and Research, Bangalore (Rs. 65 Cr)*

This Centre would be set-up by upgrading the existing Coordinating Unit of the National Cancer Registry Programme at Bangalore. The proposed center besides working on collection and analysis of data on cancer would also work on establishment and running of registries related to diabetes, cardiovascular diseases and stroke. The data thus collected is expected to help in evaluation of control activities in the concerned areas. This would also provide a base for undertaking multi-disciplinary and multi-centric research projects. Surveillance programmes would also be supported by the activities of the Centre.

*ICMR Schools of Public Health (Rs. 84 Cr)*

For decision making in public health reliable data and information is often not available. Even if data and information is available, to use these effectively would require analytical skills which may not be readily available within the health system. There is an urgent need to enhance this very limited capacity in India for strengthening research and policy development in public health. To meet this demand trained human resources in the precept and practice of public health will have to be developed. The Government of India plans to raise public health specialists through establishing, initially two Schools of Public Health through the aegis of the Public Health Foundation of India. The ICMR plans to supplement this effort by setting up a chain of Schools of Public Health.

The National Institute of Epidemiology, Chennai would provide the core support to the regional institutions to be developed at National Institute of Cholera & Enteric Diseases, Kolkata, Post-Graduate Institute of Medical Education & Research, Chandigarh and the National Institute of Virology and National AIDS Research Institute, Pune. These would offer specialized training facilities in partnership with other medical colleges and research

institutes. Several international schools of public health have also agreed to partner in this effort (like School of Public Health, Boston, Swiss Institute of Tropical Diseases, Minnesota School of Public Health, and Aberdeen University).

*National Animal Resource Facility for Biomedical Research, Hyderabad  
(Rs.259 Cr)*

For combating the health challenges posed by persisting and emerging diseases, intervention tools like drugs and vaccine would be needed. It is essential that they are evaluated for their safety, efficacy and toxicity in animal studies. Such studies it is required by law to use animals of defined quality, of genetic and disease free status in order to obtain reliable and reproducible results. Currently there is neither a private centre nor any large breeding facility in the country which can supply quality animals. It is proposed to fill this gap by setting up National Animal Resource Facility for Biomedical Research at Genome Valley, Hyderabad. This would be a major central animal facilities for large, small, transgenic animals within the health systems. There is hence, a great demand of such animals and facilities in the country.

*Institute for Research on Ageing, Hyderabad (Rs.100 Cr)*

India will have a population of 137 million older persons in year 2020 as per estimates by the Registrar General of India (SRS-1991). The older persons face physical, psychological, social and economic difficulties due to various factors. They develop degenerative disorders such as those related to joint and cario-vascular systems, suffer from mental health problems, visual and hearing impairments etc. This has direct implications for the health and social service sectors, which need to be augmented to take care of these health concerns as the population ages. India has a National Policy on Older Persons, not though much headway ha been made. Concentrated efforts have not been made to study the process of ageing, as well as the various healths, psychological and other related issues. This needs institutional set-up with proper infrastructure. Therefore, an Institute for Research on Ageing (IRA) is required to undertake multi-disciplinary studies. This multi-specialty centre would address various research areas like epidemiology, morbidity profile, health care management, nutritional assessment, drug metabolism, molecular biology, neurobiology, socio-psychology and studies on health systems research would be addressed. The Institute would encompass health, socio-behavioural, and rehabilitation areas.

### **Budget Requirement**

The ICMR's PAB has observed that the funding for medical research in the country continues to be abysmal and is ridiculously low. India should be spending a great deal more on medical research if it hopes to even touch the fringes of medical problems which face the country. As prescribed in the National Health Policy, the Government must keep its commitment of increasing the funds for medical research to 1% of its health expenditure by 2005 and 2% by 2010.

Medical research is an interdisciplinary, multi-agency effort involving the government, academic institutions, and the private sector, and requiring progress in many diverse fields of science to succeed. Medical research competes annually with other worthy domestic spending priorities for its share of our national budget. Medical research is the responsibility of the national government, and one in which the government is uniquely positioned to take the lead. The health research is to a large extent funded by the Govt. of India through Ministry of health, the funding for health research depends on health budget, which itself is meager in the national budget. The current level of funding for health research is grossly inadequate. Ideally, spending on health research should be at least 2% of the total spending. The ICMR has been able to increase its funding in last 4-5 years and utilized the same fruitfully. However, the funds available are about one third of the demand (allocation of Rs.970 crores as against requirement of Rs.2500 crores for the 10<sup>th</sup> Plan period). The ICMR and its Institutes have demonstrated ability to attract funds from the Government and other funding agencies both in India and abroad. In addition, the Council has demonstrated abilities to expend the allocated finances in a timely fashion reflective of good project management practices. However, the Council needs significant large infusion of funds to undertake large scale expansion and embark on mission mode projects.

### **Specific Research Programmes**

#### **INTRAMURAL (Rs. 1566.02 Cr)**

#### **Communicable Diseases**

##### **Tuberculosis**

##### **Major Institutes**

1. *Tuberculosis Research Centre, Chennai*
2. *Central JALMA Institute for Leprosy and other Mycobacterial Diseases, Agra*
3. *Regional Medical Research Centre for Tribals, Jabalpur*
4. *Desert Medical Research Centre, Dibrugarh*
5. *Regional Medical Research Centre, Jodhpur*

##### **Basic**

- The elucidation of the genome sequence of *M. tuberculosis* for detailed information on every gene/antigen that might be considered for inclusion as diagnostic/vaccine candidate.
- Definition of a series of functionally distinct T cell subsets will provide newer insights into the processes that regulate tuberculosis pathology together with the insights and technical advantages by the new genomics will provide unprecedented new opportunities for development of tuberculosis vaccine candidates.
- Recent proteomic studies have identified several targets crucial for bacterial survival *in vivo*. These make them potentially attractive drug targets. Such studies will continue.
- Molecular epidemiology studies utilizing newer tools generated by the rapidly expanding horizons of genomics will be taken up for

understanding transmission dynamics of the disease. This would require extensive use of computational graphics and micro array studies.

- Developing DNA chips for understanding molecular epidemiology and genomic diversity in *M.tuberculosis* and other mycobacteria.
- Identification and characterization of antigens of *M. tuberculosis* involved in the immune response in TB and HIV-TB using a proteomics based approach
- Immunogenetics and immune responses in TB and HIV-TB and immunogenetic studies in pulmonary and extrapulmonary forms of tuberculosis
- Functional genomics of *Mycobacterium tuberculosis*
- Development of diagnostics
  - phage genomics based diagnostics
  - antigen–antibody based TB diagnostics in HIV patients.
- Characterization of active anti-TB compounds and bioinformatics studies
- Rapid drug susceptibility tests
- Studies on latent tuberculosis
- Studies on in-vivo gene expression of mycobacterium involving investigation of expression of different candidate genes of *M.tb.* and other mycobacteria.

### Clinical

To undertake clinical trials while adhering to international guidelines for good clinical practices (GCP) good laboratory practices (GLP) as well as guidelines for ethical conduct of biomedical research.

- Clinical trials for shortening treatment using of TB newer drug molecules
- Trials for treatment of multi-drug resistant TB
- Phase I and II trials for new TB vaccines and drugs
- Therapeutic trials in bone TB

### Social Sciences

- Sociological and behavioral research addressing the role of gender, stigma and other factors in TB
- Socio-economic aspects of TB, TB/HIV

### Epidemiology

- Monitoring the impact of DOTS to assess the effect of interventions (DOTS or modified regimens) on the transmission dynamics of different types of strains
- Estimating the burden of Tuberculosis and co-infections and their impact on endemic communities
- Exploring the links between poverty and mycobacterial diseases and identifying strategies to improve access and maximizing benefits for the poor
- Development and evaluation of rapid assessment methods for the detection of infection and disease
- Evaluation of TB control programmes

## HIV & TB

- Randomized clinical trials for treatment and prevention of tuberculosis in HIV-infected persons
- Anti-retroviral treatment trials
- Phase I and II trials of candidate HIV vaccines
- HIV drug resistance surveillance and monitoring
- Behavioral studies on patients with HIV TB

## Operational

- Continue to refine current tools used in the control programme by identifying and removing road blocks to their effective implementation
- Assess the current performance of current tools and suggest ways of improving their usage and also provide quality assurance for the programme
- Explore ways of promoting public-private partnerships for tuberculosis control.
- Plan for the future –TB control (Maximizing efficiency of RNTCP)
- Studies on extra pulmonary TB
- Methods of integration of HIV and TB control programs
- Operational research to determine factors that impact on TB treatment completion and cure rates and best practices for delivering treatment

## Infrastructure Development

- The TRC has a satellite unit at Madurai for the conduct of its clinical trials. It is now proposed to expand this facility by building a new 2 story clinical care and research facility that will be extensions of the existing building.
- Research facility at Tiruvallur to support rural health oriented studies
- Establishment of Center for Excellence in mycobacterial Taxonomy Studies

## Leprosy

### Major Institutes

1. *Central JALMA Institute for Leprosy and other Mycobacterial Diseases, Agra*
2. *National Institute of Epidemiology, Chennai*

## Basic

### Clinicopathological studies

- Ultrastructural study of leprosy granuloma and blood vessels using immunoelectron-microscopy and molecular methods for better understanding of disease process .
- Molecular mechanisms of relationship between hormone levels and progression of disease in women, to understand the molecular and biochemical basis of changes induced by hormones resulting in progressions of disease.



- Phenotypic and functional studies of cell transitions in pathogenesis of mycobacterial diseases by investigating changes using conventional and molecular techniques.
- Studies on persisting antigens to understand the major problem of post-treatment disease activity in leprosy by looking into any persisting specific or polyclonal mycobacterial antigens in local tissues.

#### **Immunological studies**

- Profile of supply variants of cytokines in the lesion/peripheral blood of tuberculosis and leprosy patients to understand their importance and protection/pathogenesis of these infections.
- Case control association study of candidate gene polymorphism in tuberculosis to understand the role of functional polymorphism in different non-MHC genes in conferring risk to tuberculosis infection.
- T-cell signaling mechanism in tuberculosis to study the pathways of cell activation in T-cells/mononuclear cells involved in the suppression of immune response in tuberculosis patients.
- Studies towards better understanding of pathogenesis of leprosy and tuberculosis using different markers using variety of immune markers like autocytokine antibodies, anti-mycobacterial antibodies and complement system.

#### **Studies in experimental animals**

- Mechanisms for evolution of granuloma in experimental animals by using genomic and other molecular approaches and understand the different effect of intervention.

#### **Molecular mechanisms of drug resistance/persistence/virulence etc.**

- To study the mechanisms of biofilm formation and analyze their importance in pathogenesis as well as drug resistance.
- Genomic approaches for better understanding of mechanisms of pathogenicity and drug resistance in mycobacteria.

#### **Biochemical aspects**

- Drug permeability: Efflux/influx mechanisms and pharmacokinetics to understand the mechanisms of permeability of new generation antimycobacterial compounds and their pharmacokinetics *in-vitro* and *in-vivo*.
- Analysis of mechanisms of drug resistance in mycobacteria by proteomic approach. To unravel these novel mechanisms/new novel targets for anti-microbial drugs and for vaccine development.

#### **Applied**

##### **Therapeutic trials**

- Investigations on the possible prophylactic role of corticosteroids in the prevention of Type-1 reactions and nerve function impairment in different risk groups
- Study of the role of immunotherapy in female leprosy cases.

- Study on uniform MDT regimen for all types of leprosy patients to assess its efficacy and effectiveness.

### **Behavioral studies**

- Social and behavioral studies to understand different social aspects (stigma, attitudes etc.) of society as well as patients in the changing scenario of leprosy after its integration.

### **Epidemiological studies**

- Establish a model rural health centre to assess different health indicators like prevalence and types of leprosy, TB, filarial and other infections and effect of interventions.
- Association of leprosy with tuberculosis and other disease in pediatric age group.
- Examine feasibility of leprosy surveillance through IDSP.
- Assess leprosy trends in Bihar, Tamil Nadu and Andhra Pradesh.
- Evaluation of diagnostic tests for Leprosy.
- Use of qualitative methods for monitoring Leprosy elimination programme.
- Simplifying simulation model developed for leprosy (SIMLEP) to make it more user friendly for use of programme managers.

## **Public Health & Epidemiology**

### **Major Institute**

1. *National Institute of Epidemiology, Chennai*

### **Epidemiology and Public Health**

- Setting up of ICMR Schools of Public Health to create public health trained manpower for different regions of the country, link public health laboratories with public health institutes and develop network of public health institutes for rapid action, and support surveillance programmes, epidemic alerts and response.
- Field Epidemiology Training Programme (FETP) – The two year Masters in Applied Epidemiology – FETP will continue in the Eleventh Plan. This has been found useful by State Governments departments of public health who have sponsored candidates.
- Ph.D programme in epidemiology – This has been recognized by University of Madras.
- Short Courses/Workshops on field epidemiology, basic epidemiology and epidemic preparedness and response, neuro epidemiology, application of selected statistical techniques in epidemiological studies.
- Strengthening field epidemiology services in North-Eastern States of India and to develop capacity in integrated disease surveillance at State and district level.
- Short and long term course in cultural epidemiology to strengthen capacity of public health professionals epidemiologists and social scientists in cultural epidemiology.

- Networking of institutions involved in epidemiology research to develop a broad base of expertise and faculty members to meet specific training requirements in epidemiology in different areas.
- Networking with medical colleges for capacity building through training of trainers.
- Establishment of public health laboratory as a training centre and networking with other public health laboratories.
- Community based and industrial studies on cardiovascular disease.
- HIV/AIDS cohort studies and prevention trials.
- Disease burden estimation to generate data on disease burden in different parts of the country.
- Establishment of clinical trials centre.

## **Biostatistics**

### **Major Institute**

1. National Institute of Medical Statistics, New Delhi

### **Basic**

- Statistical Techniques in Clinical Trials and Epidemiology
- Health and Demographic Transitions
- Multilevel modeling
- Studies on disease burden

### **Applied/Bio-Statistical Inference**

- Experimental and analytical epidemiology
- Reproductive and child health
- Biometry and population research
- Survival analysis and competing risk modeling
- Estimation and analysis of HIV/AIDS in India
- Time series analysis
- Meta analysis
- Multivariate analysis
- Psychometrics
- Medical anthropology and nutrition

### **Operational/Survey Methodologies and Training**

- Disease surveillance
- Health Education and Health Policy Research
- Studies on unmet need of RCH Care and facilities
- Studies on un-served and underserved populations
- Survey Methodologies in Medical and health Research
- Health Economics
- Health Information System

## Diarrhoeal Diseases

### Major Institutes

1. National Institute of Cholera and Enteric Diseases, Kolkata
2. Regional Medical Research Centre, Bhubneswar and Dibrugarh

### Basic

- Molecular studies on rational drug targeting and designing in diarrheagenic parasites.
- Research towards the development of vaccines against i) *V.cholerae* O1, O139, ii) *S. dysenteriae* type 1, iii) *S.flexneri* and iv) HIV, v) Rotavirus, vi) ETEC.
- Studies on molecular pathogenesis of cholera toxin gene negative *V.cholerae* O1 and *V.cholerae* non-O1, non-O139 strain
- Enhancement of research on typhoid fever, *Helicobacter pylori* infection.
- Immunological, genetic and biochemical studies leading to better understanding of immune mechanisms of enteric infections and development of candidate vaccine(s).
- Development of new animal models for diarrheal diseases
- Molecular typing of rotavirus infection in human and its molecular polymorphic dynamism in Orissa
- Molecular and epidemiological characterization of opportunistic enteric pathogens special by *Cryptosporidium* and *Giardia lamblia*
- Molecular characterization of pathogenic *E. coli* and *Shigella* species related to acute diarrhoea among the children in Orissa
- Role of Enteroaggregative *E. coli* in diarrhoea

### Applied

- Establish a systematic surveillance system for enteric pathogens throughout India and to conduct molecular epidemiology of enteric pathogens like *V.cholerae*, *Salmonella* spp., *Shigella* spp., *E.coli*, *G.lamblia*, Rotavirus.
- Surveillance of multidrug resistant enteric pathogens and detection of drug resistance mechanisms since drug resistance poses challenges in the clinical management of diarrhea.
- The field trials for oral live attenuated human rotavirus vaccine.
- Development of simple, cost-effective diagnostic kits/reagents for rapid identification/differentiation of enteric pathogens using recombinant DNA and hybridoma technology
- Reorientation of clinical research with the facilities of gastroscopy, colonoscopy, sigmoidoscopy, autoanalyser, ultra-sonography etc.
- Facilities for intensive care for critically ill children.
- Role of and implementation strategies for micronutrients and vitamin supplementation for reduction of duration and prevention of diarrhoea and acute respiratory infections.
- Development of a highly effective superior oral rehydration solution. This study will help to overcome the disadvantages of standard WHO ORS
- Molecular diagnosis and surveillance of diarrheagenic parasites.
- Molecular epidemiological studies on viral diarrhoeas.

## Vector Borne Diseases

### General

- Population genetic studies to reveal the evolutionary trends in the species complexes and yield effective diagnostic tools towards characterization of different members of the species or strains.
- Studies on vector ecology to understand response of the vectors to the interventions in the National Programme, and to optimize control options,
- Molecular entomology: Genome mapping of vector species will allow identification of the relative role of vectors and their ecotypes and target the potential vectors for controlling the disease.
- Vector Management: Formulation of an integrated strategies strategy for control of VBDs for the National Programme and test them in different eco-epidemiological situations.
- Identification, development and evaluation of new bio-pesticides: in view of the challenge posed by vector resistance to insecticides and the environmental hazards due to insecticide use.
- Vector Surveillance for monitoring insecticide resistance in vectors and the mechanism involved .
- Host-parasite interaction: to understand the immunological and molecular basis of host parasite interaction for identifying novel targets towards development of insecticide for vector control and newer drugs for parasite control
- Establishment of Bioinformatics unit to store vast amount of data base generated on the genome of pathogens/parasites and vectors to derive leads for control of infections, prevent morbidity and pharmacogenetic approaches in chemotherapeutic control operations..
- Development of new vector products and formulations due to development of resistance in vectors to conventional organochlorine and organophosphorus insecticides and undue persistence of certain organochlorine insecticides in environment,
- Studies on development of analytical methods for pesticides and drugs for assuring quality in drugs and insecticide formulations used in operational programmes.
- Natural disaster-related risk assessment of VBDs
- Development of protocols for early advance warning system particularly the environmental based risk assessment
- Health information system for VBDs.
- Global changes in the environment and the climate several diseases are emerging/reemerging and therefore call for appropriate and timely investigation and measures for control of such outbreaks.
- Development and evaluation of community based interventions strategy for vector borne diseases.
- Health economics in relation to VBD, disease burden estimation VBD, development of molecular/immuno diagnostics for VBD, remote sensing and GIS for epidemiology and control of VBD and development, refinement and evaluation of disease surveillance tools.



## Entomology

- Field evaluation of a flowable formulation of *Pseudomonas fluorescence* against *Aedes aegypti*, *Culex quinquefasciatus* and *Culex tritaeniorhynchus*
- Taxonomic validation of sibling species under the *Anopheles culicifacies* complex, in accordance with the international code of zoological nomenclature.
- Role of dissolved oxygen in water in forming virus refractory proteins among mosquitoes
- Studies on the identification of species complexes/ geographic variants of mosquitoes using modern technologies and their role in disease transmission
- Molecular characterization of insecticide resistance among mosquito vector species for identification of gene responsible for resistance and its possible manipulation
- Identification of active principals of the plant extracts responsible for mosquitocidal properties
- Role of microbial agents in the control of important mosquito vectors in different rural and urban habitats
- Evaluation of the larvicidal potential and residual effectiveness of botanical insect growth regulators (IGRs) against mosquito vectors
- Faunal diversity and distributional pattern of the vectors of malaria and cutaneous leishmaniasis in western parts of the country, with special reference to desert ecosystem
- Control of vector mosquitoes using environmental management methods through community participation and inter-sectoral co-ordination.

## Malaria

### Major Institutes

1. National Institute of Malaria Research , Delhi
2. Regional Medical Research Centers, Bhubneswar
3. Regional Medical Research Centre for Tribals, Jabalpur
4. Desert Medical Research Centre, Jodhpur
5. Regional Medical Research Centre, Dibrugarh

### Basic

- To generate data on bio diversity of anophelines, geographic distribution of malaria vectors and anophelines to plan vector control activities.
- To identify new sibling species, develop appropriate methods for their identification-cytological, biochemical and molecular (PCR-based assay).
- Studies on the evolutionary pattern of genes conferring insecticide resistance to *An. culicifacies* .
- Mapping of drug resistance in India using molecular markers, genetic relatedness and gene flow between the samples of malaria parasites from different regions in India.
- Biological function and role in pathogenecity of rif / RIFIN genes of *P. falciparum* .

- ABCA1 gene and cerebral malaria: Role in pathogenesis relevance in genetic susceptibility.
- Molecular basis of G-6-PD deficiency in NE India and its correlation with malaria.
- Genetic/biochemical mechanisms of pyrethroid resistance in *Anopheles stephensi* strains.

#### Applied

- Develop district wise malaria risk maps based on environmental suitability.
- To forecast vector borne diseases. Based on remote sensing satellite data and environmental parameters.
- Factors affecting the efficacy of annually and long lasting insecticide treated nets against mosquitoes under laboratory conditions.
- Molecular epidemiology and basis of drug resistance in malaria in NE India.
- Effect of malaria on pregnancy .
- Studies on drug development including herbal products; pre-clinical studies and clinical trials.
- Phase 3 trials with combination therapy and artemisinin like synthetic drugs.

#### Operational

- Development and evaluation of malaria diagnostic kits including Rapid diagnostics.
- Research for implementation of blister packs; rapid diagnostics and combination therapy.
- Molecular mechanism for assessment of insecticide resistance.
- Testing and development of vector control tools using herbal, microbial and chemical products.
- Evaluation of long lasting insecticide impregnated nets, and new insecticides.
- Developing strategies for optimizing the accessibility and utilization of health care facilities offered by national malaria control programme in endemic areas.

