

102ND INDIAN SCIENCE CONGRESS
3-7 JANUARY, 2015, MUMBAI

RECOMMENDATIONS OF SECTIONAL COMMITTEES
(AS RECEIVED FROM SECTIONAL PRESIDENTS)

AGRICULTURE AND FORESTRY SCIENCES

- 1) Development of soil health card, soil test kit, nutrient expert systems for efficient and appropriate management of natural resources for sustainable agriculture.
- 2) Enhancing irrigation efficiency, water use efficiency in irrigated crops through use of existing technologies, evolving new technologies and blending with ancient methods of on-farm water management.
- 3) Identification of new sources of resistance/ tolerant against drought, salinity, high temperature in the face of climate change in field crops as well as medicinal and horticultural crops is essential for future agricultural systems.
- 4) Private-public partnership for joint research projects in Network mode involving competent scientists and modern laboratories for enhancing and sustaining agricultural productivity, food security and human development.

ANIMAL, VETERINARY AND FISHERY SCIENCES

- NATIONAL CURRICULUM : SCA should play a leading role and ascertain that different universities / research institutions awarding UG, PG degrees and other diploma certificates should modulate and revamp courses keeping in view the need of the country. UGC / ICAR / ICMR, therefore, may be approached to formulate courses which have a relevance to national development. It has to be ensured that human resource being prepared is technically sound and worthy of competing well for employment at a global level.
- ANIMAL HUSBANDRY : There is a need that Animal Husbandry department of various agricultural universities and institutions make a shift from laboratory research to farm production. This shall become possible only when accessibility of farmers, dairy and poultry entrepreneurs is ensured to cross breed quality animal heads which otherwise has remained a long awaited dream.
- BIODIVERSITY AND BIORESOURCES : Biodiversity and Bio resources are natural gifts and as such natural heritage, therefore, need to be conserved for posterity. Any

damage to this entity, particularly faunastic as a consequence of process of development is disastrous and therefore deserves a redress and rehabilitation on the following lines:

A. All educational institutions, regional and national, be desired to

i. prepare inventory of biodiversity of their region

ii. concomitant efforts to develop knowledge about their biological aspects made for proper conservation.

iii. special activities to ascertain biochemical and pharmaceutical use be carried for future growth.

B. Rehabilitation of species affected by anthropogenic and natural disasters in the past be undertaken on the analogy of rehabilitation of human beings.

C. Sanctuaries, parks, museums and botanical gardens be given special attention and their educative value enhanced for awareness of society.

FISHERY : India being a peninsular state has a long coast line and therefore, a large continental shelf promising a healthy marine capture fishery. Added to this, is natural gift of variety of fresh water, thus promising a healthy economic and food resource from aquatics at large. This potential therefore, needs to be bagged through inputs in terms of training human resource for application of modern techniques and develop industry for producing products with add on values.

LABORATORIES : ISCA needs to develop research laboratories in different states to attract unemployed science graduates as well as superannuated scientists to work independently. These laboratories should provide free access to develop techniques and products by the persons who wish to work for the society.

ANTHROPOLOGICAL AND BEHAVIOURAL SCIENCES (INCLUDING ARCHAEOLOGY, PSYCHOLOGY, EDUCATION AND MILITARY SCIENCES)

1. Anthropology and Behavioural Sciences like Military Science, Home Science, Education, Psychology and Archaeology should be made integral part of Under graduate and Post graduate studies in colleges and Universities in India focusing on holistic dimension.

2. Anthropology and Behavioural Sciences should integrate their methodologies, techniques and approaches in future research for human development.
3. National funding agencies should provide sufficient funds for integrated researches to Universities.
4. Human Development Index should be made for each ethnic groups of India and cross-cultural comparison and reasons be highlighted for future human development.
5. Biology, culture and Traditions of North East India should be studied using holistic approach and the general public should be informed accordingly from time to time. The Anthropologists and Behavioural Scientists should be given priority in this endeavor.
6. New areas of research in behavioral sciences should be highlighted every three years in Undergraduate and Post graduate studies as a special paper.
7. Identification and screening for various genetico - psycho and health problems of adolescent boys and girls should be started from school level for their future development which will also help in maintaing the National data.

CHEMICAL SCIENCES

1. Conventionally, medicinal chemistry within the context of pharmaceutical research has been primarily focused on organic compounds with therapeutic efficacy; however, the emergence of drug resistance as a worldwide problem in several diseases, specifically in cancer and tropical diseases, make it mandatory for scientists to broaden the domain of available therapies. There is an urgent need to radically revise the entire strategy of drug use and control on this aspect.

