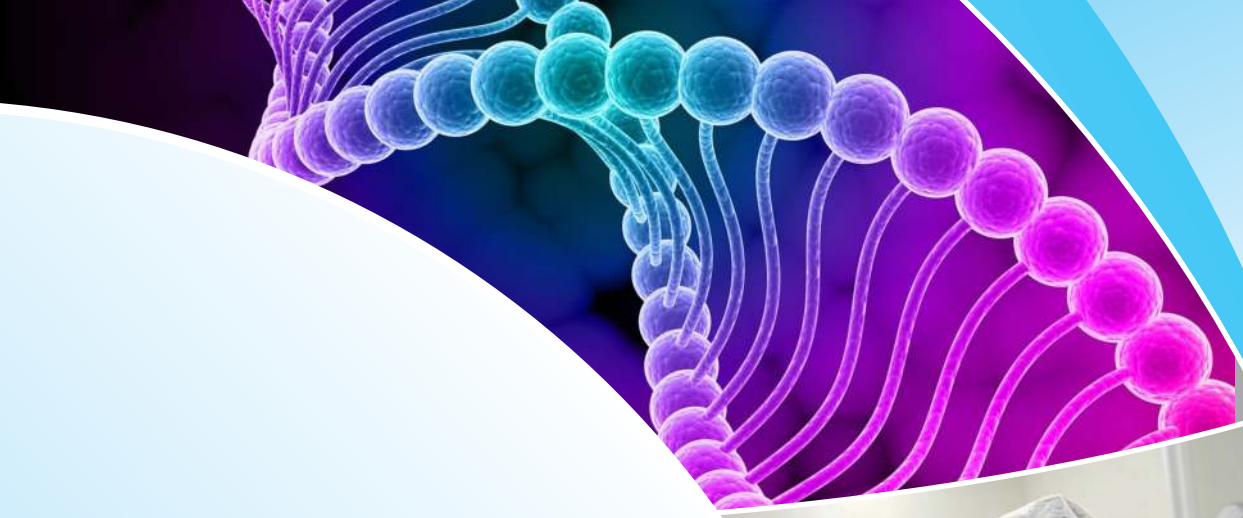

वार्षिक पत्रिका
Annual Magazine

2016-17

NATIONAL INSTITUTE OF PHARMACEUTICAL EDUCATION AND RESEARCH (NIPER), RAEBARELI

(An Autonomous Institute under the Department of Pharmaceuticals, Ministry of Chemicals & Fertilizers, Govt. of India)

Shree Bhawani Paper Mill Road, ITI Compound, Raebareli - 229010, U.P., India
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Web.: www.niperraebareli.edu.in

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Published by:
Director
NIPER, Raebareli

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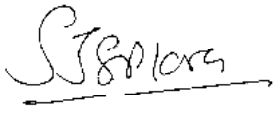
From the Director's Desk .....

It gives me great pleasure in presenting before you the Annual Magazine of National Institute of Pharmaceutical Education and Research, Raebareli for the year 2016-17, highlighting our major achievements during 2016-17, and future priorities.

During Academic year 2016-17, skill development programme for post graduate students from different universities in the country has been started from June 2017- July 15, 2017. Ph.D. program in all three disciplines (Medicinal Chemistry, Pharmaceutics and Pharmacology and Toxicology) has also been started from the academic year 2017. We believe not only in academic excellence but also in the overall development of our students along with the regular syllabus, our academic program has also encompass a series of guest lecturers from academicians and professionals in the Pharmaceutical industry, who has kept our students updated with the current technologies and also enlighten them of the various avenues in the pharmaceutical industry thus preparing them for the corporate world of pharmaceuticals. The research activities have also been conceptualized and are currently in progress. MoUs have been signed between SGPGI Lucknow, IIT Kanpur and with DPSRU Delhi are to strengthen collaborative research work. At the same time we also encourage our students to participate in various extracurricular activities to nurture their overall development. As a mark of our success, 36 students of eighth batch completed their Master's degree in M.S. (Pharm.). Once the students have graduated in the field of pharmacy manifold options are available to them. They can either pursue higher studies in the field of pharmacy (in India or abroad) or join the different sectors in Pharmaceutical industry. Wherever they have been, they left their mark and done us proud.