#### *Extramural activities to be made permanent*

**IDVC Project :** The IDVC Project is a long term project since 1986, funded by ICMR and Ministry of Health. The project was approved by SFC for tenth plan period and presently being undertaken at 10 sites in the country. In view of need of the NVBDCP for continued support to local state governments in conducting situation analysis, monitoring of insecticide and drug resistance in malaria vectors and parasites and training of health personnel etc., it is proposed to make the IDVC project as intramural activity of NIMR for sustenance of the support to anti malaria programme.

**Malaria Parasite Bank:** Malaria Parasite Bank was started in the year 1992 and is serving as a National Resource Facility. More than 30 institutes/universities are using this facility for their research activities and

this number is going to go up when the facilities are further increased. Researchers from different institutes get trained in *in-vitro P.falciparum* culture techniques. Parasite Bank at present has 580 isolates, several hundreds of positive and negative sera, *P. vivax* isolates, animal malaria parasite strains etc.

Highly skilled staff order to cater the need of country ,dedicated staff to carry out the above specialized activities are required. In addition, they will provide technical support namely production of monoclonal antibodies, in vitro cultivation of erythrocytic and exo-erythrocytic stage *P.vivax*, characterization of *P.falciparum* isolates for their erythrocytes invasion and cytoadherence properties, screening plants extracts for anti parasitic properties.

## Lymphatic Filariasis (LF)

### Major Institutes

1. Vector Control Research Centre, Pondicherry
2. Regional Medical Research Centres, Bhubneswa, Jabalpur

### Basic

- Pharmacogenomic studies of anti-filarial drugs to study the variation in response to DEC treatment.
- Immunoprophylaxis studies on VBDs Control by immunoscreening of cDNA libraries and proteomics to determine the level of infection and immunity and identification appropriate antigens and genes.
- Studies on development of a potent and safe macrofilaricide drug.
- To study the role of *Wolbachia* in development of filarial parasite in mosquito vector.
- Study of host parasite interaction in natural course by longitudinal follow-up of children living in areas endemic for bancroftian filariasis.
- Role of host genetic/immunological factors in modulating the susceptibility to filariasis.
- Human bancroftian filariasis: Immune markers of morbidity in hydrocele and elephantiasis .
- Studies on regulatory T cells in human bancroftian filariasis.

### Applied

- Development of intervention (transmission / morbidity control) Strategies: to supplement Mass Drug Administration with DEC towards Elimination of Lymphatic Filariasis (ELF) presuming that 5 rounds of MDA may not be adequate to reach the level of elimination.
- Evolve cost effective monitoring strategies for ELF programme evaluation .
- In-depth epidemiological studies to assess the prospects of ELF.
- Effectiveness, cost and feasibility of Morbidity management of LF at community level, its cost for the patients and operational feasibility are needed for large scale implementation of the programme.

- Cost effectiveness / cost benefit analysis of intervention measures towards ELF.
- Clinical trials: to develop new potential drugs and vaccines against parasites and to identify the efficacy of drug combinations. Three aspects viz. treatment schedules and optimization of case management for prevention of ADL and LF, and community based trials with morbidity management strategies are proposed.
- Decision making tools such as mathematical modeling on dynamics of infection and disease, dynamics of resurgence following interventions, prediction of the impact and cost-effectiveness of interventions are essential to select appropriate intervention tools and to assess the impact of the intervention against vector borne diseases.
- Evaluation of diagnostic tools for LF.
- Studies on co-infection of renal diseases, arthritis, and other common presentations of LF with the classical manifestations of LF and to understand dynamics of disease progression for disease management.
- Xenomonitoring of lymphatic filarial infection with *W. bancrofti* mosquito vectors using PCR assay in endemic villages of Tirukoilur, south India.
- Morbidity management of lymphatic filariasis in endemic villages of Tirukoilur, south India.
- Identification of the causative organism (bacterial/fungal) and their drug sensitivity in management of filarial lymphoedema with complications.
- Clinical trial with newer anti filarial drug like moxadectum and its adulticidal effect.
- Development of vector transmission indicators in impact assessment of MDA against filariasis.
- Transmission dynamics of filarial infection in tribes of Madhya Pradesh.
- Filariasis control in tea garden set up: working towards elimination.
- Measure spatial and temporal change in environmental conditions using GIS and remote sensing. Using the data on environmental parameters and disease prevalence/occurrence predictive models for forecasting are planned.

### Operational

- Rapid delimitation of areas for inclusion in or exclusion from MDA for ELF. This will be carried out in collaboration with the National programme Managers.
- Rapid response, epidemiological investigations in emergency and epidemic situation situations.
- Development of community strategy for morbidity management of filarial lymphoedema in filarial endemic communities.
- Development of guidelines for monitoring and evaluation of eliminating of lymphatic filariasis control programme.

## Visceral Leishmaniasis

### Major Institutes

1. Rajendra Memorial Research Institute of Medical Sciences, Patna
2. Institute of Pathology, New Delhi
3. Desert Medical Research Centre, Jodhpur

### Basic

- Characterization of immunological determinants involved in the pathogenesis of Leishmaniasis.
- Host genetic determinants responsible for susceptibility to leishmaniasis.
- Proteomics approach to determine molecules playing a role in pathogenesis of Kala-azar.
- HLA status in kala-azar.
- Use of microarray in study of role of TLR signaling and cell-cell adhesive interaction.
- Glomerular involvement in leishmanial infection.
- Coagulation factors in VL cases.
- Role of antioxidant (Glutathion) in SAG resistant amastigote macrophase model of visceral leishmaniasis.
- Analysis of mechanisms of drug resistance and pathogenecity in *Leishmania donovani* by genomic / microarray approach.
- Quantitative assessment of mutations by real-time PCR of genes encoding for resistance in leishmania.
- Cytokines profile and determination of frequencies and functional capacities of innate immune responding cells in *Leishmania donovani* infected and uninfected malnourished human beings.
- Mechanism of Lymphocyte cell death in leishmaniasis.
- Genomic microarray based identification of differentially expressed parasite genes in PKDL .
- Discovery of virulence-related genes in *Leishmania donovani* using genomic microrray.
- Characterization of circulatory and localized immune response in Indian Kala-azar (KA) and Post Kala-azar Dermal Leishmaniasis (PKDL) patients.
- Antigenicity and immunogenicity of 17kDA, 41kDa and 63kDA *L. donovani*: Implication for vaccine and diagnostic development.
- Role of cholesterol in the pathogenicity of visceral leishmaniasis.
- Studies to understand aetiopathology of PKDL lesions.
- Developing DNA chips for understanding the genomic diversity in *Leishmania donovani*.

### Applied

- Development of live attenuated vaccine against Kala-azar, using genetically modified *Leishmania*.
- Evaluation of potential of combinatorial therapy against Kala-azar and post kala-azar dermal leishmaniasis.
- Recombinant CD2 in treatment of kala-azar.
- Studies on leishmanicidal properties in Indian plants.



- Estimation of pentavalent antimony in SAG sensitive and resistant amastigote in macrophage model of visceral leishmaniasis of Bihar, India.
- A Phase 1 Double-Blind, Adjuvant and Placebo-controlled dose-escalating study to evaluate the safety, tolerability, and immunogenicity of the recombinant three-antigen *Leishmania* polyprotein Leish-111f when administered in three subcutaneous doses to healthy adults.
- Development of Immunological and Molecular Diagnostic Tests for Kala-azar and PKDL.
- Role of environmental toxicants especially heavy metals in sandy infertility.
- Toxicity, safety and efficacy study of traditional metallic preparation in management of KA.
- Epidemiological and Entomological studies on cutaneous leishmaniasis in district Bikaner.
- Drug sensitivity test of leishmania isolates from VL and PKDL cases.
- Studies on haemoglobinopathies in Bihar in relation to anemia in VL cases.
- Status of HIV-VL co-infected cases and its treatment in Bihar.
- Studies on follow up of clinical course of disease in kala-azar cases and their response to therapy: A quantitative approach.
- Quantitative assessment of parasitic load in VL and HIV-VL co-infected patients by real time PCR.

## **Viral Diseases**

### **Poliomyelitis**

#### **Major Institute**

1. *Enterovirus Research Centre, Mumbai*

#### **Basic**

- Designing Microarray for identification of Enterovirus types
  - Sequence analysis of Enterovirus genomes.
  - Identification of Enterovirus group specific (Polio, CAV, CBV, ECHO etc.) nucleotide sequences for probe designing.
  - Arranging Microarrays of increasing complexities for Enterovirus typing.
- Identification and characterization of cell receptors of Enterovirus 70
  - Identify EV70 receptor on LLCMK2 cells.
  - Study biochemical and biophysical characteristics of the receptor.
  - Purification of the receptor molecules.
- Enterovirus Pathogenesis.

#### **Applied**

- Application of real-time PCR assays for rapid diagnosis of poliovirus and Enterovirus infections.
  - Design, synthesize and test PCR primers and labeled probes for identification of wild poliovirus (indigenous genotypes), Sabin vaccine viruses and non-polio enteroviruses in real-time PCR assays.

- Eliminate post-PCR handling to reduce time and labor for reporting results.
- Incorporate the technology in Polio Eradication programme (AFP surveillance).
- Development of molecular methods for identification of vaccine derived polioviruses (VDPV)
  - Generate a large database of genome sequences poliovirus isolates of Sabin OPV origin.
  - Develop molecular probes for identifying mutations at specific site of VDPV.
  - Develop PCR primers to identify potential VDPV.
  - Application of Microarrays for one-step identification of VDPV.

### Operational

- Post-polio eradication vaccination policy
  - Evaluation of effectiveness of mOPV1 and mOPV3.
  - Post eradication scenarios: occurrence of VDPV.
  - Polio surveillance in post-eradication years.

### HIV/AIDS

#### Major Institutes

1. *National AIDS Research Institute, Pune*
2. *Tuberculosis Research Centre, Chennai,*
3. *National Institute of Cholera & Enteric Diseases, Kolkata*
4. *National Institute of Nutrition, Hyderabad*

### Basic

- Use of new technology, detuned assays that identify individuals who have acquired HIV infection recently is being proposed to assess HIV incidence and prevalence among the vulnerable sub-populations to understand dynamics of HIV infection.
- Up-gradation and expansion of virus repository and testing of candidate products for anti-HIV activity.

### Immuno-pathogenesis

- Understanding the host (genetic, innate immunity and adaptive immune response) and viral factors associated with HIV infection. Identification of such determinants would help in vaccine strategies as well as immunological intervention for slowing down the disease process.
- Develop HIV immunogens responsible for generating potent, sustained and broad innate, cellular and humoral responses.
- Development and in vitro testing of microbicide and limited pre-clinical studies on HIV vaccines.
- In depth studies on HIV-1 and HIV-2 interaction with host. The data generated may provide clues in understanding mechanisms associated with slower HIV-2 disease progression and help us design strategies for HIV-1 intervention.

- Understand factors that exacerbate HIV disease progression in patients co infected with TB. The study will help in management of HIV-TB co infected individuals.
- Characterization of HIV will be undertaken to understand viral pathogenesis of neurological complications. The results would help to design strategies for intervention in HIV-1 induced neurological complications and dementia.

### Applied

- Undertake disease burden study and also support NFHS III survey through HIV testing.
- Intensify the HIV subtype surveillance, in view of changing patterns in prevalence of these subtypes and emergence of recombinant viral strains which can potentially impact HIV vaccine development strategies in India.
- Intensify efforts to undertake drug trials by establishing a clinical trial center.
- Intensify efforts to identify herbal medicines that have anti-HIV activity that may lead to development of new drugs for management of HIV disease and development of vaginal microbicides to prevent acquisition of HIV infection.
- Further strengthen capacity to undertake vaccine trials.
- Establish a database of Indian HIV infections to obtain countrywide information of clinical aspects, laboratory parameters, treatment and management strategies used etc. therefore there is need to first network ICMR institutions and then expand to other institutes.
- Information on immune reconstitution after antiretroviral syndromes in the Indian context.
- Genomic diversity and emergence of recombinants of HIV-1.
- Clinical surveillance of opportunistic infections associated with HIV infection
- Surveillance of HIV infections among pediatrics population .
- Development of cohort of high risk groups for studying HIV vaccines and other relevant intervention.
- Study of drug resistance of anti-retroviral therapy (ART) and factors related to it.
- Studies on Liver disease in HIV infection.
- Clinical trials for vaccines and microbicides and other prevention strategies
  - Identify community needs and perceptions impacting acceptability of vaccine and microbicide interventions and Standardise strategies for communication and advocacy.
- Cohort studies and clinical trials in HIV infected adults and children: disease progression, co-infections and Opportunistic Infections (OI), Optimization of HIV and OI treatment strategies and ancillary applications
  - Optimization of treatment and care for HIV and Co-infections with special emphasis on HIV/TB.
  - Determinants of clinical progression of HIV in treated and untreated HIV infected adults and children might provide guidance on better clinical management and prophylaxis.

- Understanding neurological outcomes in HIV infected persons in the Indian context and appropriate interventions.
- Prevalence and incidence studies in ‘at-risk’ and vulnerable populations for site identification and preparation for potential prevention and interventional studies
  - Building capacity and infrastructure to carry out Clinical Trials in various parts of the country.
  - Estimations of Prevalence and Incidence would help in :
    - ▶ Development of appropriate intervention programs
    - ▶ Generation of baseline data for testing efficacy of future interventions
    - ▶ Aid in HIV Disease Burden Estimations
    - ▶ Understanding the impact of ongoing interventions.
- Establish HIV/AIDS database
  - A Central National Database: Pooling data generated through various resources and optimally utilize the nation’s clinical research and care efforts and create a National Information resource.
  - Periodic reports to guide health planning and policy.
  - Identification of trends in: clinical outcomes, treatment strategies, drug resistance mortality and morbidity.
  - Develop a database of Opportunistic Infections among HIV seropositive patients.
- Help in development of indigenous microbicide and therapeutic candidates.
- Complement research in traditional medicines in HIV in India.
- HIV/AIDS cohort studies and Prevention Trials.

### Operational

- Information on efficacy and effectiveness of the ongoing intervention programs.
- Study on negotiating skill of sex workers including cliental factors and their association with HIV; Community based surveillance of HIV among sex workers to understand HIV incidence among them and its trend.
- Study of operational issues in treatment and care programs.

### Behavioural Studies

- Observational and interventional studies in social and behavioural aspects of HIV prevention, care, community support, impact of HIV, and issues related to PLHA.
- Development of tools and interventions to assess and improve Quality of Life of HIV infected persons.
- Tools to assess and impact psycho-social stressors and coping mechanisms of HIV infected persons and designing appropriate interventions.
- Interventions to reduce stigma in various populations and program implementation.
- Identification of strategies for behaviour change and education of HIV prevention among women, children and adolescents.
- Develop behavioral models to enhance prevention efforts.

### Clinical Trial Center

NARI has undertaken many observational studies and clinical trials in the past 13 years. It is planning to undertake many new studies and clinical trials in the field of ART, Vaccines and Microbicides. At present there are 7 NARI clinics located in different areas of Pune that are working for screening, enrollments and follow up of study participants. They are scattered and patients have to move in different clinics for various procedures. The sample transfer to main NARI laboratory for various tests like HIV serology, CD4 count, viral load, drug resistance etc. also becomes difficult because the samples from all 7 clinics have to be collected. The transfer requires lot of transportation, temperature maintenance in the vehicles etc.

If there is a single clinical trial unit, with vaccine, microbicide and ART units under one roof it will be beneficial in following ways:

- a. Patient's convenience.
- b. Sample transfer will be very easy.
- c. The staff requirement will be less as management will be easy.
- d. Common facilities will be utilized by various clinical trials will be cost effective and efficient utilization of resources.

It is proposed to setup a clinic in the city area so that it will be convenient for the patients to approach for clinical care and diagnostic tests and will have capacity to undertake clinical trials. The clinical center will have sufficient floor space with state of the art facilities.

### Nutrition and HIV – AIDS

- Community based studies the co-existence of various micronutrient malnutrition in the HIV positive population, to follow individuals by monitoring the CD4 counts and identify the extent to which malnutrition may be contributing to the deterioration.
- Clinical studies into the response to ART *vis-a-vis* the nutritional status of patients or nutritional rehabilitation.
- ART induced lipodystrophies and their similarity with metabolic syndrome would be studied to undertake biochemical and molecular mechanisms involved in the drug induced redistribution of body fat.

### Other Viral Diseases

#### Major Institutes

1. *National Institute of Virology ,Pune*
2. *ICMR Virus Unit, Kolkata*
3. *Regional Medical Research Centre, Dibrugarh*
4. *Desert Medical Research Centre, Jodhpur*
5. *Microbial Containment Complex, Pune*

### Hepatitis

- In-vitro and in-vivo assessment of antivirals/immuno-modulants for hepatitis viruses.



- Clinical trials of hepatitis vaccines.
- Natural progression of carriers of Hepatitis – B and C virus infection among different risk groups - a cohort studies.
- Propagation of Hepatitis C Virus in tissue culture model for better therapeutic treatment against HCV.
- Cytokine gene polymorphism in Hepatitis.
- Identification of non-A to non-E agent(s).

### Japanese encephalitis

- Field evaluation of Neem (*Azadirachta indica*) leaves and neem cake for the control of Japanese encephalitis vectors in rice agro-ecosystem.
- Virological surveillance in mosquitoes in pre- and post Japanese encephalitis vaccine trial (SA-14-14-2).
- Geographic and genetic variation among the natural populations of *Cx. tritaeniorhynchus* and susceptibility to infection with JE virus.
- Cloning and expression of anti JE MAb variable regions for use in diagnostics.
- Differential diagnosis of encephalitis cases.
- Vaccines trials for new vaccines.
- Forecasting for JE outbreaks.

### Dengue

Study for the urban surveillance design and peri-urban maintaining foci of dengue virus in different settings of Rajasthan: Understanding socio-ecobiological dynamics of DF and DHF for a control strategy

- Development and demonstration of a surveillance design for control of dengue vectors using GIS.
- *Epidemiological studies on Dengue virus infections in West Bengal*: Recent epidemic of Dengue infection in Kolkata and some parts of West Bengal indicates re-emergence of Dengue virus in this part of the country, which needs periodic monitoring of the circulating virus.
- *Viral Repository*: A repository of viral isolates will be established at CRME, Maduari for maintenance of the strains isolated in southern region of the country.
- Isolation and characterization of apyrase enzyme from the saliva of dengue vector mosquitoes, *Aedes albopictus* (Skuse) and *Aedes aegypti* from Kerala state.
- Detection of genetic diversity among natural population of *Aedes aegypti* and *Aedes albopictus* by random amplified polymorphic DNA (RAPD) technique.
- Identification and characterization of midgut proteins of *Aedes albopictus* and their role in dengue virus transmission.
- Monitoring of Dengue virus infection in monkeys (zoonoses) in Kerala.
- Development of forecasting systems for dengue epidemics in India.
- Study of inheritance pattern of transmission competence of dengue viruses among *Aedes* mosquitoes.
- Molecular and genomic studies on peri-urban sylvatic dengue viruses as possible cause of DHF.
- RNAi as an antiviral strategy for dengue.

- Virus-host factors in dengue infection.
- Studies on the effects of dengue viruses with hematopoietic stem cell differentiation and vascular endothelial cells.
- Experimental infection and transmission of DEN viruses by mosquitoes sandflies.
- Dengue disease burden.

### **Chandipura Virus**

- Pathogenesis in human and animals
- Cloning, expression and function of different genes
- Development and analysis of Antivirals (drugs and siRNA)
- Diagnostics development
- Development of vaccines
- Ecologic and epidemiological studies

### **Influenza**

- Surveillance for human and avian Influenza virus disease burden estimation
- Strain surveillance rapid diagnosis of avian influenza
- Development of vaccines

### **Measles**

- Molecular surveillance for SSPE
- Whole genome sequencing of measles strains
- Virological surveillance for measles
  - Participation in measles surveillance
  - Diagnosis of measles virus infections
  - Isolation of measles virus from cases
- Genome-based rapid diagnosis of measles
- Molecular epidemiology of measles virus
- Evaluation of measles vaccination practices

### **Rotavirus**

- Expansion of surveillance activities
- Assessment of host-rotavirus interactions
- Cloning and expression of different Group B rotavirus genes and development of diagnostic reagents
- Clinical trial of newer vaccines

### **RSV**

- Development of rapid diagnostic tests vaccines and antivirals against RSV

### **Miscellaneous**

- Development of a Viral genomics database-cum-workbench for comparative genomics and proteomics
- Development of serological and molecular diagnostic facility for emerging high risk viruses

- Establishment of teaching and training facility for High Containment laboratory
- Screening of natural products for antiviral activities. Clinical virologists are interested in antiviral natural product due to non-availability of suitable antivirals, high cost, viral latency, side effect of existing drugs coupled with drug resistance, and problem in immunocompromised hosts.
- Sero, virological and molecular surveillance for rubella, mumps and chicken pox viruses
- Epidemiological and molecular characterization of Non-rotavirus acute gastroenteritis
- Molecular characterization of non-polio enteroviruses associated with encephalitis /meningitis
- Development and upgradation of database and database management systems.
- High resolution structural virology and live imaging microscopy of viruses
- Bridging Traditional Biomedical Knowledge (Viral Diseases) and Modern Science
- Updation of Viral Database of Indian works: Bibliographical
- Gene regulation in viral diseases using microarray
- Standardization of Viral gene arrays for rapid diagnosis
- Homology models of the envelope protein of JE, dengue CHIK viruses
- Bioinformatics tools to study sequence motifs in viruses

### **New Field Stations**

#### *Alappuzha, Kerala*

The recent outbreak of Chikungunya, the unexplained deaths that occurred in Alappuzha and the regular outbreak of dengue/JE in the region bring to light the need for ready diagnostics within the region. Because of the absence of basic virological techniques, there is a huge lacuna regarding the characterization of viruses circulating in the region. In the present scenario where vaccine studies are being planned, it is important that sufficient information is generated about the subtypes/serotypes/genotypes of viruses circulating in the region. It is important for any intervention strategy that the population at risk is defined and the risk factors are understood. It is proposed to establish a field station at Alappuzha.