2. Bioinorganic complexes have been explored, which provide diversity and unique scaffolds for potential exploitation of therapeutic effect. Chelation therapy can be used in the treatment, management or diagnosis of diseases. : to modify specificity of action, reduce toxicity, improve stability and to cope with the drug resistance. Metal chelated multidrug therapy (Combination therapy and Synergistic action) and metal ion-mediated delivery and distribution of pharmaceuticals/ nutraceuticals may be applicable to medical sciences for questions hitherto unanswered & to be an area of intense investigation into the future.

3. Metal complexes have shown potent anti-viral and anti-cancer activities in a variety of screens. Herbal research also tends to involve the usage of complexes between compounds

isolated from herbs and metals for herbo-mineral formulations. Thus metals can have a significant market (and health benefit) impact, and significant growth potential. New agents are likely to find unique market niches due to unique mechanisms of action or pharmacokinetic properties that complement other therapeutics.

4. The unique properties of metal complexes tend to offer advantages in the discovery and development of new drugs. The metal complexes are amenable to combinatorial synthetic methods, and an immense diversity of structural scaffolds can be achieved. Metal centers are capable of organizing surrounding atoms to achieve pharmacophore geometries that are not readily achieved by other means. Additionally the effects of metals can be highly specific and can be modulated by recruiting cellular processes that recognize specific types of metal-macromolecule interactions. Metals can be useful probes of cellular functions. Understanding these interactions can lead the way towards rational design of metallopharmaceuticals and implementation of new co-therapies.

5. Chemistry is the central science which leads the way for interfacial researches in the field of biomedical, pharmaceutical and material sciences; this provides a very strong base for 'MAKE IN INDIA'. However, this all require that this country must counter its inadequacies in science and technology for the sake of human development at large.

6. Interdisciplinary researches be permitted and promoted in such a way that society can avail the services of Science, Technology and Innovations at minimum cost.

7. Keeping in view the Sustainable development and Environmental aspects, the Green Chemistry and Green Synthetic strategies (in Industries) be adopted and popularized.

8. On energy front, efforts be made towards 3G Solar Cells-harvesting Sun-light.

9. Standard and quality of education in colleges, state universities, private universities and central universities must be improved; Gaps in terms of infrastructural facilities & resources be reduced/minimized.

10. An extraordinary strength-the youth of India be trained, made skilled and be given the full opportunities and good infrastructural facilities in higher education and research.

11. After 10+2 or graduation, students be selected for Teaching and Research career (catch them younger-train them better).

12. e-resources for teachers and students be made available at minimum to upgrade and share the knowledge and innovative ideas Globally and speedily. Budget allocation for higher education must be increased.

13. School and college education be tuned in such a way to compensate and maintain the academic standard in higher education. Further, measures to match and maintain the uniformity in terms of syllabi and examinations/ credit transfer among different educational institutions/universities at least within India, be ensured.

14. Industry –academia tie up, MoU among various STI agencies/institutions and associations/collaborations between CSIR/DAE labs, be promoted and made approachable /available to universities/colleges, at government level.

15. Hierarchy and interventions in higher education/ academic institutions must be abolished.

EARTH SYSTEM SCIENCES

- 1) New Uranium possibility in Indian Desert suggested.
- 2) Since vedic days Earth science is prime science. Studies of mineral resources and Ground water resources for human development. It is suggested that with the changed scenario, there should be at least five IIT pattern institutes of ‘Indian Institute of Earth Science and Technology’ in India.
- 3) In human resource development at school level, the subject should be named as ‘Earth Science’ (not geography), because it includes geology, geography, oceanography, climatology, etc.
- 4) Mineral exploration should be rejuvenated (including petroleum, coal energy minerals with metallic and non metallic economic minerals).
- 5) Ground water research and management needed to be reorganized of human development and service to the society.

ENGINEERING SCIENCES

1. The opportunities need to be created so that engineers and technologies concentrate their work in the areas water management, Energy conservation, Roads, Railway, Resource protection, Food production and distribution, Waste management, Education and learning, Security and counter-terrorism, Genetics and cloning, Global communication, Traffic and population logistics, Integrated electronic environment, interfaces and robotics, Weather prediction and control, and Space exploration.
2. Technologies such as cloud computing, widespread mobile internet access, digital payments, and next generation medical devices coupled with investments in infrastructure and automation to be used for drastic positive impact to our economy.