I thank the Department of Pharmaceuticals, Ministry of Chemicals and Fertilizers, Govt. of India for its continued support and encouragement and Director, CSIR-CDRI, as the mentor institute, for the continued co-operation in our academic and research activities. Let me acknowledge the dedication, contribution and support of our faculty and staff members, who translated NIPER Raebareli into a progressive, influential and successful educational and research institute.

With sincere best wishes from NIPER Raebareli



Dr. S.J.S. Flora
FNASc, FAEB, FABP, FSSE
Director
NIPER Raebareli

निदेशक की कलम से

राष्ट्रीय औषधीय शिक्षा एवं अनुसंधान संस्थान, रायबरेली की वार्षिक पत्रिका 2016-17 जिसमें हमारी प्राथमिकताओं की और महत्वपूर्ण उपलब्धियों पर प्रकाश डाला गया है, को प्रस्तुत करते हुए मुझे अत्यन्त प्रसन्नता हो रही है।

शैक्षिक सत्र 2016-17 के दौरान देश के विभिन्न विश्वविद्यालयों के स्नात्कोत्तर छात्रों के लिए अल्पावधि मूल्य पर प्रशिक्षण 1 जून 2017-15 जूलाई 2017 को आयोजित किया गया है। शैक्षिक सत्र 2017 से औषधीय रसायन विज्ञान, औषध ा तथा औषध एवं विष विज्ञान मे पी.एच.डी. का आरम्भ हुआ है। हम न केवल शैक्षिक उत्कृष्टता अपितु नियमित पाठ्यक्रम के साथ छात्रों के समग्र विकास पर भी विश्वास करते है। हमारे शैक्षिक कार्यक्रम मे शिक्षाविदों तथा फार्मास्यूटिकल उद्योग के व्यावसायिक व्याख्ताओं के अतिथि व्याखायान की श्रृंखला भी शामिल है जो हमारे छात्रों को वर्तमान तकनीकी तथा फार्मेसी उद्योग के विभिन्न मार्ग को भी दिखाते है। अनुसंधान गतिविधियों की संकल्पना का कार्य प्रगति पर है। एस.जी.पी.जी.आई. लखनऊ, आई.आई.टी. कानपुर एवं दिल्ली भेषज विज्ञान एवं अनुसंधान संस्थान, नई दिल्ली से अनुसंधान को सुदृढ़ करने के लिए समझौता ज्ञापन पर हस्ताक्षर हुआ है। हम अपने छात्रों को समग्र विकास के विभिन्न गतिविधियों मे भाग लेने के लिए प्रोत्साहित करते है। आठवें सत्र के 36 छात्रों अपना एम.एस. (फार्मा) सफलता पूर्वक संपूर्ण किया। परास्नातक के उपरांत छात्रों को फार्मेसी के क्षेत्र मे अनेक विकल्प उपलब्ध है। फार्मेसी छात्र उच्च शिक्षा के लिए देश/विदेश या फार्मेसी उद्योग के विभिन्न क्षेत्र में जा सकते है। हमारे छात्रों ने हमें उपरोक्त क्षेत्र में गौरवान्वित किया है।

मै औषध विभाग, रसायन एवं उर्वरक मंत्रालय, भारत सरकार के निरंतर समर्थन और प्रोत्साहन तथा निदेशक, सी.एस.आई. आर.-सी.डी.आर.आई., मेन्टर संस्थान को शैक्षिक और अनुसंधान गतिविधियों मे सहयोग के लिए धन्यवाद देता हूँ।

मै संकाय सदस्यों तथा कर्मचारियों के समर्पित योगदान तथा सहयोग कि लिए आभारी हूँ जिन्होंने नाईपर, रायबरेली को प्रगतिशील, प्रभावी, संपन्न शैक्षिक अनुसंधान संस्थान मे परिभाषित किया।

शुभकामनाओं के साथ

एस जे एस फ्लोरा

डा. एस.ज.एस. फ्लारा
एफएनएसीएस, एफएईबी, एफएबीपी, एफएसएसई
निदेशक
नाईपर, रायबरेली

NIPER- Raebareli

Raebareli is situated at the bank of Sai River and located in the heartland of the famous Awadh region which was the part of ancient Koshala kingdom. It possesses many architectural features, chief of which is a strong and spacious fort. Among other ancient building are the magnificent palaces, tomb of Nawab Jahan Khan etc.It is 80 km far from Lucknow (Capital of Uttar Pradesh) and well connected through all over India.