#### *Gorakhpur, Uttar Pradesh*

Gorakhpur region in Eastern Uttar Pradesh comprises of Terai area bordering Nepal in the North and Bihar in the east. The region is characterized by a unique ecosystem due to its location, rainfall pattern, and the water logging pattern. The underdeveloped nature of the region with one of the lowest per capita income also contributes to the overall health status of people in that region. A major outbreak of Japanese encephalitis occurred in this region during 1977-78. NIV contributed to investigation and vector bionomics in that region by setting up of the field station in Gorakhpur during 1982-1996.

During last 20 years, seasonal JE outbreaks have occurred in this region. Usually, after a severe outbreak there is less number of cases for three to four years. After building of non-immune population larger outbreaks have been seen. During 2005, there was a massive outbreak of JE cases involving about 8000 cases. In addition, encephalitis cases kept on occurring even during unfavorable mosquitogenic conditions. Similar cases were seen in 2006 also along with JE cases.

It is proposed to set up a field station of NIV at Gorakhpur to assist the local health authorities in diagnosing viral encephalitis cases. The Field station would set up an independent diagnostic and research laboratory. The field station would carry out diagnosis of viral encephalitis cases; carry out studies to understand the epidemiology of viral encephalitis in Gorakhpur area and advice State and Central Government Health Officials about the probable control measures.

### **Leptospirosis**

#### **Major Institute**

1. *Regional Medical Research Centre, Port Blair*

- Sequence typing of leptospira
- Construction and characterization of genomic library of leptospira
- Studies on pathogenesis of leptospirosis
- Development of rapid antigen based test system for leptospirosis

### **Non-Communicable Diseases**

#### **Occupational and Environmental Health**

##### **Major Institutes**

1. *National Institute of Occupational Health, Ahmedabad*
2. *Regional Occupational Health Centres, Kolkata(Eastern), Bangalore(Southern)*
3. *Institute of Pathology, New Delhi*

##### **Basic**

- Mechanistic studies on occupational hazards
- Need-based experimental studies
- Development of methodology in analytical, physiological, toxicological areas
- Molecular epidemiology
- Development of biomarkers

##### **Applied**

- Applied Ergonomics (physical and cognitive) research on work methods and practices
- Work simplification and improvement in informal and small enterprises
- Early detection of occupational diseases

- Life style changes and quality of environment monitoring

### **Operational**

- Control technology studies
- Poison information services
- Intervention programmes
- Database and software in OHS
- Education and awareness programmes
- Training methodology and modules
- Intellectual property

### **Epidemiological Research**

- Surveillance studies in small scale, farming and agriculture, and self-employed sectors
- Occupational hazards among vulnerable groups – women, children and elderly
- Critically polluted areas (organic and inorganic)
- Health risk assessment
- Accident surveillance (organized and unorganized sectors)
- Environmental-cum- biological monitoring

### **Advanced Research Laboratories**

- Tobacco Research Laboratory
- Pesticide Research Laboratory
- Applied Ergonomics Centre
- Control Technology Centre
- Cognitive Science Laboratory
- Molecular Biology Unit
- Poison Information Centre
- EDP Division
- Early diagnostic studies
- Information, education and communication Unit

### **Environmental Biology**

#### **Applied**

- Assessment (HEBM) of pesticide exposure in tea garden workers of North Eastern States of India
- Evaluation and Validation of Enzyme Linked Immunosorbent Assays Technique for monitoring Pesticides exposure

#### **Basic**

- Health hazards of Phthalates (Plasticizers)
- Role of environmental toxicants especially heavy metals in male and female infertility
- Toxicity, Safety and Efficacy Study of Traditional Metallic Preparation



## **Reproductive Health**

### **Major Institutes**

1. *National Institute for Research in Reproductive Health, Mumbai*
2. *Institute of Pathology, New Delhi*
3. *Genetic Research Centre, Mumbai*

### **Expanding Contraceptive Choices**

- Develop improved and new technologies for fertility regulation,
- Assessing the safety, efficacy and acceptability of existing methods of fertility regulation
- Enhancing the availability of such methods

### **Development of improved and new technologies**

#### *Male fertility regulation*

- Studies with several molecules including the prostate protein human seminal plasma inhibit; human sperm antigen (80 kDa) HOXBESS, AREP27, TSA-70, Progesterone receptor, FASA 57 and a number of other sperm antigens to realize their potential for male fertility regulation
- Identify potential targets for female contraception in the uterus, vagina and cervix using proteomics and microarray approaches. In addition, Functional attributes of an octapeptide derived from FSHBI
- Studies to decipher the mechanism of meiotic maturation of germ cells into eggs/sperm, arrest and resumption of acolyte development, and embryo development

### **Assessment of the safety, efficacy and acceptability of existing methods of fertility regulation**

- Clinical trials with newer or improved methods of fertility regulation such as female condoms, vaginal rings, transdermal patches, newer IUCDs, spermicidal agents, injectables; to assess the in their efficacy, safety and acceptability of such in the Indian population

### **Enhancing the utilization of available contraceptives**

- Enhance awareness, knowledge and acceptance of existing spacing methods by means of innovative IEC strategies in the community
- Enhance the status of women and empowering them to have control of their sexual and reproductive health
- Sensitize health care providers towards provision of quality services
- Build capacity and strengthen community based organizations towards educating/motivating/counseling young married couples
- Dispel misconceptions and promote male methods of contraception including non-scalpel vasectomy
- Encourage men's support towards use of contraceptives
- Promote ante-natal and post-natal checkups and provide information regarding contraceptives for spacing
- Increase awareness regarding emergency contraceptives among health care providers, pharmacists, community organizations and potential users especially adolescents.

- Provide support to women who wish to continue using spacing methods of contraception even after completion of desired family size
- Understand the specific cultural/religious barriers in the rural/urban areas to address the need for spacing/ limiting methods

### **Infertility and Reproductive Disorders**

- Patho-physiology and psycho-social aspects of infertility and the associated disorders
- Some key molecular factors contributing to infertility will be used in developing the methods for more accurate diagnosis of female infertility and evidence based modification of treatment.
- Development of markers for sperm fertilizing potential, sperm retrieval and elucidation of DNA methylation pattern in the infertile males
- Gene knockout animal models will be developed to understand intragonadal regulation of hormones
- Improve and refine the ART techniques, and pre-implantation genetic diagnosis techniques to prevent transmission of genetic abnormalities to the off-springs
- Stem cell based research programmes to establish gonadal tissue banks.
- Clinical trials to test the efficacy of drugs, particularly, Ayurvedic drugs and antioxidants in male infertility management and other drugs such as GnRH analogues and aromatase inhibitors in female infertility management

### **Reproductive Tract Infections**

- Development of novel microbicides and female condoms which have definitive role in prevention of both pregnancy and RTI/STI including HIV/AIDS
- A feasibility study for preparation of suitable cohorts for conduct of Phase III trial on microbicides
- Develop simple cost effective methods for early diagnostic of RTIs
- Map the burden of disease due to RTIs in community setting
- Understand the CD4 independent mechanism of HIV transmission
- Understand the role of host genetic factors and viral variants in RTIs/HIV pathogenesis and progression, mother to child transmission
- Identify the normal vaginal microbial flora and pathogen-host interactions in RTIs.
- Immunomodulatory role of *C. trachomatis* in patients of cervical cancer
- Effect of treatment on murine chlamydial salpingitis and ultrastructural morphology of inclusion bodies
- Study of virulence genes in Indian strains of *Chlamydia trachomatis*
- Effect of sex hormones on induction of immunity by dendritic cells in female reproductive tract during *Chlamydia trachomatis* infection
- Inclusion proteins and their contribution towards chlamydial pathogenesis
- Role of iron in pathogenesis of *Chlamydia trachomatis*
- Mouse model of Chlamydial Salpingitis/Infertility
- Development of diagnostic assay for *Chlamydia trachomatis*
- Immune response to *Chlamydia trachomatis* infection in spontaneous aborters

### **Maternal and Child Health**

- The mechanism of transfer of some of the commonly and chronically administered drugs to the breast milk, pharmacogenomic aspects of their metabolism, and their impact on the growth and development of infants
- Common causes of high risk pregnancy such as pre-eclampsia, gestational diabetes, infections during pregnancy which contribute substantially to maternal and fetal morbidity and mortality
- Predictive markers for diagnosing women at risk
- Understanding the physiology of cervical ripening/parturition to help unravel the intricate mechanisms involved in pre-term/post-term parturition with the objective to help develop new and more effective drugs to prevent pre-term delivery or for induction of labor
- Use of misoprostol for prevention of postpartum hemorrhage and for induction of labor

### **Unsafe Abortions**

- Evaluate the impact of social values, male responsibility, family dynamics and decision making on abortion, develop suitable interventions to increase the use of effective contraception and thus decrease abortions
- Prevalence of unsafe abortion and the incidence of associated morbidity and mortality in urban and rural settings
- Feasibility of integrating abortion and post-abortion care with other reproductive health services including family planning and empowerment of women as an effective mechanism to curtail abortion

### **Adolescent Reproductive Health**

- Operationalizing adolescent friendly services within existing health infrastructure
- Determining the magnitude of sexual abuse by school going and out of school adolescents
- Reducing the unmet need of contraception among married as well as unmarried young adolescents
- Prevention of RTI/STIs including HIV/AIDS among adolescents

### **Menopause and Osteoporosis**

- Evaluate individual susceptibility to osteoporosis by DEXA among infertile men, lactating women, women using injectable contraceptives
- Evaluate therapeutic options and impact of exercise on osteoporosis and BMD
- Screen women with urogenital symptoms to identify the urinary tract infections, urologic pathologies and urodynamic studies and develop therapeutic algorithms
- Ascertain the genotype variants associated with low BMD and their prevalence in Indian women
- Study the degree of association between osteoporosis (young normal healthy individuals) or atraumatic fractures with genetic susceptibility
- Assess the utility of osteoblastic markers

- Develop awareness and educational programmes for the young adults and elderly for attainment of optimal peak bone density and fracture prevention, respectively
- Develop in-house assays for monitoring bone health

### **Stem Cell Research**

- Lineage specific differentiation of embryonic stem cell lines into germ cells, beta cells of pancreas, cardiac myocytes etc.
- To develop *in vitro* models using embryoid bodies for drug screening, genotoxicity and mutagenicity and in understanding early embryonic development, cell-cell communication and differentiation.
- To evaluate the therapeutic efficacy of stem cells in appropriate nonhuman animal models for human diseases.
- Multicentre clinical trials using various kinds of stem cell therapies.
- Stem cell banks for cord blood, embryonic stem cells and gonadal stem cells/ biopsies will be established.
- To develop *in-vitro* models using embryonic stem cell lines to facilitate screening of drugs for toxicity.

### **Preclinical Reproductive and Genetic Toxicology**

- Effect of bisphenol A on ovulation and menstrual disturbances in women will also be investigated
- Evaluate general, reproductive and genetic toxicity of the molecules developed “in-house” viz, R17-a synthetic peptide of human seminal plasma inhibin, peptide 1 of 80kDa HAS, Octapeptide- a synthetic peptide of FSH binding inhibitor, Nisin gel, (a new formulation of Nisin microbicide) and an anti-microbial peptide identified from Indian crab hemolymph.
- Newer approaches such as Toxicogenomics, -epigenomics and -proteomics will be adopted to study toxic manifestation of these compounds at the molecular level

### **Reproductive Cancers**

- To understand the molecular and genetic events underlying the breast, cervical, ovarian and prostate cancer.
- Role of steroid sex hormones in the etiology and/or progression of ovarian and prostate cancer.
- The role of viral infections, such as HPV and HIV, in cancer pathogenesis.

### **Bioinformatics and Data Annotation**

- To investigate structure-function relationship using various bioinformatics tools to design effective therapeutic modality.

### **Functional Genomics Facility**

- Develop diagnostic and prognostic markers and to identify the candidates for prevention and therapeutic intervention of various reproductive disorders;
- Develop a molecular map of reproductive tissues; and

- Construct a database of genotypes and of prevalence of gene polymorphisms predisposing the Indian population to reproductive health risks.

## **Genetic Research**

### **Prevention of Birth Defects**

- Feasibility of introducing Genetics services in rural family welfare program and Control program for common genetic disorders by antenatal monitoring maternal serum

### **Maternal and Child Health**

- Genetic heterogeneity of MTHFR gene polymorphism and its implication as a risk factor for neural tube defects down syndrome and spontaneous embryo loss.
- Gene mutations associated with Congenital Adrenal Hyperplasia (CAH).
- To study the transfer of anti tuberculosis and anti HIV drugs from mother to nursing with emphasis on genetic polymorphisms in drug metabolizing enzymes. The aim would be to study the transfer potential from maternal plasma to breast milk, which is given to the nursing. Number of factors can influence this transfer i.e. physiochemical properties of the drug as well as maternal pharmacokinetics an invitro culture system based on CIT 3 cells will be used in a transwell system. Quantitation method will be based on HPLC. The role of gene N Acetyl Transferase2 (NAT2) polymorphism will be studied in this context.

### **Adolescent Health in Tribals**

- To identify different causes of anemias genetic disorders and to plan interventional studies through health, nutritional, counseling camps in Ashram schools

### **Population Genetics**

- To study genetic variation in Y chromosomal and mitochondrial DNA for establishing maternal and paternal lineages in reproductive health disorders.
- Screening for mutations in disorders like beta thalassaemia, fragile X syndrome and common birth defects

### **Pharmacogenomics and Toxicogenomics**

- To study the genetic predisposition with toxicants which cause gene characterization charges.

### **Novel Approaches Towards Gene Therapy**

- To study whether stem cell transplants generate FMRP in the mouse model of the Fragile X Syndrome
- Genetic heterogeneity in cells with a CGG repeats expansion. A search for modifying factors which prevail – FMR1 methylation and a correct FMRP expression in cells from patients with Fragile X Syndrome



- Mechanisms involved in the silencing of FMR1 gene in Fragile X Syndrome
- Therapeutic approaches using viral vectors as delivery system for FMR1 in FMR1 knock out Mice.

### **Reproductive Endocrinology**

- The role of Y chromosome micro deletions as a possible genetic factor for male infertility
- Identifying genes responsible for premature ovarian failure
- Identifying molecular mechanisms involved in sex reversal i.e. XX males and XY females

### **Development of National Data Base for Genetic Disorders**

- To study and establish diagnostic criteria and different diagnostic features for a number of common genetic diseases.
- To help identify new disorders peculiar to India
- The centre will be instrumented in setting up networking facilities in all metropolitan cities of India. They will accurately genotype a number of conditions like complex syndromes. The catalog of this information will have a national content i.e. the national online index for Genetic diseases (NOIGD). It will constitute all information about genetic diseases including phenotype, developmental milestone, modes of inheritance and genetic aberrations.

### **Development of New Technologies**

- Raising up of monoclonal antibodies 2 HbA<sub>2</sub> and converting it in to a user-friendly kit and commercializing this technology for use in mass screening which is very important for the Prime Minister's rural project.
- In the area of recurrent spontaneous abortions researchable programs would be undertaken to identify genetic and metabolic causes of recurrent spontaneous abortions suing M-FISH, sperm FISH, T-FISH, whole chromosome paints, Comparative Genotype Hybridizations (CGH) and microarray system.

### **Establishment of a Tissue and DNA Bank**

- Establishment of a facility to preserve DNA samples from healthy and diseased individuals or extremely important to gain more comprehensive views on their pathology and physiology.

### **Oncology**

#### **Major Institutes**

1. *Institute of Cytology and Preventive Oncology, NOIDA*
  2. *Institute of Pathology, New Delhi*
  3. *National Institute for Research in Reproductive Health, Mumbai*
- Creation of Center of Excellence in Papilloma virus. Focused on:
    - Development of DNA vaccine against HPV-16

- Clinical trial of already developed prophylactic vaccine against HPV- 16
- Development of novel anti-HPV therapeutics
- Understanding of molecular mechanisms of HPV – mediated carcinogenesis in human
- Bio-informatics and Drug designing  
Using bioinformatics and computational proteomics tools, different anti-cancer drugs will be designed exploiting the structure of a protein that causes a disease. It would focus on the qualities of an effective drug, like high specificity, low toxicity, and ease of delivery. Animations will be generated considering the physical and chemical properties of the target once-proteins and potential inhibitors will be developed. A complete computer-aided drug design system will be built.
- Molecular immunology, immunotherapy of cervical and breast cancer
  - HLA gene polymorphisms in relation to HPV infection in cancer of the uterine cervix
  - Identification of tumor cell specific and tumor associated antigens in cervix and breast cancer
  - Development of Interferons and other Cytokines as anti-tumor agents
  - Development of Monoclonal Antibodies against cancer cells
  - Cancer Cells as immunogen.
- Mission-Mode Projects
  - Development of Molecular GTumor markers and creation of cellular and molecular cancer diagnosis mandate
    - ▶ To provide the state-of-art, molecular and genetic diagnostic facility to patients/public
    - ▶ To develop new and cost-effective diagnostic tests/kits
- Develop the clinical facilities especially for the early diagnosis of the common cancers like cancer of the uterine cervix, breast and the tobacco-related cancers.
- Development of field site for undertaking activities on preventive control measures of major cancers in a community set up using para medical staff and community workers.
  - To create awareness at community level about common cancers
  - To conduct studies to describe the extent and type of cancer problem making use of descriptive, analytic and molecular epidemiologic tools
  - To develop mobile clinics with colposcopy, visual inspection of cervix, and liquid-based cytology for mass scale screening of population for precancer and cancer lesions.
  - To carry out interventional studies to bring about change in incidence of cancer:
    - ▶ Behavioural intervention to bring in changes in high risk life styles
    - ▶ Early detection of Reproductive Tract Infections (RTIs) and the management of patients and their spouses
    - ▶ Early detection of cancers (cervix, breast and oral) - through symptoms survey and screening of asymptomatic population using multi modal approaches

- ▶ Bring about reduction of susceptibility of target organs through chemo- preventive agents or through ablative treatment
  - ▶ Assessing the efficacy and feasibility of different local destructive therapies for precancerous lesions of cervix and oral cavity through long term prospective studies.
  - ▶ Carry out studies for molecular prognostic parameters/markers for common cancers.
- Comparative study of genetic, clinical and epidemiological factors of breast cancer in rural and urban areas of India
  - Determine prevalence of breast cancer among rural and urban populations.
  - To study the reasons of variations of prevalence
  - Analyze the genetic susceptibility to *BRCA1*, *BRCA2* and *p53* gene alterations by single nucleotide polymorphism (SNP) in familial and sporadic breast cancer from urban and rural parts of India.
  - Analyze the level of expression of c-erbB2/ HER/neu in breast cancer patients by Immunohistochemistry.
  - Analyze the expression and methylation profile of above genes in breast cancer patients.
- Human Resource Development through establishment of
  - School of Cytology
  - School of Behavioural Oncology

## Tumour Biology

### Basic

- Analysis of expression of microRNAs during transformation and senescence in cultures of primary breast cancer
- Development of predictive markers through genomics and proteomics in Breast Cancer
- Population Genetics of Breast and prostate Cancer

### Applied

- Establishment of Breast and Prostate Cancer Cell Lines from Breast Tumors
- Proteomic approach to find new biomarkers for Prostate Cancer
- Study on chemo-preventive role of Lycopene in prostate neoplasms
- Study of transforming proteins as possible targets for immunotherapy in patients of superficial TCC
- Study the role of cyclo-oxygenases in cytokines dysfunction of invasive and non-invasive TCC of human bladder
- Molecular Stratification and Risk Assessment of FAB Subtypes of Acute Leukemia using genomics and proteomics

## **Adult Stem Cell Biology**

### **Applied**

- Human non-embryonic stem cells of the skin:therapeutic potential
  - Use of cultured Human epidermal keratinocyte stem cells on supportive biopolymer gel scaffold for autologous application in burns patients
  - Application of autologous Human Melanocyte-keratinocyte co-cultured sheets and pure melanocytes on laser abraded depigmented macules in vitiligo patients: A comparative study
  - Identification and standardization of alternatives to Fetal Calf Serum for stem cell culture applications
  - Evaluation of TH1/TH2 Cytokine profile, genetic susceptibility and Ultrastructural alterations in Indian Vitiligo patients

## **Medicinal Plants and Traditional Medicines**

### **Major Institute**

1. *Regional Medical Research Centre, Belgaum*

### **Traditional Medicines**

- Screening of indigenous plant resources for anti-malarial and anti-mosquito activities
- Feasibility and efficacy of alternative methods, such as LLINs, entomopathogenic fungi, for controlling malaria vectors in NE India

### **Women Health**

- Identify reproductive health problems in women and utilization of health services by pregnant and lactating mothers. To determine the practice of traditional medicine for common health problems in women

### **Child Health**

- Chart out awareness programme for rationale use of traditional medications for children in order to reduce infant and childhood mortalities
- Evaluation of pharmacological activities of biomolecules and herbal medicines in neurodegenerative disorders in
  - Immunomodulators/Antioxidant Activities
  - Antibacterial/antifungal/wound healing activities
- Survey on usage, availability and efficacy of Traditional Medicines/ formulations in Belgaum region
- Phytochemistry / Quality Control / Standardisation of herbal medicine
- Medicinal Plants of Western Ghat :IEC Centre
- Clinical Trial Unit
- fragile X syndrome, for therapeutic approaches using viral vectors as delivery systems for FMR1 gene in fragile X knock out mice.
- Reproductive Endocrinology

- Development of National Data Base for Genetic Disorders
- Development of New Technologies

## Nutrition

### Major Institutes

1. *National Institute of Nutrition, Hyderabad*
2. *Regional Medical Research Centres, Bhubaneshwa,*
3. *Regional Medical Research Centre for Tribals, Jabalpur*
4. *Desert Medical Research Centres, Jodhpur*

### Women, Child and Adolescent Health

- Assess the prevalence of undernutrition and its correlates to enable formulating appropriate strategies.
- To address the long standing problem of low pre-pregnancy weight, poor weight gain in pregnancy and low birth weight. Study the food sources of micronutrients in populations subsisting on adequate protein calorie on the lean body mass, weight gain in pregnancy and pregnancy outcome would be carried out.
- Determine the effect of oral and parenteral iron supplementation in severely anemic pregnant women in the community.
- See the effect of varying degrees of protein energy supplementation (given *ad lib*) in severely malnourished children on their recovery and body composition.
- Measure body composition of new born babies, and relate it with maternal and cord blood trace element status. In addition insulin and glucose levels will be estimated to see if the foetal programming is evident at the time of birth itself.
- Relationship between multiple micronutrient deficiencies and low birth weights, increased IMR, stunting, and high MMR.
- body compositional changes from new born period to adolescent will be studied using DEXA and relate it with feeding practices and dietary intakes in infancy.
- The role of optimal ratio of n-6 to n-3 polyunsaturated fatty acids in growth, pregnancy and lactation will be studied in animal models in relation to foetal programming and investigate the long-term effects of n-3 PUFA and trans fatty acids on foetal programming of insulin resistance. Animal experiments to ascertain the role of n-6 and n-3 PUFA for the prevention of obesity in genetically obese rat models and associated abnormalities.
- Analyze oligosaccharide compositions of human milk and its health implications on infants using the state-of-art technology.