ENVIRONMENTAL SCIENCES

1. All India coordinated project on Conservation of natural resources, mainly biodiversity of flora and fauna be launched in view of the changing climate scenario so that our biodiversity could remain intact and play important role in improving the livelihood of our people
2. All India coordinated project on the assessment of air quality in terms of inorganic (NO_x, SO_x, CO₂, SPM,etc) and organic (pollen, spore, bioaerosol, etc.) pollutants be carried out in phased manner and effective measures be taken through the reduction of air pollutants so that GOOD health is ensured on our MOTHER earth.

INFORMATION AND COMMUNICATION SCIENCE & TECHNOLOGY (INCLUDING COMPUTER SCIENCES)

(1) To improve research performance of young researchers, ISCA should connect with leading professional societies in the world to organize national and international events and to improve academic network. For example, IEEE, American Mathematical Society, International Congress of Mathematicians etc., Association of Computing Machinery etc. Joint programmes of scientists from various fields will give a broader scope of interaction and collaboration.

(2) Publication of full paper should be done by tying up with some standard research publishing companies such as Springer -Verlag, Inderscience, Elsevier etc. so that the articles can be indexed in scholarly databases such as SCOPUS or web-of science. This will definitely improve quality of paper presentations.

(3) Submission of papers should be online process. Review process should also be rigorous to improve quality of research presentations. Online and we-based systems must be incorporated to improve the quality.

(4) Industry-linkages must be explored.

(5) The President of the Congress should have a greater say on all academic programmes.

MATERIALS SCIENCE

To improve R & D atmosphere to get innovative materials which can help the multi-dimensional growth of the nation and results of S & T should reach each and every human being of the nation, virtual R & D teams be formed and bring together the research promoters, investors and consumers so that when the material / product is ready they can be well accepted by each and every one.

As the future generation cannot be deprived by consuming natural resources and polluting the environment, advance material is needed for sustainable development.

MATHEMATICAL SCIENCES (INCLUDING STATISTICS)

1. Young Indian Mathematicians should be felicitated.
2. Young Indian Mathematician may be preferred for invited talks.
3. All senior mathematicians may attend paper presentation sessions.
4. ISCA may approach institutes like TIFR, IIT, ISER, University of Delhi, BHU to send paper for presentations.
5. Efforts should be made to improve the quality of publications so as to meet international standards.
6. Young research scholar should be encouraged to participate and present their research work.

MEDICAL SCIENCES (INCLUDING PHYSIOLOGY)

1. Exploring brain plasticity in different environmental stress:

In the past few years, experimental findings and clinical observations have revealed that the brain is dynamic in nature. The ability of the brain to respond to intrinsic and extrinsic stimuli by reorganizing its structure, function and connections is known as brain plasticity. Based on the research evidence, it is believed that there are two types of modifications that can take place in the brain. These are the changes in the internal structure of the neurons, particularly at the site of the synapses and an increase in the number of synapses between the neurons. It could be both progressive and retrogressive. Brain plasticity changes with the surrounding environment and this plasticity is influenced by a myriad of factors including pre- and post-natal experience, drugs, hormones, aging, disease, stress and other factors (growth, dietary and genetic). It entails the structural and functional changes that can take place in the brain cells, in relation to its synaptic connections with other brain cells as well as on various neuro-chemical changes taking place within the cells. A plethora of biochemical, metabolic and physiological processes is involved in generating plasticity. By using different brain imaging techniques such as functional MRI, positron emission tomography, EEG etc. we can characterize the structural and functional changes leading to plasticity and cognitive processing in different stressful environment. It can further help us design the therapeutics for improving behavioral and cognitive performance under such environmental conditions.

2. Non-Pharmacological Interventions to reduce the risk of Diabetes Mellitus:

Compared with the normal population, people with Diabetes Mellitus have increased morbidity and mortality, resulting in reduced quality of life. The quality of life may be reduced even before diabetes is diagnosed. Age, weight and ethnic group are the three factors that most affect prevalence of Diabetes Mellitus. The risk of diabetes is much higher in people of South Asian ethnicity (i.e. from the Indian subcontinent: Pakistan, India, Bangladesh, Nepal). Lifestyle factors are the main determinants of Diabetes Mellitus. Hence, lifestyle modification, physical activity guidelines can serve as clinically effective and cost-effective strategies to manage Diabetes Mellitus.

NEW BIOLOGY (INCLUDING BIOCHEMISTRY, BIOPHYSICS & MOLECULAR BIOLOGY AND BIOTECHNOLOGY)

- 1) Cohesion and joint collaboration among basic scientists, clinicians and industry people should be there for a meaningful research output.
- 2) It was felt that in session speakers did not stay for all days, may be due to time shortage, but it would be better than in this platform more discussion could help in research output.
- 3) Students should encourage to ask question and interact with speakers.