The National Institute of Pharmaceutical Education and Research (NIPER), Raebareli was created vide Govt. of India's Gazette Notification No. 1362 dated 26th September'2008 under Sub-section (2A) of Section 4 of the National Institute of Pharmaceutical Education and Research Act 1998 (13 of 1998) as amended in 2007 (19 of 2007) as an Autonomous body under the aegis of Ministry of Chemicals and Fertilizers, Department of Pharmaceuticals, Govt. of India. The Institute (NIPER-Raebareli) has been established as a centre of excellence for higher education, research and development in Pharmaceutical Sciences. The Institute, marking a beginning with M.S. (Pharm.) from 14th November 2008, offers M.S. (Pharm.) and Ph.D. programme in Medicinal Chemistry and Pharmaceutics and Pharmacology and Toxicology in order to boost R&D activities in pharmaceutical sciences. The Institute admits the students of M.S. (Pharm.) through All India Common Entrance Test NIPER- JEE.

Since its inception, NIPER Raebareli has been functioning with the object to create an environmental congenial for synergizing academia, R& D and industry through training and research. Through consistent efforts, it has been transformed itself to be a world class institute of teaching and research in pharmaceutical sciences and set up fruitful collaboration with various organization.

The course work for first and second semester for M.S. (Pharm.) students are conducted at NIPER, Raebareli, while third and fourth semester involving project work are completed under the guidance of scientists of CSIR-CDRI, Lucknow and faculties of NIPER Raebareli. NIPER-Raebareli is functioning in a beautiful campus and taking very confident steps to achieve its objectives. To encourage students for updating their knowledge and awareness about latest development in pharmaceutical sciences, NIPER Raebareli provides a strong educational environment inside classroom and laboratories for students to expand their knowledge as independent research practitioners and enhance skill up gradation through specialized course. It has well equipped laboratory instruments some of them are HPLC, Tablet coating machine, Rota evaporter etc. It has also CPCSEA approved animal facility. The institute has a well- developed library and a digital computer centre equipped with all IT facilities for professional.

Vision

- The vision of NIPER Raebareli is to establish "Centre of Excellence" in Pharmaceutical Education and Research.
- The main emphasis of NIPER is to produce high quality, value based skilled professional for both Industry and Academia.

Mission

- To impart quality education and research in Pharmaceutical Sciences with continuous enrichment of knowledge and skill, to inculcate the competitive attitude, leadership quality with ethical approach, to meet the needs of Pharmaceutical Industry and Academia

Objectives of NIPER, Raebareli

- To establish as a renowned Institute for imparting teaching and research in the field of Pharmaceutical sciences in northern part of India.
- To provide education and promote research in the area of drug development, drug design and molecular modeling etc.
- Enhancement of creativity, motivation, professionalism and ethical attitude in students.
- To develop communication, presentation skills, teamwork, multi-disciplinary approach and ability to relate Pharmaceutical sciences to broader social issue

Administrative & Technical Staff

Dr. Atul Kumar (*Dean*)
Dr. Anila Dwivedi (*Registrar)*
Dr. Anupam Deep Sharma *(Deputy Registrar)*

Consultant / Advisor

Dr. R.P. Tripathi

Administration

Mrs. Deepa Bakshi, *(Asst grade –I)*
Mr. Amar Mishra *(Asst. grade-I)*
Mr. Niraj Kumar *(Asst. grade-II)*
Mr. Subhash Chandra *(Asst. grade-II)*

Academics / Examination Cell

Mrs. Deepa Bakshi (*Asst. grade-I)*
Mrs. Seema Gupta (*Asst.*)