### Stem cell research

- Understanding the conditions and factors (nutrients) within the microenvironment of the stem cells (proliferation and differentiation) to study the linkage specific differentiation/Trans-differentiation.



- Role of nutrients in *in vitro* regeneration of insulin secreting  $\beta$  cells and hepatic cells from adult tissue stem /progenitor cells –ex vivo proliferation, differentiation and its *in vivo* feasibility.
- Explore the use of Human Umbilical Cord Blood for growth potential of Umbilical Cord Serum in routine and specialized cell cultures; Exploring the Human Umbilical cord blood as a source of stem cells and for lineage specific trans-differentiation.
- Feasible approaches in harnessing the stem/progenitor cells for the establishment of cell lines from NIN's mutant obese rats.

### Nano-technology

Nano-technology has the potential to advance the science of nutrition through delivery of several intervention strategies which will reduce the risk and complications of several chronic and degenerative diseases. Areas that would be addressed include :

- Identifying sites of action (molecular targets) for bioactive food components (including essential and nonessential bioactive food components) i.e., obtaining accurate spatial information of a nutrient or bioactive food component in tissue, of nutrient and biomolecular interactions in specific tissues.
- Characterizing biomarkers that reflect exposure, response, and susceptibility to foods and their components.
- Identification of new target delivery systems for optimizing health (Nano-machines carrying antioxidants and health promoting phytochemicals, able to circulate through the bloodstream, kill microbes, or undo tissue damage through foods).
- Development of sensors for rapid detection of pathogens in foods.
- Improve nutritional assessment, low-level detection of essential and nonessential nutrients and metabolites and measures of bioavailability.

### Molecular Biology

- Identification of nutritionally important components and understanding the mechanism of action of resistin and other adipokines in the modulation and secretion of chemokines involved in chronic low grade inflammation and Syndrome X for developing therapeutic interventions for the insulin resistance.
- Previous collaborative study with hospitals on genetic analysis to screen different polymorphism and its association with diabetes demonstrate the prevalence of pro-12-ala mutation in Andhra Pradesh. A meta study on genetic analysis will be carried out on a much larger population and its association with metabolic syndrome will be analyzed.

### Chronic degenerative diseases and ageing

- In view of the epidemiological, nutritional and demographic transition, the prevalence of diet related chronic diseases such as hypertension, diabetes, coronary artery diseases etc. and its correlates will be studied.
- Cohort studies on low birth weight babies and undernourished children in relation to adult chronic diseases will be initiated, to develop large scale

database to help study the relationship between childhood undernutrition and adulthood chronic degenerative diseases.

- Assess health and nutritional status of elderly to promote measures for healthy ageing.
- Investigate dietary as well as exercise regimes, which can promote loss of fat and lead to improvement in muscle mass in various age groups,
- Delineate the role of activity, exercise, nutrition and other related factors on bone health in men and women.
- Demonstrate the impact of calcium rich foods on the bone health of adults, study pregnancy related changes in bone mass in women from different income groups
- Establish the critical bone mineral density at which fractures occur in men and women.
- Develop a suitable experimental animal model of type-II diabetic cataract / retinopathy and study the biochemical and molecular basis, and their modulation by dietary agents.
- Study the health effects of use of coconut oil in animals and human metabolic studies. Obese rat models will be used to study its effects on obesity and insulin resistance.
- Consumption of high erucic acid containing rapeseed /mustard oils result in several deleterious effects. It is proposed to establish the safety of low erucic acid mustard seed oil in animal model.

#### **Micronutrients**

- Micronutrient fortified wheat flour (*Atta*) intervention trials will be undertaken to test its impact.
- assess the zinc status of Indians and develop as well as validate a biomarker using proteomics approach.
- Study effect of maternal iodine deficiency/hypothyroidism on cell survival/apoptosis in the developing brain of the offspring in animal model.
- Establish an animal model to study the sequential embryo-fetal morphological development of adipocytes and skeletal muscle cells and the effect of changes in maternal micro-macronutrient status on the differentiation of mesodermal cells into adipocytes/myocytes.

#### **Sports Nutrition**

Evaluation of physical, physiological profile and estimate energy requirements of different groups of athletes based on their energy expenditure levels as suggested by FAO/WHO/UNU(1985) during their transition phase, pre-competition phase and competition phases of training.

#### **Food Science**

- The Nutritive Value of Indian Foods (NVIF) needs revision since data on several key nutrients are not available. Undertake a study on the nutrient composition of Indian foods to describe both the foods and the composition data more fully and to express data through appropriate distribution of values.
- Assess the availability and use of fresh and preserved less familiar foods used by the tribal population and their nutrient composition.

- evaluate the safety and the nutritional benefits of GM foods before such foods are introduced to the general population.

### **Infrastructural Development**

A National Centre for Health Communication is proposed to create a national level health extension network as well as to strength training and research components of health and nutrition communication. The following activities are planned:

- Content analysis of nutrition component in science text books of schools,
- Diet and lifestyle factors and their association with metabolic syndrome.
- Devise appropriate nutrition education strategy using different media and to train college students to act as change agents.

### **Heamatology**

#### **Major Institutes**

1. *Institute of Immunohaematology, Mumbai*
2. *Regional Medical Research Centre for Tribals, Jabalpur*
3. *Regional Medical Research Centres, Bhubneswar*

#### **New infrastructure**

- **Haemato Virology Centre**

The mechanism of how anti viruses affect haemopoetic system is not very well known. The virus – host cell interaction studies and effect of various viral proteins and various haemopoietic cells at their consequences will be studied.

- **Nutritional Anaemia Research Laboratory**

Nutritional anaemia interacts with haemoglinopathies, haematologic malignancies and many other inter-current infections and disease. Prenatal programming of the factor organs due to trace elements and vitamins deficiency relevant for haemopoietic system is an important area of research.

- Molecular Epidemiology Centre for Inherited immunodeficiency.

India is a vast country with 100 crore people. Even if we take that 1:100,000 people are born with severe immunodeficiency then atleast 10-20,000 children are born with severe immuno deficiency. IIH is strategically located in K.E.M. Hospital and all the patients attending all the major Government, charitable and even private hospitals for recurrent infection since birth can be evaluated at this centre. At present no such centre exist in India, IIH already has Immunologists, Paediatrician, Flow cytometry specialist, Molecular biologists.

#### **Molecular modelling and complete bioinformatics station**

Present day biology work cannot go ahead without high throughput software and expert in the area of molecular modelling and bioinformatics. Important work in the area of platelet biology and coagulation research has been done, would be undertaken to molecular modelling for all the mutations detected so far give an insight into alternate therapies for certain incurable conditions in this area.

## Stem Cell Research Centre

This centre will have two broad components

- Clinical Application
- Basis Stem Cell Research
  - characterisation of haemopoietic stem cell colony forming behaviour in various haemoglobinopathies and non haemoglobinopathies disorders with a view to see Foetal Haemoglobin gene activation and ease at which the stem cells circulate in peripheral blood
  - Developing animal models for thalassaemia and Sickle Cell anaemia
  - Trying to see in vitro culture of silencing various transcription factor by siRNA technology
  - Trying to repair single nucleotide defect of haemoglobinopathic disorders using site directed mutagenesis
- **R & D Centre for Developing Diagnostic and Therapeutic antibodies**

IIH has a hybridoma unit from where we have already produced HbF antibody. However this unit needs complete over hauling with augmentation of manpower and change in focus. We already know that tailor made antibodies have become a very important diagnostic & therapeutic agents. In future may such antibodies can be produced. This set up can be our future for R&D for various therapeutic and diagnostic antibodies.

## Community Health

- Community Control of Hemoglobinopathies: Establishment of Regional Centres for Molecular Characterization and Prenatal Diagnosis
- ICMR task force project on G6PD deficiency in India

## Genomics

- Molecular characterization of ABO alleles in Indian population
- Study of disease pathogenesis in cases of Glanzmanns Thrombasthenia by Gene Expression Studies
- Epitope specificity studies in Hemophilia patients with inhibitors
- Screening for unknown thrombophilic mutations polymorphisms in the Factor V gene in cases of Factor V Leiden negative and APC resistant cases
- Study of cytogenetic, immunophenotypic and biologic characteristics of AML with study of FLT3 gene mutations
- Use of Cell Free Fetal DNA from Maternal Blood for Non- Invasive Prenatal Diagnosis of Hemoglobinopathies
- A study of Fc  $\gamma$  receptor polymorphism in Systemic Lupus Erythematosus : Significance for the clinical expression of the disease
- Array Comparative Genomic Hybridization studies in hematological malignancies
- Foetal Rh genotyping from maternal plasma in Rh alloimmunised women
- RHD gene polymorphisms in Rh (D) negative Indians

- Study of genetic heterogeneity in heterocellular hereditary persistence of fetal hemoglobin
- Identification of Rare Blood Groups in Donor population

### Child Health

- Assessment of Neonatal screening approaches for Sickle Cell Disease and the effect of early intervention in management of the disease
- Molecular basis of hyperbilirubinemia among the neonates in India

### Immunology

- Characterization of the role of circulating leucocytes in Sickle Cell Pathogenesis
- Polymorphism of b-2 microglobulin gene in Seronegative spondyloarthritis patients
- Molecular Characterization of HLA among the Thalassemia families referred for prenatal diagnosis in order to evaluate the feasibility of obtaining a HLA matched donor
- Identification of novel HLA allele restricted cytotoxic T lymphocyte (CTL) response to selected Gag (p24 & p 17) peptides in HIV 1 infected patients from Western India
- Involvement of HLA antigens in patients with recurrent spontaneous abortion
- Molecular and clinical characterization of HLA – B7 CREG and its comparison with HLA-B27 associated Seronegative Spondarthritis (SSA) Patients
- HLA G and KIR polymorphisms in unexplained Recurrent pregnancy loss patients
- Distribution of HLA allele among HIV-1 infected serodiscordant couples.
- Role of HLA alleles in *P. falciparum* infected Malaria patients
- Immunopathology of recurrent miscarriages.
- Comparison of Western blot, ELISA and reverse transcriptase PCR technique for HIV-1 detection.
- Follow – up study of Western Blot Indeterminates by Real Time PCR Technology.
- Study the prevalence and pattern of Primary Immunodeficiency diseases in Western India and to establish algorithm for evaluation of Primary Immunodeficiency diseases.

### Stem Cell Research

- Expansion and characterization of Mesenchymal stem cells derived from Umbilical cord blood, its potential to differentiate into haemopoietic lineage and cardiomyocytes.
- Modulating the phenotype of sickle cell disease by gene silencing using siRNA
- Hematopoietic Stem Cell Transplantation from Related Cord Blood in Thalassemia Major Patients
- Regulation of Hb Switching and its importance in Hemoglobinopathies



### Development in Proteomics

- Proteomic approach to study metabolic regulation in Pyruvate Kinase deficient cases.

### Food, Drug Toxicology and Safety

#### Major Institute

##### 1. Food and Drug Toxicology Research Centre, Hyderabad

- Develop surveillance system based on molecular epidemiology for food pathogens
- Hazard Analysis Critical Control Point (HACCP) approaches to ensure food safety. Safety of street foods and monitoring of emerging pathogens;
- Toxicological evaluation of herbal foods, supplements, nutraceuticals and genetically modified foods.
- Effect of low protein, high fat and high fiber diets, vitamin and mineral restriction and supplementation on the toxic effects of selected pharmaceutical and herbal drugs
- Studies on fluorosis and lathyrism
- Develop defluoridation methods that can be used at community and households levels.
- Develop simple methods to detect contaminants and adulterants in food and food products.
- Create and maintain data base on foodborne illnesses and outbreaks

### Diet and Cancer

- Human clinical trials with phytonutrients
- Epidemiological studies on upper gastro intestinal tract cancers vis-a-vis dietary habits
- Studies on modulatory effects of antioxidants in oral cancer
- Studies on Herbal products Safety and efficacy studies on Indigenous drugs/formulations

### Laboratory Animal Sciences

#### Major Institute

##### 1. National Centre for Laboratory Animal Sciences, Hyderabad

This center has been a pioneer in the supply of various species and strains of laboratory animals has to transform into an upgraded modern facility. In order to achieve this it has been proposed to:

- Construct additional Space for strengthening guinea pig and rabbit colonies.
- Construct a ABSL 3 containment area.
- Construct a Hostel cum Guest House for the regular training programme for students and guest lecturers.

- Replace the existing polypropylene cages and racks with Individual Ventilated Cage systems to improve microenvironment and quality of the laboratory animals.
- Modernize the feed preparation, sterilization and packaging.
- To modernize the health, genetic and feed monitoring laboratories.

### Major Institute

1. *National Center for Primate Breeding and Research, Sasunavgarh*

Setup nursery for the newborn animals; facility for specific pathogen-free animals; experimental animal facility for housing animals individually for experimentation purposes; construction of research laboratories; administrative block; staff quarters for essential veterinary, housekeeping and security staff; and guest house for the visiting scientists, upgrade facilities to international standards.

### Health Issues of Vulnerable Populations

#### Major Institutes

1. *Regional Medical Research Centre, Port Blair*
2. *Regional Medical Research Centre, Jodhpur*
3. *Desert Medical Research Centre & Tribals, Jabalpur*
4. *Regional Medical Research Centre, Bhubaneswar*

### Haemoglobinopathies in Tribal Populations

- Genetic markers and severity of sickle cell disease
- Protection afforded by haemoglobinopathies towards malaria
- Clinical profile of sickle cell disease
- Prevalence of haemoglobinopathies among ST & SC populations of MP and CG
- Prevalence of haemoglobinopathies among ST & SC populations of MP and CG
- $\alpha$ -thalassaemia in few tribal population of central India
- Molecular characterization of common haemoglobinopathies in Central India
- Genetic distances among the major tribal populations of Madhya Pradesh
- DNA markers in various main tribes of MP and CG
- Molecular spectrum and morbidity pattern of Thalassemia and sickle cell disease in Orissa – cohort study.
- Molecular characterization of E beta thalassaemia in NE India

### Tuberculosis

- Molecular Epidemiology of *Mycobacterium tuberculosis* in central India
- Impact of RNTCP on Tuberculosis Prevalence among tribal population of Madhya Pradesh. & Chhattisgarh
- Prevalence of Palmonary TB among tribal population of Chhattisgarh
- Molecular characterization of *Mycobacterium tuberculosis* in NE India

- Effects of plant extracts on *in vitro* growth of *Mycobacterium tuberculosis* and identification of active principals in the plant extracts
- Role of zinc deficiency in development of tuberculosis disease
- Effect of oral salbutamol on result of sputum smear examination for AFB in RNTCP setting
- Quick methods using PCR for drug resistant tuberculosis in RNTCP setting
- To find out the current rate of irregular, defaulters and drop out in the treatment of tuberculosis and its causes and remedial steps
- Study of role of zinc supplementation in treatment of tuberculosis:
- Study of social and biological factors contributing to relapse of pulmonary tuberculosis in Northern India.
- A study on tuberculosis case contact tracing methods in the desert part of Rajasthan
- To find out the current rate of irregular, defaulters and drop out in the treatment of tuberculosis and its causes and remedial steps

### Paragonimus

- Molecular characterization and population genetics of *Paragonimus* in NE India
- Pathogenicity of different *Paragonimus* species to humans
- Host immunity and outcome of paragonimiasis
- Childhood paragonimiasis
- Development of diagnostics for paragonimiasis
- Treatment outcome in co-infection of tuberculosis and paragonimiasis
- Impact of paragonimiasis in tuberculosis control programme

### Malaria

- Molecular identification of sibling species of malaria vector complexes in NE states
- Genetic biodiversity and population genetic analysis of malaria vectors in NE
- Development of malaria control strategies in various epidemiological settings of NE India
- Malaria control in forest based camps
- Clinical trials of newer antimalarial and combination drugs
- Evaluation of commercially available and newer rapid diagnostic kits for malaria
- Development of an integrated strategy to control malaria in Jaisalmer district of Rajasthan
- Identification of epidemic indicators and risk factors in view to predict and prevent an epidemic of malaria with particular reference to arid situations
- Studies on the causative factors of drug resistance in *falciparum* malaria case
- A study on community participation for malaria control in the desert part of Rajasthan
- Longitudinal study on Socio-economic and Socio- behavioural aspects of malaria dynamics in the desert

### STD and HIV/AIDS

- Opportunistic infections in HIV/AIDS patients
- Epidemiology of sexually transmitted infections in primitive tribes of India
- Molecular epidemiology of HIV virus and its recombinants
- HIV/AIDS and drug abuse in high and low prevalence states of NE states
- Coping mechanism and influence of family in AIDS patients
- HIV and tuberculosis
- Opportunistic infection and morbidity and mortality among HIV patients and hepatitis
- Mapping, size estimation and integrated behavioural and biological survey for HIV/AIDS in NE
- Epidemiology of viral hepatitis in tribal populations of M.P. and Chhatisgarh

### New and Emerging pathogens

- Molecular epidemiology of Japanese encephalitis virus in NE
- Serological response to  $\beta$  cell peptide from structural and non structural proteins of JE virus in humans
- Epidemiology and molecular characterization of West Nile virus in Assam
- Viral aetiology of stomach cancer in Mizoram
- Monitoring of human influenza virus in NE
- Role of auto immunity in JE cases in NE
- Assessment of effect of inclusion of hepatitis B vaccine in EPI program in Andaman & Nicobar islands
- Molecular epidemiology of enteric pathogens in Andman & Nicobar Islands
- Prevention and control of hepatitis B among the tribes of Andbar & Nicobar Islands
- Control of subperiodic form of bancroftian filariasis in Nancowry group of Islands
- Molecular epidemiology of Herpes Simplex Virus-2 in high-risk groups of Eastern India.
- Immunobased detection and monitoring of Dengue, Human Metapneumovirus, Para influenza virus, Chandipura virus, Nipah viruses in community will be initiated.
- Emergence of drug resistant viruses is a great challenge for therapeutic intervention. But the facility for testing viral sensitivity or resistance is lacking. This study is being proposed to develop antiviral testing facility to serve the Eastern and North Eastern part of the country.

### Non-communicable Diseases

- Genetic Polymorphism in patients with calcium oxalate urolithiasis
- Long term follow up of Urolithiasis cases
- Effect of Exposure to Environmental Salt on Blood Pressure of Salt Workers
- Prevalence & risk factors of non communicable diseases in Andmans
- Pattern of care and survival in oesophageal cancer

- Morbidity and mortality among hypertensives in different ethnic groups of NE India
- Hypertension and CHD in younger group in NE India
- Young stroke and mortality in Assam
- Cancers in north-east India: role of pesticides and tobacco
- Comprehensive study of cancer stomach and oesophageal cancer in Assam
- Salt sensitivity and gene polymorphism in essential hypertension in various ethnic groups of NE India

### **Nutrition and Micronutrients**

- Estimation of fluoride burden in Madhya Pradesh
- Estimation of Iodine deficiency disorder in Madhya Pradesh
- Epidemiology fluorosis in the villages of Sonbhadra District, Uttar Pradesh
- Nutritive value of unconventional traditional foods of Madhya Pradesh
- Identification of trace element receptors and genes involved in Micronutrient
- Deficiencies among the child population of Madhya Pradesh
- Meta-Analysis of Micronutrient Deficiency Disorders (MDDs) in Rajasthan
- Time-trend and situation analysis of opium addiction
- Nutrition package for children and women
- Studies on association of anemic adolescent girls and low birth weight babies
- Community based educational intervention programmes to create awareness among rural mothers regarding infant feeding practices and diet during childhood diseases
- Situation analysis of Mid-Day Meal /nutritional and Anaemia Programmes
- Effect of intake of high fluoride drinking water on chronic diseases in endemic belt of desert region
- Preparation of diet atlas of different foods available and consumed in desert region of Rajasthan and analysis of their nutritive values
- Assessment of iodine deficiency disorder in children
- Longitudinal nutritional monitoring surveys
- Community intervention studies on anaemia among adolescent girls in Orissa
- Development of home-based management strategy for improving moderate/severely malnourished children in Orissa.
- Nutritional studies among tribes to know the impact of modifications made in the food rationing system based on recommendations made in earlier studies



## **EXTRAMURAL (Rs. 1427.55 Cr)**

### **Basic Medical Sciences**

#### **Allergy**

- Study of indoor environment for its effect on children and to identify risk factors
- Study of the association of pollen with sensitization patterns
- Effect of foods including antioxidants on allergic patients
- Maternal allergen exposure and its relation to development of sensitization pattern in newborns as well as cohort studies to investigate its effect in development of atopy and allergic manifestations.
- Interaction of susceptible genes and environmental allergens in the development of allergy and asthma
- Identify novel immuno-modulatory microbe derived molecules that have therapeutic potential in allergy.
- Investigate the factors associated with the absence of symptoms in those patients testing positive for dominant allergens in particular city or location.