PHYSICAL SCIENCES

1. For human resource development, research should be connected to common man addressing needs and problems.
2. Human resource development can be achieved only by value addition manufacturing through indigenous innovations.
3. Optics and light – based technologies are to be encouraged , as they are the technologies for the future ,which can take the nation to higher level. Optics and optics related technology should be included as compulsory subjects in the UG and PG curricula.
4. Emphasis should be given for the development of high power lasers (femto- second and pico-second lasers) in India . These are useful for material processing for health care (opto -fluids and micro- fluids)
5. For doing research at the cutting edge level, borrowed technologies will not help us as other countries provide the technology only after they have fully utilized them for research purpose. We have to generate our own technology for scientific equipment and development.

6. UK is spending 30 billion pounds for new materials. We could also give emphasis for new materials which can have scientific and industrial applications. Solar cell development is an important area where India have to concentrate due to its close proximity to the Equator.

6. Quantum computing can be one are which can be given thrust as it has direct impact on the whole development of mankind.

8. Inter-disciplinary research should be promoted as it can provide discoveries which can help in human development in a big way.

9. In foreign countries such as the UK and the USA , the universities are having Research Service Departments to commercialize research. Such departments should be started in the university system to support research efforts.

PLANT SCIENCES

1. Considering that climate change may affect all organisms, crops and ecosystems in India, it is necessary to widen the scope of research and involve a much larger segment of plant scientists for: (i) study of impact of elevated CO₂/ global warming on representative species of all major plant groups; (ii) assess the likely influence on communities and ecosystems; (iii) develop location and species-specific mitigation strategies.
2. India being a biodiversity rich country undergoing rapid urbanization and development, there is urgent need for inventorisation of the flora (and fauna), including all major groups (algae, fungi, lichens, bryophytes, pteridophytes, gymnosperms and angiosperms). However, considering that experts on these groups in different regions are insufficient for the task, there is a need for major programme for resource development. Each Botany Department in Indian Universities should have tagged faculty positions for teaching and research on the seven major groups of plants.
3. Recognizing the role of plant taxonomy in critical areas of conservation, crop improvement, forestry and medicine, fund allocations need to be upgraded for field exploration, documentation, phytochemical analysis, bioprospecting and molecular studies on Indian plant diversity. Regional herbaria and network of botanical gardens should be established/ strengthened. For specialized training in Plant Taxonomy a national-level Institute of Training and Research in Plant Taxonomy should be set up. Centers of Excellence in research on taxonomic groups in different parts of the country should be set up.
4. There are ample indications that several plant species are losing their variability and vigour, and communities are facing changes due to constraints in pollination and seed dispersal all over the world. Several species are threatened in their natural habitat on account of such human-induced factors. The country needs a programme for study of pollination and seed dispersal of RET trees, orchids, mangroves, medicinal and aromatic plants, and aquatic species. Pollination Studies are also crucial for optimal yield and improvement of pollination-dependent crops and plantations.

5. To meet the food and nutritional needs of the country, India needs a drastic improvement and diversification of agriculture. While this would require continued agronomic and genetic upgradation through modern technology, it is equally important to conserve in-situ and ex-situ the wild relatives, land races and genetic diversity of the economic species. The agrodiversity of the country should be documented using traditional and molecular approaches so that conservation efforts are placed on more scientific lines.
6. Indian taxonomists have worked in isolation owing to limited resources for travel, exchange and receiving plant specimens from other countries. Facilities should be made available to taxonomists to travel widely over the entire range of distribution of the taxa of their interest. This would also curb the 'new-species-syndrome' for which the Indian taxonomists have often been criticized.
7. Taxonomists are finding it hard to collect study materials from the field, specially from protected areas owing to what seems to be a misinterpretation of the Biodiversity Act. Such impediments are proving detrimental in study of plants in their natural habitat and creating in herbarium specimens for research in systematics. The regulatory framework needs to be suitably amended to encourage research on plants which would also help in their conservation and sustainable use.
8. Dedicated institutes and centers of taxonomic research should be set up in biodiversity-rich areas of the country as these areas are at present little known for their rich plant (and animal) diversity despite being recognized as International Hotspots of Biodiversity by IUCN.
9. For more effective conservation and monitoring of RET plant species, Sanctuaries and Reserves should be developed for conservation of critically endangered and endemic species, particularly in the North-East, Western Ghats, and higher reaches of the Central and Western Himalaya.
10. For wider participation of the botanical community in conservation of India's plant wealth, Species Watch Groups should be set up for constant monitoring of status and making timely recommendations on conservation of RET species. Plant Watch Groups should also be set up to report on effect of climate change on wild species.