#### **Anatomy**

- Variation in the structure of organs, their nerve, blood supply and musculature
- Developmental anatomy and teratological studies for studying effects of chemicals/drugs on developing fetus at gross and microscopic level research on special stains for immuno-histochemical localization and confirmation of morphological changes using electron microscopy;
- Studies on neuro-anatomy and neurobiology using molecular methods like confocal microscopy, imaging etc.
- Anthropometric measurements at various stages of fetal development
- Placental changes in normal and abnormal conditions.
- Data base for prevalence of congenital malformations in various States and their categorization
- Developing computer programmes/multimedia in anatomy and plastination of human body parts.

#### **Biochemistry**

- Role of proteases in regulating different biochemical processes
- Biochemical and structural biological aspects of substrate-inhibitor interactions
- Lipid biochemistry pertaining to biomembranes in the areas related to phospholipid and sphingolipid metabolism, lipid rafts and second messenger generation in health and disease
- Study of signal transduction pathways related to Gproteins, phospholipases, protein kinases, phosphatases and phosphorylases in health and disease.

- Protein modification and structural changes by acetylation, palmitoylation, phosphorylation etc. in health and disease.
- Investigating role of transcription factors in health and disease.
- Identification of enzymes of clinical significance for diagnosis and monitoring of disease.
- Regulation of expression of gene expression at mRNA and protein levels in health and disease.

#### **Human Resource Development**

- ♦ Human resource development in new drug discovery process
- ♦ National programme of training in toxicology including safety evaluation of drugs and chemicals to meet the manpower development
- ♦ International meets :Global Forum for Research on Bioethics and regional workshop with participation from SEAR region
- ♦ Training Program :Workshops for sensitization of medical undergraduates, non-medical and medical postgraduate students and researchers will be organized.
- ♦ Short term courses will be carried out for training the trainers

#### **Promotion of Research in Medical Colleges**

- Conducting training program in clinical research
- Promoting Clinical Pharmacology Teaching in the Medical Schools
- Strengthening Short Term Studentship (STS) Program in view of its growing popularity
- Research methodology workshops and annual conferences for meritorious STS Students

#### **Drug Development**

- ♦ Establishing network of new pre-clinical toxicology centers for carrying out animal toxicology studies using good laboratory practices (GLP) protocols, clinical pharmacology units and clinical trial facilities
- ♦ Setting-up special centers for conducting mutagenicity, teratogenicity and reproductive toxicity studies on new molecules using good laboratory practices (GLP) protocols.
- ♦ NIF Collaboration :Validation of non formal – non traditional leads
- ♦ To set up a regulatory pharmacology cell at ICMR, Hqrs New Delhi
- ♦ Set up task force on molecular pharmacology collaboration with NIPER, Mohali and NCCS , Pune
- ♦ Drug delivery system
- ♦ Set up a task force for researching new drug delivery systems
- ♦ Multicentric clinical trials on benign prostate hypertrophy, cancer and filariasis
- ♦ ICMR – NIF joint initiative for validation, value addition and benefit sharing on traditional knowledge

#### **Traditional Medicine Research**

- Validation of Unani formulations through partnership with CCRU

### **Bio-medical Ethics**

- Revision of ethical guidelines for biomedical research on human subjects
- Evaluation of IECs in Institute / projects funded by ICMR and other funding agencies

### **Human Genetics**

- Task Force on Handigodu disease
- A pilot study to be initiated to understand the disease burden and to explore the feasibility of introducing universal newborn screening in the country. Initially 6 diseases were identified which include PKU, galactosemia, CH, SCAD, CAH and tyrosinemia.
- Genetic studies of folate metabolism in human neural tube defects (NTD)

### **Haematology**

- Molecular studies in pathogenesis and management of myelodysplastic syndrome (MDS) patients in India
- Second phase of “Community Control of Thalassemia Syndrome” the technology developed during the phase I is being transferred to 5 centres at different geographical location of the country for prenatal diagnosis of thalassemia major.
- Hemophilia: Supporting research for production of factor VIII and IX by recombinant DNA technology using CHO cell lines.
- Map G6PD deficiency in the country

### **Physiology**

- Exercise Physiology: Aerobic exercises in swimming pools and on land, under water problem in stimulated diving in chambers
- Pain : Biopsychosocial and cultural dimensions of pain problems and perception; chronic pain—autonomic and visceral parameters, neurophysiological basis of management strategies.
- Neuropsychological indices of brain – cognitive inflexibility/impairment, memory, attention defects etc., in the Indian setting.
- Stress, life style and its impact on mind body interactions; linkage to conditions like hypertension IHD, diabetes, asthma, other stress conditions and immunological profiles
- Effect of yoga, meditation, pranic healing, yoga and mind-body relationship
- Nutrition Physiology: Sensory – metabolic interactions in control of food intake, hedonic matrix, ontogeny of food habits and food preferences – socio economic and cultural influences, Nutrition based problems in tribal areas of India
- Environmental Physiology: High altitude, pollution (noise, electro-magnetic and others)—cardio-respiratory parameters, brain indices, systemic effects. Adaptation to high temperature, lung functions in children and Indian standards along with effects of environmental pollution and incidence of wheezing/Bronchial asthma

- Neurobiology of addictive diseases, alcoholism and childhood conduct disorders-use of recent technologies
- Sleep disorders, and yoga
- Chrono-biology and circadian rhythms

#### **Basic research**

- Education/ Training : Educating physicians and public about Stem Cell therapy
- Setting up umbilical cord cell banking facilities in India

#### **Genomics**

- Funding for research, manpower development and capacity building, addressing Bioethics and IPR Issues and developing linkages with the Confederation of India Industries (CII)
- RNAi in embryonic stem cells and future prospects for therapy
- Genomics and Molecular Medicine

#### **Establishment of Biomedical Innovation Fund**

- To test and validate novel and highly creative ideas even if they have a high probability of failure. This scheme will be open to only Council's scientists for support.

#### **Evidence based medicine**

- To set up Centres on Evidence Based Medicine at PGIMER , Chandigarh and CMC, Vellore

#### **Alternate to animal experimentation**

- Establishing Center for alternatives to laboratory animals which will aim at :
  - standardizing, practicing and publicizing the established methods and systems;
  - developing newer methods and systems to replace use of laboratory animal systems for research and pharmaceutical work;
  - developing new sensitive and specific methods for screening, assaying, quality control, toxicity tests etc. and
  - imparting training in the above aspects and to render guidance to R&D and commercial organization.

Research in such as alternatives to laboratory animal experimentation. In-vitro procedure , in-vitro tissue preparations, cell lines and hybridomas etc.

- Development of in vitro techniques
- targets for screening and basic studies on cell cultures, cell lines, isolated
- receptors, enzymes etc.

#### **Other areas**

- Setting up Indian normative clinical laboratory parameters (INCLAP) task force

The international clinical parameters for normalcy in regard to various tests (such as for sugar, hemoglobin, various enzymes, PSA etc) are not applicable for the divergent ethnic groups of India and there is a need to set up our own standards after appropriate multi centric studies covering major ethnic groups. Accordingly, ICMR will constitute Indian normative clinical laboratory parameters (INCLAP) task force.

### **Medicinal Plant Unit**

#### **Establishment of knowledge base/information resource, and development of databases on various aspects related to medicinal plants/plants based drugs**

Development of databases through focussed programme in the area of medicinal plants will help in utilisation of full potential of medicinal plants besides protecting country's ethno medicinal and biological wealth.

#### **Database on medicinal plants of India**

The database would include regional names of the medicinal plant, its Sanskrit synonyms as well as the Ayurvedic description (wherever available), ethnobotanical studies, apart from the habitat and the parts used, on one hand, and the details of botanical, pharmacognostical, chemical, pharmacological and clinical data on the other, backed by complete references and bibliography on each aspect of the information cited, besides the colour photographs of important medicinal plants.

#### **Database on research projects/programmes in the area of medicinal plants**

The database would help in laying down priorities, planning research activities and of course in avoiding unnecessary duplication of research eventually leading to judicious utilization of funds and national resources for better health care.

#### **Database on institutes and scientists involved in research on medicinal plants**

The proposed data bank shall help the users to have an easy access to the Institution/scientist working in a particular area or areas of mutual interest and shall also facilitate, planned research and promote collaborative/coordinated research in the area of medicinal plants.

#### **Database on theses on plant based drugs**

The data bank would serve as nodal point for information on research theses and the work contained in them on medicinal plants based drugs. This may help in fruitfully utilising the research efforts/results (particular unpublished data) and avoiding duplication of research efforts.

#### **Database on ethnobotanical studies/folklores**

It is proposed to develop a database on ethnobotanical claim. The database would incorporate information on botanical names of the plant, synonyms, family, habit and habitat, distribution within region, country and the world,



specific description of the plant, name of the ethnic community, language they speak, cultural use in socio religious ceremonies, use of plants and its parts as food, medicine, oil, condiments etc. The database would also have information on phytochemical studies, pharmacology etc.

#### **Database on Nutritional value of medicinal plants**

In view of the global importance of some medicinal plants and their use as food, condiments, spices and nutraceuticals, it is proposed to have database on nutritional value of select important medicinal plants

#### **Consolidation of Indian Research Efforts in the area of medicinal plants and presentation in series of Review Monographs with particular focus on their medicinal potential**

Aims at consolidation of Indian research contributions (published information) at the various national laboratories/institutions across the country in the area of medicinal plants, and present in the form of series of Review monographs.

The rough estimate is to cover over 10,000 plant species which are reported to have medicinal value/investigated for their medicinal value. It is also proposed to have digitalization of this data on medicinal plants.

#### **Quality Standards**

Aims at development of standards of selected medicinal plants, employing analytical and chromatographic techniques and to prepare monographs as per WHO specifications on Quality standards. The monographs focus on phytochemistry, chemical markers, their structure, qualitative and quantitative standards including chromatography fingerprinting, pharmacology, toxicology, clinical aspects, safety, side effects/contraindications, if any, references and illustrations, besides covering other aspects like general description, synonyms, geographical sources and diagnostic descriptions etc.

- Establish a Centre for Advanced Research on quality standards of Indian medicinal plants
- Phytochemical profiles of extracts of selected medicinal plants - an atlas of chromatographic profiles

The aim is to establish methods for phytochemical evaluation of herbal extracts for ensuring consistency in composition of the chemical constituents of the extracts and hence the activity. The methods evolved and the data generated would aid in the quality control of the extracts.

#### **Safety Studies**

##### **Heavy metals and persistent pesticide analysis in medicinal plants**

The aim is to screen some selected medicinal plants for estimating levels of heavy metals and persistent pesticide residues. The data will help in setting up limits for these residues and will be a step forward towards safe use of medicinal plants. Samples have been analysed for heavy metals Pb, Cd, Cr, Ni, As, Hg using Atomic Absorption spectrophotometer/ICP and

organochlorine pesticides i.e. isoforms of HCH, endosulfan, DDT and its metabolites using GLC.

Establish a Centre for Advanced Research for analysis of heavy metals and persistent pesticides in medicinal plants/plant based drugs.

#### **Integration of leads from Ayurvedic and Unani system of medicine, modern medicine and multidisciplinary research studies in the area/disease of public health importance**

Aims at integration of leads/scientific information on diseases (including etiopathogenesis) and plant drugs as given in the ancient texts (ISM) and allopathic system of medicine on one hand and the multidisciplinary research data generated on these plant remedies with focus on pharmacological, toxicological, clinical, phytochemical, pharmacognostic, on the other.

#### **Other proposed initiatives**

- Atlases on various aspects including on pharmacognostical, phytochemical profile of medicinal plants.
- Atlases of chromatograms of all single drugs included in the pharmacopoeia.
- Retrieval, analysis and dissemination of information related to medicinal plants, plants based drugs/products through traditional and digital means
- Human resource development/strengthening of existing infrastructure and facilities.

### **Epidemiology and Communicable Diseases Division**

#### **Viral Diseases**

##### **HIV/AIDS**

- Natural history studies among children, HIV-1 and 2 and HIV-2
- Trials of drug combination therapy for management of adult, pediatric HIV disease and TB co-infection
- Preventive intervention research : clinical trials of microbicides, vaccines, ARV regimens to reduce mother-to-child transmission
- Pharmacogenetic and pharmacokinetic studies of ARV drugs
- Social and behavioural studies related to treatment adherence, stigma, and unmet needs
- Impact of HIV on overall and age/sex specific motility

##### **Influenza**

- Step-up strain surveillance for influenza to check for development of new virus strains
- Disease burden estimation
- Other respiratory viruses like Metapneumovirus
- Disease burden of RSV and vaccine trials

### **Reactivation associated viruses**

- Generate data on infections caused by rare viruses like BK polyoma virus, JC virus, CMV, HSV and VZV in this group of patients
- Standardization of real time PCR for diagnosis of infections caused by these viruses

### **Hepatitis**

- Develop a combined vaccine for Hepatitis A, B and E
- Studies on immune correlates of HCV infection should be studied
- Development of indigenous vaccine for HAV + HEV
- Development of combined diagnosis for HBV, HCV + HIV
- Use of novel techniques like nanotechnology and microarray in diagnosis of Hepatitis

### **Measles**

- Assessment of the usefulness of the combined Measles & Rubella Vaccine in the Indian scenario with a view to reduce the incidence of Congenital Rubella Syndrome in new born babies.

### **Mycobacterial Diseases**

- Common areas of research in Tuberculosis (TB) and Leprosy
- Molecular epidemiological studies using RAPD, IS 6110, AFLP and other methods
- Drug permeability and pharmacokinetics
- Proteomic approaches to understand mechanisms of intracellular parasitization and drug resistance etc.

### **Tuberculosis**

#### **Basic Sciences**

- Studies using proteomic and genomic approaches focused to identify the markers/ molecules for early diagnosis, mechanisms of drug-resistance and vaccine candidates
- Validation of new generation DNTA-fingerprinting methods to differentiate the strains in different geographical areas

#### **Clinical Sciences**

- Development of new and improvement in the existing treatment regimens to reduce the duration of treatment

#### **Operational Aspects**

- Operational research studies on implementation of and impact of DOTS and DOTS-Plus in the country
- Development of a network of laboratories and referral system for maintaining the quality assurance of sputum microscopy and culture
- Tools for assessing the quality-assurance methods
- To define and evaluate the tools for quality assurance and testing of smear-microscopy under the national TB control programme

## Leprosy

### Basic Sciences

- To study mechanisms of nerve damage, ultrastructural studies to understand the pathogenesis of the disease
- To understand the differential gene expression of *M. leprae* in human host using genomic approaches
- Ultrastructural as well as the study of leprosy granuloma in skin, nerves and blood vessels using immunoelectron-microscopy and molecular methods etc
- Structural studies of cell transition in pathogenesis of mycobacterial diseases
- Comparative studies of mycobacterial granuloma and immune mechanisms to understand disease process
- Investigations on the relationship between hormone levels and progression of disease in women
- Molecular methods for drug resistance in leprosy
- Immunotherapy in borderline leprosy
- Design of new regimen to shorten treatment, to have common regimes and for preventing relapse

### Clinical Sciences

- Development of user-friendly short-duration regimes such as Clofazimine – containing regimens, regimens containing newer drugs and immunotherapy
- Studies to focus especially on techniques which improves the pathological diagnosis (in-situ early diagnostic methods)

## Vector Borne Diseases

### Malaria

- Bio-diversity of anophelines with emphasis on malaria vectors
- Population Genetics of Vectors
- Refractory mechanisms in *Anopheles* species
- Molecular markers in drug resistance mapping in *Plasmodium falciparum* and *P. vivax*
- Mapping malaria risk factors
- Early warning system for malaria epidemics
- Population biology of vectors
- Satellite and environmental factors:
  - Field evaluation trials of insecticides, drugs
  - New and improved tools for prevention, diagnosis and management of malaria
  - New and improved strategies for malaria control
  - Identify appropriate indicators for evaluating the impact of effective malaria control/disease treatment on different aspects.
- Malariogenic stratification

- Development of indicators for assessing impact of malaria control on family/ society economy, school attendance, cognitive abilities of school going children
- Development of strategies/policies to improve access to drugs especially at the periphery
- Strategies to prevent malaria during pregnancy

### Visceral Leishmaniasis

Impact of Environmental Management, Insecticide Treated Bed Nets and DDT Spray in Kala-Azar Control

- Epidemiological impact of DDT in villages/sub-centre with different levels of resistance
- Impact of ITBNs
- Impact of environmental modification
- Development of molecular markers for the characterization of populations of *Phlebotomus argentipes*
- Development of kala-azar risk maps

### Field Evaluation Trials

- Safety and efficacy of clinical trials to evaluate new drugs
- Therapeutic efficacy trials for monitoring and mapping drug resistance
- Laboratory and field trials to evaluate new insecticides/ vector control tools in different vector eco-systems
- Monitoring of DDT resistance in sand flies
- Evaluation of diagnostic kits/ assays for parasite detection

### New and Improved Tools

- Identification of vaccine candidate antigens
- Evaluation of vaccine candidates for their efficacy
- Development of herbal products with anti-parasitic and anti- sand fly properties

### Strategic Researches

- Development of methods for measuring drug resistance
- Impact of inequity of accessing drugs on disease control/elimination
- Role of socioeconomic, environmental and behavioral risk factors in disease transmission

### Filariasis

#### New and Improved Tools, and Field Evaluation Trials

- Clinical trials of existing and newer anti filarial drugs especially in pediatric age group
- Development of drugs and drug combinations against adult filarial worms
- Development of diagnostic tools for *Brugia malayi* identification and to differentiate *Brugia* from *Wuchereria* sp. and also from other parasite sp
- Validation of 'critical mosquito densities' for disease transmission following MDA



### Strategic Researches

- To compare the efficacy and accuracy of strategies for monitoring the progress of LF elimination
- Sustainable morbidity management strategies
- Impact of MDAs on prevalence and incidence of ADL, lymphodema and hydrocele

### Biodiversity of *Culicine Mosquitoes*

- Update fauna of culicine mosquitoes, a few species of this group of mosquitoes are vectors of filariasis and Japanese encephalitis
- Development of Filaria risk maps

### Dengue

- Diagnosis and treatment
  - Characterization of the dengue virus genome
  - Evaluation of currently available diagnostic kits, and to develop assays/kits for improved early detection of antibody, antigen and RNA is of importance in the dengue control programme
  - Control of deaths due to DHF/DSS by developing effective treatment strategies
  - Animal model for studying dengue pathogenesis
  - Novel vector control measures using genetic manipulation and SiRNA technique.
- Studies on Population Genetics of Vectors
- Role of *Aedes albopictus* in the transmission of Dengue
- Dengue early warning system
  - Development of Dengue vaccine
  - Japanese Encephalitis
  - Mapping of JE Prone areas using Satellite Remote Sensing
  - Early warning system for JE Epidemics
  - Evaluation of biological control agents and insecticide treated mosquito curtains/Nets for JE control

### JE Vaccine

#### New and Improved Diagnostic tools and drugs

- Some antivirals effective against JE, Dengue and Influenza
- Novel approaches like SiRNA for *in vivo/in vitro* viral diagnostic studies.
- The JE diagnostic kit developed by NIV though effective, it is expensive and supply cannot meet the demand. There is a need to develop cheaper diagnostic kits.
- Reagents for sensitive and specific detection of JE virus in vector species

### Diarrheal Diseases

- Development of Molecular Methods for the identification of emerging diarrhoeal pathogens
- Establishment of surveillance system for the identification of pathogens of emerging diarrhoeal diseases ( Bacterial pathogens *Vibrio cholerae*,

*Vibrio parahaemolyticus*, *Shigella*, *Salmonella* and diarrhoeagenic *Escherichia coli* )

- Establishment of surveillance network of diarrhoeal diseases in india
- Establishment of a network system for early warning of outbreaks and epidemics
- Detection and molecular characterization of diarrhoeagenic viruses
- Evaluation and monitoring of drugs for enteric pathogens
- Development of a candidate vaccine against Shigellosis

### **Tribal Health**

- Stratification for malaria control in tribal dominated high malarious states
- Burden of vector borne and other communicable diseases in different tribes
- Association of hemoglobinopathies and transmission of malaria

### **Vaccines**

The following areas have been identified for research on vaccines

- Estimating disease burden for vaccine preventable diseases such as Hib, *S. pneumoniae*, HPV, measles virological surveillance
- Site preparation for clinical trials on vaccine: Hib, malaria, HPV
- Studying the mechanisms responsible for effective protective immune response of candidate vaccines such as for leishmania, malarial parasite
- Study role of T-cells in controlling infection in humans
- Use new technologies in genomics, proteomics and other disciplines to study parasite – host interactions to enhance scientific understanding of the human immune response induced by *P. falciparum* and other parasites.
- To identify and validate correlates of protection for new vaccine design and facilitate predication of efficacy
- Develop standardized tool kits of validated assays, reagents and operating procedures to enable comparison of results from models, field trials and other experiments for specific new vaccines under development
- Development and testing of candidate vaccine for TB, Malaria Leishmania and other diseases
- Capacity building development of sites and site preparation for clinical trials on vaccines
- Conduct clinical trials for new vaccines such as rotavirus, influenza, meningococcal meningitis, pneumococcus, HPV, malaria, cholera, JE, HIV, typhoid, TB
- Studies on use of adjuvants to improve immunogenicity of vaccines
- Influenza:
  - Surveillance for influenza
  - Monitoring of virological, serological and clinical parameters of H5 N1 infection in humans, poultry, wild birds and animals
  - Development of influenza vaccines that target conserved viral proteins.
  - Develop/evaluate H5 N1 and H9 N2 influenza vaccine.
- Studies on alternate delivery of vaccines such as aerosol, mucosal application of vaccine

- Economic evaluation of vaccines planning immunization within a larger envelope for health
- Cost effectiveness of substituting measles vaccine with MMR vaccine in the National Programme; cost effectiveness universal vs. targeted use of new vaccines
- Studies on financing of vaccines and vaccine delivery
- Operational research on whether addition of new vaccines will increase or decrease the perception of value of immunization or affect the demand for vaccination and on sustainability of new vaccines if introduced into the programme
- Social and behavioural research on acceptability of different vaccines (public perception and demand creation), client conveniences, the feasibility of introducing additional vaccines in the national programme, public private co-ordination models, impact assessment on disease burden.

## **Non-Communicable Diseases**

### **Oncology**

- Research on cancers of various organs especially gall bladder, oesophagus, prostate, cervical, breast, etc.
- Prevalence of tobacco use and toxic constituents of smokeless tobacco
- Animal studies for drug efficacy, clinical trials of cancer management strategies, chemoprevention.

### **Cardiovascular Diseases**

- Using biomarkers to identify individuals at risk, stages of the heart disease
- Interventions to prevent obesity
- Molecular mechanisms linking obesity to heart disease and metabolic disturbances, interventions to prevent obesity, lipid normograms for adults and children
- Health care delivery for cardiovascular diseases in remote areas
- Clinical genetics network for premature coronary artery disease, epidemiology of premature coronary artery disease genetic epidemiological studies of cardiovascular diseases testing the homocysteine lowering therapy hypothesis in premature CAD

### **Registries**

- Registry in essential hypertension
- National Acute Coronary Events (NACE) Registry
- Stroke registry epilepsy registry trauma registry

### **Mental Health**

- Socio-biology of MH problems, morbidity of CMDs, biological psychiatry
- Alcohol and drug abuse
- Health behaviour research, mental health of special groups, treatment of severe mental disorders

- Mechanisms for stress, stress induced diabetes, neuro-immunology of stress, depression and alcohol

### **Neurological Disorders**

- Dementia
- Stroke surveillance in community, neuromuscular diseases, neurotuberculosis, neuro-toxins and neuro-disorders

### **Geriatrics**

- Burden of chronic diseases in the elderly, Activities of Daily Living and Quality of Life, nutritional status
- Health systems research to improve health care for the geriatrics population

### **Diabetes**

- Pathogenesis, Genetics, Risk Factor Modification
- National Diabetes Prevention and Control Programme
- Pre diabetes, screening of subjects, diabetes complications
- Management of diabetes with yoga, indigenous medicines

### **Asthma**

- Pathogenesis of asthma, prevalence of COPD, diagnosis and management of asthma and COPD

### **Gastroenterology**

- Non-alcoholic fatty liver disease: celiac disease, inflammatory bowel diseases

### **Otorhinolaryngology**

- Research on otitis media, presbycusis, otosclerosis, cochlear implant, modifier gene contributing to severity of hearing loss

### **Ophthalmology**

- Studies on ARMD; Corneal diseases; cataract; childhood blindness

### **Nephrology & Urology**

- Secondary prevention of diabetic nephropathy:
- Genetics and etiopathogenesis of nephrotic Syndrome. prevalence and causes of ckd in children + assessment of renal disease in patients with CKD + evaluation of targetted intervention studies for CKD
- BPH (Benign Prostatic Hyperplasia)

### **Oral Health**

- Caries susceptibility in relation to saliva, immunological studies of periodontal diseases and dental caries
- Evaluation and treatment needs of geriatric population
- Oral health promotion , behavior, and environment
- Developing tooth Bank through stem cell

### Surveillance of NCDs

- Health systems research for NCDs
- Family History as a public health strategy for prevention of NCDs

### Database of Non Communicable Diseases

- National Centre for Disease informatics
- Health state valuation studies
- Health Infrastructure evaluation
- Economic burden of NCD
- Socio-behavioral consequences of NCD in the community
- Development of a comprehensive NCD mortality instrument
- Development of a feasibility module on cause of NCD deaths
- NCD Mortality Surveillance
- Vulnerable population's conceptual model to rural health
- Achieving better health through health impact assessment

### Social and Behavioral Research

- Stress among school students and its determinants
- Psychosocial trauma of natural disasters and social disturbances
- Sociocultural study of adult drug addicts seeking treatment and care in health facility
- Study of psychosocial health of HIV +ve people
- Social determinants of health, inequalities in health care

### Establish following Centers for Advanced Research

- National information resource Centres in priority areas like nutrition, vector born disease, occupational health etc in ICMR Institutes.
- Biomedical communication will be established at some institutes.
  - Scientometric studies
  - Analysis of biomedical research in icmr network of research institutes and indian medical schools
  - Preparation of support system for making *Indian Journal of Medical Research* (IJMR) a web-based journal

### Publication, Information & Communication

#### Publications

- Improve quality of ICMR Bulletin will continue publishing articles on variety of topics of national interest. It is planned to publish Bulletin on art paper in 4 colour with photographs/illustrations.
- Start a popular publication in medical/ health sciences in English.

#### Information & Communication

- Organize ICMR exhibitions in important cities of the country for depicting contributions/achievements of the Council.
- Explore possibilities for issue of more Press Releases; to take Press parties to at least one Institute during one six-monthly period; to prepare feasibility report and explore means for audio-visual/multi-media



programs of ICMR achievements; to arrange for lectures at neighbouring universities and public Institutions on special occasions like World/National Days related to S&T and health for awareness and highlighting ICMR's achievements

#### Update Union Catalogue of journals in ICMR libraries

- Launch Online Journal Publication system to Indian biomedical journals that would facilitate online submission, peer reviewing, copy editing & final publishing to medIND journals.
- Start with Online journal publication of Indian Journal of Medical Research and this facility would be extended to other journals.
- The **BIC** will be expanded to become the Central IT facilities of the Council. It will form an IT bridge between the Headquarters and institutes through networking and video conferencing.
- Establish video conferencing facilities in all ICMR institutes.

#### Intellectual Property Rights

- Expand and strengthen techno-legal assistance at the Institute level
- Set up IP/Tech transfer cells at all ICMR Institutes/Centers
- Extend the techno-legal assistance to all biomedical inventions in India, especially focus on individual inventors
- Aim to formulate a national policy frame-work in place for protecting, preserving, exploiting and benefit-sharing systems in place for all biomedical inventions in India
- Establish a system of rewarding innovations for both ICMR and non-ICMR technologies
- Formulate policies for responding to national and international IP policy needs
- Intensify the IP and technology transfer appreciation programmes country-wide
- Studies on various WTO / TRIPS and other issues on R&D in health to help India become globally competitive

#### Human Resource Development

- In the area of human resource development in biomedical communication, information and IPR, workshops will be organized on (i) biomedical communication; (ii) preparation of research proposals; (iii) training for editors of biomedical journals in India and South Asia; (iv) how to effectively retrieve information through the computerized bibliographic databases; (v) bioinformatics; (vi) information, education and communication (IEC); (vii) emerging technologies for effective management of library and information services; and (viii) intellectual property rights and technology transfer for both ICMR and non-ICMR scientists.
- Provide expertise to neighboring countries in the region as also other developing countries to develop skills in set up and run technology management offices
- Offer training in the best practices for the management of IP in health in India and South Asia.

## Reproductive Health and Nutrition

### Nutrition

- To assess micronutrient status during different trimesters of pregnancy and its correlation with pregnancy outcome
- A multicentre study is proposed to assess micronutrient status like zinc, selenium, copper, folic acid, B12 etc. on prevalence of multiple micronutrient deficiency in vulnerable groups at district level in different parts of country.
- Studies to estimate the prevalence of osteopenia and osteoporosis in rural and urban parts of India; assess the functional ability of persons afflicted with osteoporosis; assess the impact of an elaborate IEC package to combat the problem of osteoporosis in the country
- Assess the prevalence of diabetes and pre-diabetes (Insulin Resistance Syndrome) among Indians vis-a-vis role of nutritional factors
- The National Nutrition Monitoring Bureau (NNMB) Bureau will : (i) carry out second repeat survey to study the secular trends in diet and nutritional status of the tribal communities in the country. (ii) evaluate national nutrition programmes such as ICDS, MDM, National Anemia Control Programme, IDD programmes etc.
- Nutritive value of food items - for macro, micro and phyto-nutrients using newer techniques; analysis of uncommon food stuffs for their nutritive value
- Food safety including food contaminants, adulterants and genetically modified food items
- Evolving and testing better tools for assessment of nutritional status
- Evolving appropriate norms for assessing the nutritional status of Indians
- Assessing the determinants of nutritional status
- Nutritional status and health, especially epidemiological data on the health consequences of deviation from the norms
- Nutrition-fertility and nutrition-infection interactions
- Micro-nutrient deficiencies and their health consequences
- Changing dietary habits and lifestyles focusing on obesity and noncommunicable diseases
- Nutritional problems of the elderly and increasing longevity and nutritional implications
- Clinical nutrition, including nutritional management during illness and nutritional rehabilitation
- Emerging changes in nutritional status due to changing ecology, agriculture, life style and social policy
- Effectiveness of nutrition intervention as assessed by health and nutritional benefit and cost of different interventions

### Child Health

- Studies on operationalization of exclusive breast feeding and improving young infant and child feeding in the community

- Determine relationship between infant feeding practices and risk of HIV 1 infection and to study the morbidity pattern among the HIV positive children
- Develop simple algorithms for identification and management of sepsis and its applications in the existing programme for use by health care provider, simplified regimen for treatment of newborn sepsis, probiotics for prevention of neonatal sepsis
- Develop and test prefilled syringes for injectable antibiotics for administration by community workers
- Community based implementation of kangaroo mother care in reducing neonatal mortality due to hypothermia
- Follow up of babies which were resuscitated with room air and 100% oxygen in a study done 10 years ago
- Studies on integrated community based care which includes some or all components of provision of maternal and newborn care, monitoring for maternal and newborn postpartum complications and illnesses and managing and referring them, counseling of women and family members enforcing healthy behaviours
- Test home based newborn survival interventions in urban slums

#### Acute lower respiratory infections

- Estimate disease burden due to *H. influenzae* and *S. Pneumoniae*
- Set up surveillance system for antimicrobial susceptibility of organism causing pneumonia.
- Identify risk factors for developing severe ALRTI and mortality in children

#### Immunization

- Conduct studies to determine the wastage and the wastage multiplier factor for the vaccines currently being used under the UIP, to determine the reasons of wastage of vaccine and suggest measures for reducing wastage.
- Studies to measure measles antibody level in children below 5 years of age and seroconversion rates in children receiving only measles vaccine and those receiving MMR vaccine at 15 months

#### Database

- Develop database on childhood and maternal morbidities and mortality from the tertiary hospital as well as from the district hospital (secondary level) including registry for recording birth defects

#### Maternal Health

- Study the prophylactic effectiveness of 600 mcg of oral misoprostol in reducing the incidence of PPH, the associated morbidity and mortality study the feasibility of use of misoprostol by the trained birth attendants while conducting domiciliary deliveries
- Studies on different routes of administration and the logistics of the distribution mechanism of misoprostol study the role of drape with calibrated receptacle for quantitative measurement of blood loss at time of delivery in peripheral settings

- Pre-eclampsia and eclampsia are among the major contributors to maternal and perinatal morbidity and mortality worldwide. In India, preeclampsia/Eclampsia contribute towards 12-20% of all maternal deaths. There is an immediate need for programs to implement the few, known effective interventions for the management of the severest forms of the disease and in addition for focused research to develop effective preventive and therapeutic strategies that will minimize the burden of preeclampsia/eclampsia
- Preparing guidelines for management of pre-eclampsia by the health worker at the community level and field-testing on a pilot basis the feasibility in the community
- Multicentric RCT on dose modification of magnesium sulphate for management of eclampsia. An earlier study to observe the effect of the antioxidant lycopene on the occurrence of pre-eclampsia and intrauterine growth retardation in primigravida women indicated that the antioxidant. The results of this study will be substantiated through a double blind multicentric RCT to generate evidence for use of lycopene to reduce the incidence of pre-eclampsia
- Studies on epidemiology of pre-term labor with an objective to identify the causes and risk factors so that intervention can be planned
- Operational feasibility of 80% coverage and compliance with iron folic acid supplementation in children from 6 months to 18 years, pregnant and lactating women. Evaluate social marketing and public private partnership with IEC activity for their potential in our scenario to increase consumption and compliance level
- Multicentre studies to determine the best approach to provide community based post-partum care (PPC)
- Increasing institutional deliveries in the rural areas through increased awareness of safe motherhood practices
- Used information technology to provide communication channels between the peripheral and referral centers and thereby improve maternal health services in the rural areas
- Increase the participation of males in reproductive health
- Evaluate the efficacy and effectiveness of a simple inexpensive and easy to implement intervention to reduce episiotomy rates in health facilities
- Multi-centric trial to provide evidence about the best timing of umbilical cord clamping and cord traction on maternal and neonatal outcomes to guide the assistance of deliveries around the world
- Studies on introducing simple interventions to reduce this increasing cesarean section
- Studies on epidemiology of malaria during pregnancy, association between malarial infection at different gestational period and outcome of pregnancy and the provision of malaria prophylaxis during pregnancy in malaria endemic area
- A safe, inexpensive, and widely used mucous-membrane antiseptic agent. Multicentre randomized clinical trial to test the efficacy of chlorhexidine washing of the vagina during labor and washing of the neonate to reduce the rate of both neonatal mortality and morbidity associated with infection and puerperal sepsis/endometritis

- In women with HIV complicating pregnancy, studies will be carried out on antiretroviral drug strategies (duration/drugs) of breast feeding moms post-partum; identification of appropriate infant feeding practices following rapid weaning in India; study of breast milk composition (nutrient value) in women on ART; HIV and tuberculosis: treatment strategies/immune reconstitution syndrome; HIV and other co-infections/immunologic mechanisms; Nevirapine resistance/resistance to other drugs; treatment strategies for women who need treatment post MTCT prophylaxis and on treatment strategies for HIV infected children

### **Reproductive Tract Infections**

- Multicentric studies to determine whether screening and treating asymptomatic pregnant women for BV reduces adverse pregnancy outcomes
- Examine the risk associated with various deficiencies of key nutrients, critical in mounting optimal immune response such as protein, energy, vitamins A, B12, folic acid, and iron and zinc, with lower RTI in women at risk for these nutrient deficiencies in India
- Vaginal ecology and innate defense mechanisms by which the normal vaginal flora and epithelial tissues are impacted by STIs, and the effect of hormonal influences on the vaginal ecosystem
- Mechanisms of pathogenesis of organisms that cause STIs and associated syndromes including BV, PID, infertility, and premature delivery; the role of inflammatory and immune defense mechanisms in persistence and pathogenesis
- Mucosal immunology in the male and female genital tract including mucosal immune responses in normal subjects, those with STIs, and after interventions including topical microbicides, therapeutics and vaccines
- Interactions among STIs, and STIs with HIV; the effect of STIs in the acquisition and progression of HIV infection and the role of HIV in alterations of the natural history, diagnosis, or response to treatment of STIs

### **Microbicides**

- Development of new, safe and accessible methods of preventing the transmission of HIV/AIDS and of other sexually transmitted diseases by means of microbicides, the focus will be on product discovery and development; pre clinical screening and characterizing in vitro and in animals; clinical studies for safety, efficacy and contraceptive effects; clarifying regulatory review; and advocacy and policy work among both NGO and government actors. Additional research sites will be developed for expanded safety and effectiveness studies for HIV prevention methods and socio-behavioral studies to assess the community and individual preparedness and awareness. Capacity building of sites including training and strengthening of laboratory and other capabilities like data management would be carried out.



### **Establish Centres for Advanced Research**

- Advance centre for adolescent health and gender equity research
- Advance centre for research in childhood retinoblastoma.
- Advance centre for research in childhood cancers.
- Setting up of umbilical cord cell banking facilities in India
- Advance centre in stem cell research.
- Molecular and cellular reproduction
- Use of nanotechnology in reproductive health

### **Social & Behavioural Research**

#### **Gender Issues and Women Studies**

- Illegal abortion – a study of psycho-social dynamics
- Factors resulting in inequality in the utilization of RCH services
- A study of perception and beliefs about RCH services and impact on service utilization

#### **Adolescent's Health and Sexuality**

- Understanding social environments & consequent behaviours of adolescents in impoverished situations
- Reproductive and sexual health education to out of school adolescents

#### **Microbicides**

- Study of acceptability of microbicides
- Social and behavioural issues in microbicide trials (Site preparedness)

#### **Male Participation in Reproductive Health**

- Role of male participation in prevention of STDs and HIV/AIDS
- Factors influencing spousal support in utilizing RCH services

#### **Decentralized Governance and Health System – Organizational Behaviour Issues**

- Study of PRIs' capabilities (strength & weaknesses) to manage the grass root health system
- A study of organizational behaviour of ANMs
- Studies on social determinants of health

### **International Health Division**

#### **International Fellowship Programme**

The world is now witnessing a rapid change in the way biomedical research is conducted. The developing countries are in the grip of formidable challenges posed by the existing communicable diseases coupled with new emerging infections. On the positive side, rapid advances in science and technology have brought in new technologies to understand the disease process and find strategies for prevention and cure. There are areas at the cutting edge of science such as molecular medicine, genomics, immunology, which have revolutionized knowledge for finding rapid diagnostics, vaccines,

new drug targets and other therapeutic measures. There is an urgent need that researchers working in the core health sectors like diagnostics, epidemiology, surveillance and cure are exposed to the latest advancements in knowledge and interact with International scientists in their respective field of work.

To achieve the objective of building up of a highly skilled pool of biomedical researchers in all aspects of biomedical research including basic, applied, epidemiological and clinical sciences, the ICMR has embarked on an International fellowship programme for capacity strengthening of scientists of our country. There are six fellowships per year from India to abroad for junior level scientists for a duration of 3 to 6 months, three fellowships per year for senior level scientists for a period upto 2 weeks & five fellowships per year for the junior level scientists from developing countries to work in Indian labs upto a period of 1-6 months. The number of fellowships are planned to be doubled in the 11<sup>th</sup> Plan period.

The following are the ongoing international programmes & other activities of ICMR, which are likely to be expanded during the 11<sup>th</sup> Plan period.

(I) The ICMR is the signatory of the following MOUs/Special Arrangements/Joint Statements and plays a role of implementing agency which are in operation at present:

- a. **ICMR-INSERM (France)** MOU for cooperation in biomedical sciences (in pursuance renewed on of Indo-French S&T Agreement signed on 18.7.1978) Areas of collaboration are infectious diseases (TB, AIDS, malaria, leishmaniasis), human genetics, neurosciences, surveillance / epidemiology employing modern techniques.

The progress under ICMR-INSERM MOU was reviewed in January, 2000 and modalities of cooperation, further areas of mutual interest were finalised during a meeting between Directors-General of ICMR - INSERM. As a follow up, five Joint Working Group (JWG) meetings coordinated by IHD & four workshops on various topics of identified fields were held in India in France in the years of 2000, 2001, 2003, 2004 and 2005. Joint calls for proposal for Indo-French (ICMR-INSERM) programme are being published regularly by IHD. Nine joint collaborative projects are in operation under which exchange of scientists from both sides will take place every year. Many workshops and Joint Working Group (JWG) meetings will be organised alternatively in India and France.

The next meeting of ICMR-INSERM JWG is scheduled to be held in France in Feb., 2007.

- b. **ICMR-GSF (Germany)** Special Arrangements for Cooperation in Biomedical Sciences Renewed on 30/5/1990 (in pursuance of Indo-FRG Agreement on S&T and an addendum was signed in Jan /March, 1974).

Areas of cooperation are infectious diseases including aids; oncology; family planning and reproduction medicine with special emphasis on birth control; health for mother and child (prenatal medicine); research on scientific basis on traditional medicine (i.e. study of compositions and pharmacological properties of natural products); biomedical research related to human health; environmental toxicology; drug development related to tropical diseases, infectious diseases and cancer; bioethics

A Indo-German S&T Committee oversees this programme with DST as co-ordinator on the Indian side. Last meeting of Joint Committee was held in Berlin in September, 2003. As a follow up of this meeting, an Indo-German Workshop on Bioethics was held in Germany in November 2004 and two Workshops one each on Environmental Toxicology & PET Radiopharmaceuticals were held in India in 2005. An Indo-German Workshop on 'Cancer Research' is scheduled to be held in Germany in 2006. Indo-German Joint call for proposal is also handled & published by IHD from time to time. 4 joint collaborative projects are ongoing which have the component of exchange of scientists funded by IHD. As a result of a recent joint call for proposal, twelve projects have been received which will be peer reviewed and approved projects will be implemented during the 11<sup>th</sup> Plan period. Many workshops of common interest are to be organised with funding from IHD, ICMR in India and Germany after duly approved by Indo-German Committee (IGC) in S&T.

A MOU between ICMR and Helmholtz Association (HGF), Germany for co-operation in Medical Research was signed on 24th April, 2006 at Hannover, Germany during the visit by Hon'ble Prime Minister of India to Germany. The areas of interest which have been identified for cooperation are infectious diseases, oncology & biomedical research related to health. The ICMR and the Helmholtz Association are distinguished research organizations in their home countries with outstanding scientific resources and scientific technical facilities at their disposal. This collaboration will advance the development of research cooperation in the field of the biomedical sciences. The exchange of scientists/ researchers, joint execution of research projects, organization of collaborative projects would be the modes of cooperation in coming years. A kick-off meeting and inauguration of Indo-German Science Centre for Infectious Diseases will be organized at ICMR Hqrs., New Delhi on 3<sup>rd</sup> April, 2007.

- c. A Memorandum of Understanding (MOU) between ICMR-CIHR (Canada) for cooperation in the field of Biomedical Sciences was signed at New Delhi in January 2005 wherein areas such as life style diseases, public health & disease surveillance have been identified for collaboration. An exploratory visit by Indian experts in the field of 'Life Style Diseases' visited Canada in October, 2005.

The collaboration under this mechanism is likely to be increased in the next plan. A Joint Steering Committee co-ordinated by IHD in scheduled to meet in 2006.

- d. An MOU for south-south collaboration has been signed between the MRC (South Africa), FIOCRUZ (Brazil) and ICMR to work together on health issues of mutual importance in the forthcoming five year plan.
- e. For the following Indo-US Joint Statements signed recently by the Ministers of Health of India and Secretaries, DHHS, USA, the ICMR plays a role of nodal agency :

**Joint Statements & Subject Areas**

- Indo-US Joint Statement on HIV / AIDS
- Indo-US Joint Statement on Maternal and Child Health and Human Development and Research
- Indo-US Joint Statement on Environment and Occupational Health
- Indo-US Joint Statement on Emerging and Re-renewed in June, 2005
- Emerging infectious diseases in (signed in Nov. 1997) and expanded in Nov. 2005
- Meeting of ICMR-NIH Policy Forum on Biomedical Oct. 2000 Research

**f. Other MOU**

Indo-US MOU between MOH, ICMR & IAVI.

As a follow up of these Joint Statements, the meetings Joint Working Group (JWG) are organised in India and USA to determine future plans, priorities and proposals for further Indo-US collaboration. Further activities are likely to be enhanced in the coming years.

The ICMR also takes part in the implementation of the following agreements for bilateral collaborative research in Medical Sciences:

- i. Indo-Russian Working Group on Science and Technology coordinated by the Department of Science and Technology (Department of Science and Technology) Ministry of Science and Technology (DST), Govt. of India, New Delhi. In accordance with a decision of the 4<sup>th</sup> meeting of the Indo-Russian Working Group on S&T held in Nov. 1998, a Sub-Working Group (SWG) on Medical Sciences was set up with Director-General, ICMR, as a co-Chairperson. Ist session of Indo-Russian SWG was held in New Delhi on 12/1/2000 wherein modes of cooperation and 12 areas namely, immunology, epidemiology, biophysics, biochemistry, clinical genetics, haematology, oncology, endocrinology, cardiology, vaccines, maternal and child health and malaria for joint collaboration were identified. As a follow up, an Indo-Russian Symposium on Immunomodulators and 2<sup>nd</sup> meeting of SWG were held in Moscow during

11-15<sup>th</sup> August, 2002. The mutually suitable dates/venue of the next workshop & SWG meeting remain to be finalised.

- ii. In addition to above, ICMR also participates in joint bilateral discussions in advisory capacity for collaborative research in the field of biomedical sciences under various agreements operated and coordinated by the Department of Science and Technology, Ministry of Science & Technology, Govt. of India such as Indo-Japan, Indo-Vietnam, Indo-Hungarian, Indo-Italian, Indo-Bulgarian, Indo-Myanmar, Indo-Argentina, Indo-Slovenia, Indo-France, Indo-Malaysia, Indo-China, Indo-EC and Indo-Uzbekistan Joint Committees on Science and Technology as well as with the Ministry of Health & Family Welfare, Govt. of India for Indo-Cuba and Indo-Mozambique Joint collaboration in medical research.
- iii. Under other agreements signed by the Ministry of Health and Family Welfare such as Indo-Cuba, Indo-Mozambique, and the IHD co-ordinates activities for medical research which are likely to be increased during the next plan.

The IHD provides inputs/suggestions from time to time on various issues to technical Divisions dealing with these Joint Statements.

In a large number of these agreements, MOUs, Joint Statements, projects are being/will be undertaken in which the Indian components of the studies are being funded by the ICMR. The number of jointly funded projects is likely to increase.

### **ICMR Awards / Prizes**

Indian Council of Medical Research (ICMR) is one of the oldest medical research bodies in the world. It not only is the apex body to encourage and coordinate medical research in the country but also recognizes the contributions made by the biomedical scientists in various fields by rewarding them with the Awards and Prizes every year.

ICMR gives a total of 37 awards including the prestigious Dr.B.R.Ambedkar Centenary Award for Excellence in biomedical sciences. Majority of these awards are annual while few are on alternate years. Some of the ICMR awards are exclusively for women scientists, for underprivileged communities and for researchers working in the under developed areas. Certain awards are for young scientists below the age of 40 years. ICMR awards are advertised in national newspapers and widely publicized in scientific journals of the country in addition to being displayed on the ICMR website. Many new awards are also instituted from time to time.

### **Scientific Advisory Committee – Overseas**

With the aim of involving Indian diaspora in the health sector of our country, the IHD has taken a lead to constitute a Scientific Advisory Committee – Overseas. In this Committee, the eminent scientists of Indian origin advise the Indian scientists on issues like utilisation of advanced technologies in our country as well as on the mechanism of interactions and collaboration



between scientists of Indian origin and scientific organisations in India. The possibility of scientific collaborations by writing joint research proposals and hands-on-training opportunities for this purpose are to be discussed in order to develop sustained linkages between NRI medical research professionals and their counterparts in India. The Council will bear the club class airfare and local hospitality for the overseas scientists. The scheme will be fully operational in the coming years.

## **New Capital Works – 11<sup>th</sup> Plan**

### **Tuberculosis Research Centre (Rs.11.75 Cr)**

#### **Construction of a patient care research facility at the TRC Unit at the Govt Rajaji Hospital Madurai**

The TRC has a satellite unit at Madurai for the conduct of its clinical trials. This unit is functioning out of a cramped location on the first floor of the Thoracic unit of the Govt Rajaji Hospital Madurai. The Unit handles over 200 out patients a day and has facilities for investigations for pulmonary TB on a limited scale. Although all clinical activities are carried out the centre the establishment of full fledged laboratory to support the clinical studies has been difficult for want of space. It is now proposed to expand this facility by building a new 2 story clinical care facility that will be extensions of the existing building. Preliminary discussions with the hospital authorities have been held and they are supportive of the idea and will permit the construction. The proposed facility will house examination rooms, counseling rooms and facilities for setting up full fledged laboratories to support the clinical trials.

#### **Construction of a research facility at Tiruvallur to support rural health oriented studies**

The TRC is planning to start several studies to understand the links between poverty and communicable diseases such as tuberculosis especially when they occur in rural settings. The TRC Unit at Tiruvallur is ideally located to carry out the studies and with its advantage of having studied the population in the surrounding rural area for nearly four decades. It is now proposed to set up a research facility at the Tiruvallur unit that will consist of research laboratories, office space with laboratory and training facilities.

### **Central JALMA Institute for Leprosy & other Mycobacterial Diseases (Rs.8.47 Cr)**

#### **Renovation / Modernization of Office**

The office needs to be modernized with computerization for linking, monitoring of the progress and optimization of working within the resources available. The infrastructure needs to be modernized with modular furniture in the office for proper utilization of the space available which presently has become full with the almirahs.



### **Security wall, water harvesting & landscaping & maintenance of laboratory blocks**

The Institute has a big campus of which 2/3rd area is developed. The old wall is falling off at several places and some of the areas are not fenced. Further, for healthy functioning, proper landscaping, gardening and conservation of the water is must. In addition, water tanks needs to be created to handle any fire eventualities. As such this estimate must be approved.

### **Upgradation / Renovation of Hostel**

The Institute is undertaking Human Resource Activities in the form of research and guidance to young students and scientists (M.Sc., Ph.D., MD, etc.). The guest house constructed by the Japanese has to accommodate large number of visitors. Present small hostel is able to accommodate only 5-10 students. At a given point of time 40-100 students are working in the Institute. In view of the increasing demand, the present hostel needs to be renovated and extended by addition of two-storeyed building with 50 rooms as a part of one-time modernization of the institute.

### **National Institute of Cholera& Enteric Diseases (Rs.16.79 Cr)**

#### **National Institute of Virology (Rs.21.18 Cr)**

- Centralised Animal Breeding facility
- Repair Staff Quarters
- Renovation of Labs
- Utility services at NIV
- Lab. Building with GMP condition
- New Lab Building with furnishing
- Purchase of 100 acres of land for future expansion of NIV

#### **Microbial Containment Complex (Rs.9.81 Cr)**

- Verticle extension of compound wall
- Utility services at Pashan
- Students Hostel Building 2nd & 3rd Floor
- BSLIII & IV with Primary Health Centre
- Canteen recreation facility
- Teaching and training facility
- Faculty guest house
- Maintenance block

### **National AIDS Research Institute(Rs.9.08 Cr)**

#### **Guest House and Student Hostel**

The Institute runs a number of collaborative studies, both nationally and internationally. Also being a nodal Institute for research in HIV and AIDS we receive many dignitaries and distinguished scientists. The Institute is also expected to play important role in providing advanced training to Doctors, researchers etc. Presently the Institute does not have Guest House facility and Trainee Hostel. We utilize the facilities including hotels in the neighbour hood of the Institute. This involves a lot of logistic issues. Having a facility on

the campus is hence essential. Hence it is proposed for construction of building for accommodating 8 numbers of suits and 20 trainee hostel rooms. The total floor area of construction will be 3600 sq. ft.

### **Clinical Trial Center**

NARI has undertaken many observational studies and clinical trials in the past 13 years. We are planning to undertake many new studies and clinical trials in the field of ART, Vaccines and Microbicides. At present there are 7 NARI clinics located in different areas of Pune that are working for screening, enrollments and follow up of study participants. They are scattered and patients have to move in different clinics for various procedures. The sample transfer to main NARI laboratory for various tests like HIV serology, CD4 count, viral load, drug resistance etc. also becomes difficult because the samples from all 7 clinics have to be collected. The transfer requires lot of transportation, temperature maintenance in the vehicles etc.

If we have a single clinical trial unit, with vaccine, microbicide and ART units under one roof it will be beneficial in following ways:

- Patient's convenience
- Sample transfer will be very easy
- The staff requirement will be less as management will be easy
- Common facilities will be utilized by various clinical trials will be cost effective and efficient utilization of resources.

It is propose to build clinic in the city area so that it will be convenient for the patients to approach for clinical care and diagnostic tests and will have capacity to undertake clinical trials. The clinical center will have sufficient floor space with state of the art facilities.

### **New laboratory Block**

Building third floor on the new Building and connecting it with old Laboratory block. The laboratory space available at present is not adequate. We have provision to build one more floor on the new administrative block. It is proposed to build the third floor on the administrative block and connect it to third floor of old building through a bridge. This way the new laboratory space could be connected to laboratories in old building and also sequestered from administrative offices. The new space will be utilized for developing pharmacokinetics laboratory, central instrumentation room and other research laboratories. Drug resistance testing laboratory and molecular virology laboratory from old block will be shifted to new space.

### **Modernization of Freezer Rooms**

NARI is having 6 nos. of walk in  $-20^{\circ}$  freezer rooms for storage of plasma, serum samples and reagents. These  $-20^{\circ}$  freezer room are working since more than 14 years, and recently under breakdown due to wear and tear. The average life of the plant is around 15 years; which were installed in 1992. These plants are designed for hot water defrosting. The refrigerant R-22 gas in the plant is costlier and will be banned in near future by the environment department. Hence it is essential to modernize 6 freezer rooms with air cooled condensing system and freezer gas.

### **Modernization of Central Air conditioning system**

The existing Central AIR condition system with 240 ton capacity is old and breakdowns are common due to passage of 14 years. Consequently the maintenance of air conditioning system is high and it is uneconomical to run this system. Therefore it is proposed to install sophisticated package type units that consume less electricity. The new unit proposed is of Voltas make compact unit or similar configuration.

### **Small Animal House**

The Institute is going to undertake activities related to the anti-retroviral treatments and development and testing of the anti-HIV vaccines. Both these are crucial activities and require animal experimentation for toxicity and immunogenicity studies for new drugs and vaccine candidates. It is proposed to set up a small animal house that will hold the experimental animals. Another Institute under ICMR, National Institute of Virology is located in the same city and has an animal house with breeding facility as well as facility to conduct experiments in large animals. Considering the costs involved in the animal house construction NIV facility will be utilized for large animals. However, a new facility for small animals is requested at NARI campus in Pune. It is not practical to use NIV facility for small animals due to logistic reasons. The two institutes are about 15 KM apart with rather chaotic traffic. This facility will also be useful for basic immunology and microbiology studies, for raising antisera and to raise monoclonal antibodies. There is sufficient space in NARI campus to house the animal house.

### **Enterovirus Research Centre (Rs.19.53 Cr)**

#### **Construction of Enterovirus Research Centre's new building at Haffkine Campus, Parel, Mumbai**

A plot measuring 1826 sqm has been purchased at Haffkine Campus in Mumbai. An amount of Rs.2.46crore is paid to the Government of Maharashtra. Due to some difficulties the possession of land and initiation of construction has been delayed. This laboratory building housing BSL-2 and BSL-3 facilities, library, animal house and also the administrative block needs to be completed. The presently occupied area at Haffkine will then be handed over to the Haffkine Bio-Pharmaceuticals Corp. Ltd.

This new structure is absolutely essential for functioning of ERC in the 11<sup>th</sup> Plan period and beyond. In the absence of the new laboratory building the contribution of ERC towards polio eradication program would be seriously compromised. High containment laboratory for wild poliovirus research and wild poliovirus repository/ virus bank, at Pashan, Pune.

A new MCC complex of National Institute of Virology has become fully operation at Pashan, Pune. The Enterovirus Research Centre has a large collection of wild poliovirus (strains) isolated over the past 4 decades. In addition the centre has a large collection of Enterovirus isolates in its bank. When polio eradication is achieved in India, this collection of virus strains will require high containment facility for safe-keep. Importantly, any research work required to be done using wild poliovirus strains will have to be

performed under strict bio-safety norms in-force in the future date It is therefore proposed that a high containment BSL3/polio facility be created for the Enterovirus Research Centre at the MCC, Pune.

#### **ICMR Virus Unit (Rs.1.38 Cr)**

- Cost of land for new building
- Construction of new 2-storied building
- Shifting of laboratories and
- Modernization of office
- Modernization of laboratories
- Establishment of animal house
- Security wall, water harvesting, landscaping, maintenance of institute building

#### **National Institute of Malaria Research (Rs15.07 Cr)**

##### **Construction of MRC Building Complex at Pappankalan, Dwarka**

At present NIMR is functioning from four different places in Delhi/NOID which include two rented buildings. It causes hardship in coordination and smooth functioning of scientific activities. Due to rapid development of modern technologies there is strong need to have upgraded laboratories to keep pace with latest trends. Therefore, the foremost requirement of NIMR is to have its own building complex for better organization and efficient output. Sincere efforts made in this direction have resulted in finalization of the contract for construction of Research Block which is likely to be completed by June,2007. In addition NIMR needs an Animal House for laboratory experiments and also for mosquito colonization, mosquito feeding experiments, testing of antimalarial compounds, maintenance of rodent, avian and mammalian malaria parasites etc. NIMR is an Institute of international repute frequently engaged in organizing national / international conferences, training courses and workshops. Many eminent scientists and research scholars visit the Institute for collaborative research and for specialized trainings. Therefore, an auditorium, international hostel cum guest house are essential for above mentioned activities. Besides Director's residence it is proposed to have residential buildings in the campus for housing some staff in A,B, C and D categories for better functioning and maintaining essential services. The site plan for above mention buildings has already been approved by Delhi Urban Arts Commission and DDA.

- Research Block
- Animal House
- Auditorium
- International Hostel & Guest house
- Director's residence
- Type 2B Housing
- Type 3C Housing
- Type 4D Housing

- Type 5E Housing
- Servant quarters
- ESS ( Electrical sub station civil work)
- Development of sites
- Sub station works( Electro-mechanical work)
- DG Set (2 x 500 KVA)
- Room for liquid nitrogen plant
- Maintenance of Building complex

#### **Vector Control Research Centre (Rs.6.81 Cr)**

- Acquiring existing lease land on outright purchase
- Construction of Library Building and auditorium
- Construction of third floor for invitro and invivo screening of plant extracts/synthesis compounds and animal experimentation laboratory
- Conversion of Health and Fitness room into fully furnished canteen and dining room
- Provision for passenger lift with necessary civil work
- Acquiring land and construction building for HRD training centre including students hostel, Guest Room and Quarters for warden
- Provision of access control in important laboratories

#### **Rajendra Memorial Research Institute of Medical Sciences (Rs.10.73 Cr)**

##### **Proposed budget estimate**

1. *Construction of quarters*  
The oldest Group "D" quarters is under process of demolition. These quarters will be replaced by some new quarters.
2. *Training centre*  
This institute is well recognized at international level for kala-azar research and clinical trials. This institute is under process of recognition by various universities for Ph.D. So, there is a need to establish training centre to cater the need of various Ph.D. students working in this fields. Auditorium, seminar and meeting rooms of new and existing building should be equipped modern slide projection facilities like computer base slide projector, conference facility in video camera, audio visual set up, computer generated display board.
3. *Renovation of quarter*  
This institute is presently having 55 numbers of quarters, which were renovated in the year 2001 and will require renovation again in the 11<sup>th</sup> five year plan.
4. *Renovation of Block A, B, C & D*  
These non-residential buildings will require one-time renovation in the 11<sup>th</sup> Five-year plan.
5. *Establishment of Bioinformatic Centre*  
It is proposed to establish Bioinformatic Centre at the Institute, which will require space provision, High speed Server with ISDN Internet connection and other relevant facilities.



Bioinformatics is a field which uses computers to store and analyze molecular biological information. Bioinformatics can then solve problems of molecular biology, predict structures, and even simulate macromolecules. Bioinformatics may be used to describe the computers for the purpose of molecular biological work. The most well-known application of bioinformatics is sequence analysis. In sequence analysis, DNA sequences of various organisms are stored in databases for easy retrieval and comparison. Computers are also used to collect and store broader data about species. This information can be used for a number of applications, including tracking changes in populations and biomes. There are many other applications of bioinformatics, including predicting entire protein strands, learning how genes express themselves in various species, and building complex models of entire cells. As computing power increases and our databases of genetic and molecular information expand, the realm of bioinformatics is sure to grow and change drastically, allowing us to build models of incredible complexity and utility.

Researchers have to study the genetic sequence of various organisms for which they take help of the Basic Local Alignment Search Tool (BLAST) of Medline. However this is also not sufficient for research. Since the institute has no Bioinformatics Division, the scientists usually face immense trouble in doing sequence analysis, analyzing protein strands of various organisms etc. Hence a separate division of Bioinformatics is required for this institute as the volume of research is increasing day by day.

#### **National Institute of Medical Statistics (Rs.5.01 Cr)**

- The new building for Cancer Registry
- Wing for National Clinical Trials Registry
- Wing for the IDSP Survey
- Development of Human Resource Centre
- Convention Centre
- International hostel for training at NOIDA

#### **National Institute of Epidemiology (Rs.7.72Cr)**

##### **Centre for Research in Medical Entomology (Rs.3.65 Cr)**

##### **Institutional Building**

The CRME is at present housed in a residential building with only 3600sq.ft. of area. This is a residential accommodation, modified to laboratories. There is no proper animal house, tissue culture laboratories, contamination free labs, etc. which are absolutely essential for doing research in frontier areas in modern biology, epidemiology and control of vector borne diseases. The need for separate animal house was strongly recommended by the 16<sup>th</sup> & 17<sup>th</sup> SAC of this Centre. This is essential to become self sufficient for production of antigens and MAbs required for studies on dengue and JE. The CRME conducts training courses for public



health workers sponsored by national and state health departments. There is no proper accommodation for these trainees, and hence hostel facilities are necessary. In the 11<sup>th</sup> Five Year Plan provision has to be made for adequate modern laboratories, hostel facilities and guesthouse. There are visiting scientists, for whose stay, the CRME does not have any guest houses/rooms. Therefore, in order to accommodate all these requirements and to build a modern laboratory, a building with about 90,000 sq. ft (10,000 sq. m) of laboratory space is needed which has been proposed in the 11<sup>th</sup> Five Year Plan. The CRME has to acquire land and take up construction of staff quarters, insectary and hostel facilities including guest rooms.

The major constraints repeatedly faced are with supply of antigens and specific monoclonal antibodies for our studies. We external sources have to be depended upon for these materials. This problem has been put forth in 11<sup>th</sup> SAC at CRME. Based on the suggestions, we are submitting a protocol with the following objectives to be included in the 11<sup>th</sup> five year plan document for funding from ICMR.

### **Objectives**

- To create infrastructure facilities at CRME, Madurai for Animal House maintenance for production of JE/Dengue – antigen – mouse brain
- To carry out permitted animal experiments (a) raising of immune sera
- To generate hybridoma for monoclonal antibody (MAB) production against JE and dengue viruses

### **Animal House**

Animal house will be established fulfilling the following criteria to maintain mice colonies, rats, rabbits, guinea pigs, monkeys, chicken, goose and mosquitoes. The animal house will be suited away from the laboratory or in a location separate from the laboratory which is reasonably free of smoke and noise and will have sufficient place for service units.

### **Regional Medical Research Centre (Rs. 2.82 Cr)**

#### **Expansion of office and lab space**

With the expansion of the activities of the Centre including the activities as part of the WHO Collaborating Centre, an acute shortage of laboratory and office space is being felt. During the 10<sup>th</sup> plan period several sophisticated equipment including Automated DNA Sequencer have been procured and several new laboratories had to be set up. A proposal for expansion of the building was made during 10<sup>th</sup> plan. However, it has not yet been sanctioned. In view of this, it is proposed to undertake capital work for expansion of the building in 11<sup>th</sup> plan.

### **Regional Medical Research Centres (Rs. 4.80 Cr)**

#### **Construction of two-storied building adjacent to existing Lab-cum-Admn. building for OPD service and indoor beds**

For more effectiveness of clinical research activities through intramural and extramural activities of the Centre, it is required to have an OPD service and

indoor beds facilities for patients for undertaking clinical trials with newer drugs that requires direct supervision of cases by researcher. In local hospitals no space available to cater to research bed. The Centre has undertaken clinical drug trials on filariasis at Capital Hospital temporarily. There is no existing vacant-built-in space for undertaking such clinical trials with in the Center's building. Hence, provision of OPD and 25-bedded indoor facility for clinical research activities is essential. Thus, one block of two storied building is proposed to be constructed adjacent to Lab-cum-Admn. building for OPD service in the ground floor and indoor beds in the 1<sup>st</sup> floor. Since this centre has been recognized by WHO for undertaking clinical trials with new antilarial, expertise and cases are available, hence this facility will augment the clinical research activity in filariasis and other diseases of importance in this region.

#### **Sinking of two numbers 150 mm diameter deep tube well including installation of submersible pump sets and other electrical installations**

The Centre is having only one deep tube well for the residential area and the water discharged by it, is inadequate to fill the sump within a reasonable time for lifting the water to over head tank. Besides, there is no arrangement of supply of water to office building except water supply by Public Health Department of Govt. of Orissa. Further, animal house of the Centre under construction is in the extreme corner of the campus and due to its far distance from the main water source, the pressure of the water at that point i.e., less and inadequate. Hence, one deep tube well for residential area and office building and another for animal house are essentially required.

#### **Installation of fire extinguishers at RMRC Lab-cum-Admn Building**

Safety of Lab-cum-Admn. Building against fire.

#### **Construction of Type-III Qrs. in the half constructed Type-III block**

Currently there are 102 permanent staff strength in the Centre & 58 quarters constructed in Campus. According to the demand of the staff and review of requirement made by the Centre, construction of 3 nos. Type-III quarters are required to complete the half constructed (3 nos.) quarters in the Type-III block.

#### **Installation of 380 KVA Generator along with all electrical instillations**

Presently, the Centre is having only one 62.5 KVA Generator set which was purchased 20 years back. The same is used during power failure and the power generated by the existing generator is not sufficient to manage the load required for various equipments/instruments in different laboratories/cold rooms. Further, there is a provision for laying cable from the Generator set to street lights,

Pump houses for use at the time of power failure. Hence, the existing generator will not be sufficient to manage the above requirement and requires a Generator installation of 380 KVA capacity.

### **Construction of Generator shed for installation of 380 KVA Generator set**

One Generator shed is required for installation of above 380 KVA Generator set

### **Laying of water connection pipes from deep tube well to water sump of Lab-cum-Admn Building**

Water supply by PH Deptt. of Govt. of Orissa is the only source of water supply to Lab-cum-Admn. Building. The same supply is irregular, inadequate and not dependable. Hence, there is a proposal for laying water connection pipe from deep tube well of residential area to water sump of Lab-cum-Admn. building for non interruption of water supply.

### **Special repair/renovation of sewerage line and septic tank**

The sewerage line & septic tank in the campus were constructed 20 years back at the inception of the Centre, which are presently damaged due to normal wear and tear. This requires repair/renovation.

### **Construction of RCC over head tank 50,000 lit. Capacity**

The existing three storied Lab.-cum-Admn. Building is planned for construction of two more floors and after its completion, the existing water supply through pump set will not be feasible to lift the water to the fifth floor. Hence, one RCC over head tank 50000 lit. Capacity is required for construction for Lab.-cum-Admn. Building.

### **Special repair of laboratory**

The laboratory was built in 1990. The available laboratory benches and tables are very old and obsolete. The laboratory made 20 years back did not have facility to cater to current need required to apply modern technologies that need to be updated. No major replacement undertaken since last 20 years. Therefore the experiments related to modern biology may not give reproducible results of international standards. Now in the 11<sup>th</sup> plan most of the researchers has given proposals related to genomics and proteomics which requires a clean dust free working environment. For all these works modernization of laboratories with appropriate flooring, roof, modular working benches, adequate lighting, dark room facility, facility for training and demonstration are essential. To equip with modular furniture, compactor for keeping books, CD, 15 computers etc. with networking and connecting to digital printer, automation of the library with web OPAC.

### **Regional Medical Research Centre for Tribals (Rs.5.18 Cr)**

- Capital and other works
- Provision of tiles in the corridor passage in RMRCT main building
- Construction of maintenance house
- Construction of library building
- Construction of guest house with infrastructure
- International guest house (20 rooms)
- Construction of air-conditioned OPD block as clinical unit with 30 bedded indoor facility for clinical trials
- Construction of administrative block
- Construction of additional floor main building

- Tribal museum/huts
- Air-conditioning of the laboratory building (central A/C)
- Fish tank
- Landscaping and development of unused land
- Pest control unit
- Repository

#### **Institute of Cytology and Preventive Oncology (Rs.8.50 Cr)**

- Auditorium
- Research-cum training hostel
- Cafeteria for 24 hrs canteen
- Animal test research lab
- HPV vaccine lab with BSL III/IV facility
- Furniture and fixture
- Residential quarters (Sector – 35)

#### **Regional Medical Research Centres (Rs.4.73 Cr)**

- Research and Training facilities (laboratories, lecture theatres, hostel for trainees)
- Residential quarters
- Corridor between existing Block A & Block B
- Improvement of existing drainage system and water supply
- Infrastructure strengthening (air conditioning, refrigeration, electrical substation, transformer, diesel generator etc)

All the works under `Capital` head are required to be done as a central facility. Some of these constructions (2 nos. of laboratory blocks under a) were committed in earlier plan periods but due to various operational problems these could not be undertaken. Construction of Training complex including trainees hostel, training facilities (under a), up gradation of the animal house, corridor between Block A & B, improvement of drainage system and infrastructure strengthening (c,d,e,f) are envisaged as new activities under 11<sup>th</sup> plan.

#### **Research and Training facilities**

The original laboratory building which was proposed as multistory single unit was not permitted due to the nearness of the centre to the Dibrugarh airport. Instead, the laboratory building was approved for construction as 3 different low height blocks. So far, only the first unit has been completed and is operational. The construction of remaining two units has been delayed due to various operational reasons. These two units laboratory units have to be built immediately to start full-fledged laboratory work. Further, RMRC, Dibrugarh is hosting many training programmes for doctors, paramedical staff, students etc. in various fields as a commitment towards human resource development. Most of the time a problem is faced for accommodating trainees at one place as there is no such facility nearby. Therefore, a hostel for accommodation of about 30 trainees at a time is essential. In addition, substantial number of theory classes and entire practicals for M.Sc. (Biotechnology) course of Dibrugarh University are also

conducted in the centre. For these purposes a good infrastructure including lecture halls, class rooms and laboratory practical facility is needed.

### **Construction of residential quarters**

Activities of RMRC, Dibrugarh are spread over 8 north-eastern states. Staffs while deputed for field activity do not want to leave their family members in the town/ out side the Campus due to the prevailing situation in NE region and always look for accommodation within the campus. Staff members of RMRC, Dibrugarh face many problems accommodating themselves in rented house. Work suffers when staff members while on tour/field duty feel insecure for the safety of their family members. Therefore, the staff quarters more than the normal allowable limit are essential for this centre in view of prevailing law and order situation. In view of this, 4 nos. of Type V quarters and 8 nos of Type IV residential quarters are proposed to be built in phases during the 11<sup>th</sup> plan.

### **Provision of corridor between Block A & Block B**

There is no link between the existing Administrative Block (Block A) and the Laboratory Block (Block B) and one has to commute under the sky for going from one building to another. The movement between these buildings becomes very problematic especially during rainy season and in Assam it rains most part of the year. Therefore, it is essential to have a proper covered corridor to link these two buildings.

### **Improvement of existing drainage system and water supply**

The centre is situated in low land as a result the drainage system is faulty and water does not get drained out easily during rainy season. Due to the faulty drainage system the centre witnesses flood almost every year. The residential quarters and laboratory areas get inundated every year during monsoon. In the year 2004 the Campus was under 2-3 feet water for several days causing severe difficulties and loss to the Govt. property. Therefore, the existing drainage system need to be improved immediately. Further, the water supply of the Campus needs augmentation by way of installing a new deep borewell along with submercible pump.

### **Infrastructure strengthening (Air conditioning, refrigeration, electrical substation, transformer, diesel generator etc.)**

Air conditioning, refrigeration, electrical substation, transformer, diesel generator etc. are part of the civil construction and electric connection required for a well equipped research laboratory.

### **Desert Medical Research Centre (Rs.2.67 Cr)**

The work order for construction of building of the Centre has since been placed. The cost of construction has been estimated to Rs.15.00 crore. A provision of Rs.10.00 crore has been made in the financial year 2006-07 and hence balance of Rs.5.00 crore would be required in the financial year 2007-08 i.e., first year of the 11<sup>th</sup> Five yearly Plan and subsequently Rs.0.40 crore for maintenance. Hence, a sum of Rs.5.40 crore has been proposed.



## **National Institute of Occupational Health ( Rs.6.98 Cr)**

### **Upgradation and Modernization**

- Upgradation of the existing laboratories, along with the renovation of the main and Annex building at NIOH (this includes a generator room & generator, lifts for main and extension building, central air-conditioning, electrification and rewiring of the laboratories)
- Well-equipped mobile laboratory facility at NIOH and ROHC (E & S)
- Animal house, at NIOH
- Extension of the existing auditorium and civil work for additional conference/committee/faculty & guest rooms on the upper floor of the auditorium
- Guest house-cum-international hostel at NIOH
- Common hostel facilities for ICMR at ROHC (E)
- Upgradation of laboratories at ROHC (E)
- New building and laboratory facilities at ROHC (S)
- Internal roads, compound walls, gardens, gates, garage, parking and lighting of the NIOH premises

### **New Building (80,000 ft) to house new laboratories at NIOH**

With the changed scenario in the field of occupational health and safety it has been felt necessary that the NIOH takes greater research thrust in selective areas of importance namely, molecular biology, applied ergonomics, control technology and engineering services, cognitive science laboratory, pesticide toxicity laboratory, tobacco research laboratory, poison information services, cognitive science laboratory, early occupational disease detection facility and information & communication unit. Due to the extreme lack of laboratory space in the existing NIOH premises, a proposal is made to undertake new building construction (centrally air conditioned) dedicated to house selective state of the art centres and laboratories as mentioned above and initiate advanced studies. The four storied building can accommodate nine new laboratories and the basement will be utilized to establish the new control technology and engineering centre. A new control technology and engineering center at NIOH will be established to undertake variety of intervention studies and prototype development of products, devices and control structures.

### **Extension of Auditorium and Conference Halls/Meeting Rooms at NIOH and Seminar and Class Room at ROHC(S)**

The institute proposes to extend and renovate the existing auditorium building. At present the institute has only one small conference room. In order to prepare the institute, to undertake future programmes like national and international conferences, it is timely that this auditorium building is converted to a composite convention center to house a large auditorium, two new conference halls and four small committee rooms. The facilities of the auditorium will be equipped with the state of art audio-visual equipment, furnitures and interiors and central air-conditioning etc. The total complex will have approximate floor space 15000 sq. ft.



The new ROHC (S) building is coming up, to extend its activities in occupational health and industrial hygiene in Southern Region of the country. There will be need to establish seminar and class room facilities to undertake various training programmes and meetings etc. The proposed expenditure required for furniture and audio-visual equipment.

### **Construction of Guest House and Training Hostel at ROHC(E) and Extension and Renovation of existing Guest House at NIOH**

National Institute of Cholera and Enteric Diseases, Regional Occupational Health Centre, ICMR Virus Unit and NNMB (Nutrition Centre) situated in Kolkata. ROHC(E) is centrally located in newly built up Salt Lake area having extra space for building up common hostel facilities for ICMR. This guest house facility will be utilized jointly by the ROHC (E), National Institute of Cholera and Enteric Diseases and other above centres for their various programmes on occupational health, enteric diseases, bio-technology and molecular biology, nutrition covering South East Asia Region. This will consist of facilities for lecture rooms, library, committee rooms, student hostel, guest house (for visiting faculties), informative wing including internet facilities, computer facilities, study room and rooms for interaction in small groups. These facilities are not available in this region and other ICMR institutes in eastern region may utilize these facilities also. This is a centrally placed organization having space available for making this arrangement. These facilities will also be useful for organizing scientific meetings, workshops, seminars etc. Therefore such facilities is very much required at ROHC(E), Kolkata.

The old guest-house of NIOH has been constructed about 20 years back and the bed capacity is very limited. The plasters and sanitary fittings are damaged, for which renovation is badly required. In view of the fact that the institute has been engaged in different training programmes from time to time, additional bed capacity will require complete renovation of the existing guest house facility to accommodate at least 50 beds is required. Cost includes civil construction and furniture and fittings.

### **Institute of Immunohaematology (Rs.6.29 Cr)**

- Training facilities (library, laboratories, lecture theatres)
- Administrative block
- Recreation Hall and Canteen
- Animal house
- Trainees Hostel/ Guest House
- Residential Quarters Type - III
- Air conditioning, refrigeration, electrical substation, transformer, diesel generator, etc
- Building 4 floors over 13<sup>th</sup> floor of KEM Hospital

### **Institute of Pathology(Rs.5.40 Cr)**

New building to be constructed for

- Residential flats for staff
- Annex for housing new facilities and expansion of existing laboratories

The Institute of Pathology in recent times has expanded its research activities into new research areas in molecular pathology like Leishmaniasis (*Kala-azar*) and Chlamydiasis, molecular aspects and genetics of tumor biology, Environmental monitoring of major pollutants and adult stem cell research. The institute has also procured sophisticated equipment like Confocal Laser Scanning Microscope, Flow Cytometer, Electron Microscope, Micro-array Scanner, Real Time PCR and is in the process of procuring DNA Sequencer and Gas Chromatograph-liquid Chromatograph-Mass Spectrometer and other big equipment. In addition to the existing Cell Culture laboratory three more cell and tissue culture laboratories have been created in the existing space. Moreover, with a sweeping rise in extra mural fund raising and simultaneous academic activities like Ph.D. and DNB programmes there has been tremendous increase in student strength. As a result of the increased research and academic activities the crunch of availability of space has become a very serious limitation to the ongoing and future plans of research.

In view of these recent developments, we have approached the Medical Superintendent of Safdarjung Hospital for a possible shifting of their two departments from our building and provision of space for our animal house. However, the MS has expressed his inability in this direction. Keeping our sudden developmental activities and space limitation in mind, we would like to make a proposal for acquiring fresh land and constructing facilities like modern Tissue Culture laboratory, Electron Microscopy laboratory, Animal House etc.

### Regional Medical Research Centre (Rs. 2.01 Cr)

#### Construction of Main Laboratory & Administration Building

**Justification:** The proposal to set up RMRC, Belgaum was included in the 7<sup>th</sup> Plan and land was acquired. In the initial stage residential quarters were constructed and the construction of main laboratory and administration building is yet to be undertaken. The estimates for main building is already submitted by State PWD. Considering the mandate and goals of the Centre, it is essential to construct main laboratory and administration building as proposed earlier, so that necessary infrastructure is fully established to carry out the research activities and to achieve the mandate of this Centre.

#### Animal House

**Justification:** The mandate of the Centre is scientific validation of Herbal Medicinal Products/Traditional Medicine. For this purpose, it is essential to look into toxicological aspects as well as to determine mode of action of herbal products. Furthermore, animal models will have to be utilized to assess the biological efficacy before conducting human studies. In view of this, it is essential to construct a state-of-the-art animal house for maintaining mice, rats and rabbits. The animal house will be designed and maintained

as per the requirement of CPCSEA. It is decided to construct animal house away from main building for the safety of animals as well as staff.

#### **Electrical Sub-station up gradation**

**Justification:** At present RMRC Campus has 160 KVA capacity dry Transformer with 75 KV power connection. RMRC is proposing to construct main Laboratory and office complex (2007-08) in order to achieve the mandate of the Centre. The Main building will have sophisticated lab facilities along with state of the art fully Air-condition auditorium and Animal House facilities which will require at least 500 KVA capacity transformer. Therefore, it is proposed to install one 350 KVA capacity transformer in addition to the existing one.

#### **Electrification of Additional Land**

An additional land of about 4.3 acres was acquired by the Council in 1998. It is proposed to develop garden of medicinal plants for Research and Demonstration needs of the Centre. At present there is no electricity in this area. New cable has to be laid from ESS for street lights in this area.

#### **Landscaping of RMRC Campus**

**Justification:** RMRC is located in 24.7 acres of land. The main building and residential quarters are proposed to be in the area of 20 acres and the remaining adjacent area will be utilized for Herbal Garden. As RMRC is being developed as a National Research Centre focusing on Traditional Medicine, the institute needs at least moderate landscaping. Considering the vast area, it is proposed to beautify the campus in a phased manner.

#### **Pipeline for water distribution & sumps**

As proposed earlier, a 1.0 lakh litre capacity water tank is built by the State PWD. However, distribution lines are not yet laid down. At present borewell water is being used, as the consumption is limited. This will not be sufficient once the residential quarters are occupied and Main Lab building and Animal House starts functioning. Therefore, it is proposed to procure water from Belgaum Municipal Corporation and distribute the same throughout the campus from the water tank.

#### **Providing interlocking paver blocks for inside footpaths and to the parking area**

**Justification:** The campus of RMRC covers almost 25 acres of land. The campus is provided with a round shaped internal road, adjacent to which are footpaths. The internal road work has been completed by State PWD. In the original estimates, footpaths with mud were proposed. In the meeting held in February 2003, Sr.DDG(BMS), EE HQ and other Committee Members proposed providing footpaths using paver blocks.

#### **Covering the Storm Water drain with pre cast RCC slab**

**Justification:** The RMRC site is provided with open drains. These drains are fairly deep and are adjacent to footpath and hence needs to be covered. In view of this, the present work of covering the open drains with RCC slabs is proposed.

### **Greenhouse**

**Size:** 100 X 20 X 10 Feet.

**Justification:** As RMRC is working in the area of traditional and herbal medicine, it is proposed to develop a medicinal plant garden of selected medicinal plants of Western Ghats for demonstration and experimental purposes. Many of the medicinal plants, especially the herbs, are specific to their natural habitat and needs special environment (glass house) to cultivate them. The greenhouse provides the controlled environment suitable for the exotic herbal plants. The greenhouse facility can minimize the problems related to topography, soil conditions and climate conditions in cultivating medicinal plants. This allows the cultivation of medicinal plants at any time of the year. This facility will also help in the conservation of wild medicinal plants under different threat status and shall serve as gene bank.

- Control System - Fully Computerized / Weather Station.
- Galvanized Steel Construction.
- Special Aluminum locking and fastening profile for covering material.
- Bearing hanging load 25 - 30 Kg per Sq. Mt.
- Natural Roof and side wall ventilation system.
- UV stabilized covering materials.
- Cellulose Cooling Pad and Exhaust Fan System.
- Heating system in cold climate.
- CO2 Generator.
- Motorized Shading / Thermal Net.
- Micro Irrigation System.
- Fertigation System.
- Misting System.

### **National Institute of Nutrition (Rs.9.10 Cr)**

Library-cum-Auditorium - 1000 sqm/floor x 4 floors

### **National Centre for Laboratory Animal Sciences (Rs.2.87 Cr)**

Animal BSL3 containment area

Animal BSL 3 facility requirements for conducting studies with infectious or biohazardous agents

### **National Institute of Research in Reproductive Health (Rs.12.90 Cr)**

#### **Genetically Modified Animal Facility**

Diverse research projects dealing with understanding the mechanisms involved in reproductive physiology and health necessitate the use of animal models where human genes could be over-expressed or deleted. These genetically modified animals would help unravel gene regulation in vivo under physiological and pathological conditions. A number of candidate antigens relevant to fertility have been identified at NIRRH e.g. 80 kDa, 26 kDa, 57 kDa, R-17 etc. Animals manipulated at the loci for these genes will help deciphering the function of these genes.

Besides there is need to build up an in-house facility for Severe Combined Immune Deficiency (SCID) mice. These are immuno-compromised mice, the only *in vivo* available model and will be used for xeno-transplantation studies.

Ongoing projects that require genetically modified animals include: Regulation of c- kit expression in the testis, evaluation of functional viability of cryopreserved ovarian and testicular biopsies from monkey, sheep or human by xenotransplantation in SCID mice; and testing and characterization of human embryonic stem cell lines for pluripotency using SCID mice.

Genetically modified animal facility will be established over the existing institute building and will also be available to other national laboratories for experimentation.

### **Student's Hostel**

At present, there are 55 registered students working at the Institute towards their Ph.D./M.Sc. degrees of University of Mumbai in various research streams. The students are drawn from all parts of the country. Interestingly , female students out number the male students. The University has permitted the Institute to take up to 106 students. It is likely that during the next two years the number would increase to 80 students.

As the institute does not have hostel facility, non-Mumbai resident students face problems in finding suitable accommodation at an affordable cost in proximity to the institute, and spend substantial amount of their precious time in travel. By providing hostel accommodation the institute will be able to attract and retain a larger number of meritorious students.

It is proposed that this facility be developed over the existing building of the ICMR International Hostel building at Worli, Mumbai. It is projected that the construction of student's hostel would cost approximately rupees two crores.

### **Seminar Hall**

In recent years the research programmes, the number of scientists and supporting staff of the Institute have increased considerably, with no concomitant increase in building space. There is a need for a Seminar Hall to conduct regular scientific meetings, seminars, lectures, symposium. Towards this it is proposed to construct a Seminar Hall of approx. 6000 sq. ft. area to accommodate nearly 200 participants in the wing above the Animal House Block of the Institute.

### **ICMR Headquarters (Rs.3.10 Cr)**

Annex New Building

***(Details of budget allocations for new activities are given in Annex-4) ※***