IT Resource Manager

Mr. Manoj Kumar Mishra
Mr. Pawan Shukla

Stores & Purchase

Mr. Shibli Wasim *(Asst. grade-I)*
Mr. Ravindra K Shukla *(Asst.)*
Mrs. Asiya Parveen (*Asst.)*

Guest House / Hostel Incharge

Mr. Kamal Singh

Accounts

Ms. Mona Jain (*Asst. grade-II)*

Library

Mr. Somit Kumar *(Asst. Librarian)*
Ms. Nivedita Rathore

Laboratory Assistant

Mr. Nitya Nand Rai
Mr. Sushil Kumar Singh
Mr. Vishwadeep Tripathi
Ms. Monika Verma

Placement Cell

Dr. Shalini Gupta (*Professional Advancement & Placement Officer)*
Ms. Aditi Mishra *(Asst.)*

Electrician

Mr. Mohit Kumar

Faculty

Medicinal Chemistry

Dr. K.N. Tiwari

Dr. Abha Sharma

Dr. Nihar Ranjan (to join soon)

Pharmaceutics

Dr. Deepak Yadav (to join soon)

Dr. Kohle Ujjal Damu

Dr. Kumarswamy Murali (to join soon)

Pharmacology & Toxicology

Dr. S.J.S. Flora

Dr. Awanish Mishra

Dr. Sanjiv Singh

Dr. Laxman Pulli (to join soon)

Academic Activities

NIPER Raebareli offers M.S. (Pharm.) and Ph.D. in all three disciplines i.e. Medicinal Chemistry, Pharmaceutics and Pharmacology & Toxicology. The students are given excellent teaching and laboratory facilities, supported by the Faculty of NIPER, Raebareli, eminent scientists of CSIR-CDRI, DRDO and other reputed educational institutions from Lucknow and neighbouring cities. The 10th batch students joined NIPER Raebareli in the First week of August, 2017 through Joint Entrance Examination (JEE) conducted by NIPER, Mohali. Students of 9th batch are carrying out their III and IV semester project work under the supervision of NIPER faculty at NIPER Raebareli and few are working under the guidance of scientists from CSIR-CDRI, Lucknow.

The total strength of students in I semester of the current academic year is 37 and III semester is 35 (Table 1). Till now a total of 259 students have passed out and 72 are currently continuing their studies in I and III semester.

Courses	No. of Students in 9th Batch (2016-18)	No. of Students in 10th Batch (2017-19)	Ph.D
M.S.(Pharm.) Medicinal Chemistry	16	16	2
M.S.(Pharm.) Pharmaceutics	13	15	2
M.S.(Pharm.) Pharmacology & Toxicology	6	6	2
Total	**35**	**37**	**6**

List of Students of 9th batch (2016-18)

Sl. No.	Name of Students (Mr/Ms)	Department
1	Shanu Singh	Medicinal Chemistry
2	Chetananda Patel	Medicinal Chemistry
3	Shintu Mathew	Medicinal Chemistry
4	PiyushVatsa	Medicinal Chemistry
5	S.M.Prabhakaran	Medicinal Chemistry
6	KallurePriyaSomnath	Medicinal Chemistry
7	Anam Fatima	Medicinal Chemistry
8	ThakarSnehalRajendra	Medicinal Chemistry
9	KousarJahan	Medicinal Chemistry
10	JondhaleYogeshTanhaji	Medicinal Chemistry
11	Puja Kumari	Medicinal Chemistry
12	SantoshKumari	Medicinal Chemistry
13	Vaneet Kumar	Medicinal Chemistry
14	Amit Kumar	Medicinal Chemistry
15	Illa Siva Kalyani	Medicinal Chemistry
16	Mane RajendraUttam	Medicinal Chemistry
17	Ashish Kumar	Pharmaceutics
18	Ajit Singh	Pharmaceutics
19	Shubhankar Jha	Pharmaceutics
20	Lanke Tejesh Varma	Pharmaceutics
21	Kusuma Sushma Praveena	Pharmaceutics
22	Kummaripalli Srikanth	Pharmaceutics
23	Shainky Patidar	Pharmaceutics
24	TitameUdayArun	Pharmaceutics
25	Ganeshkumar Sitaram Thombre	Pharmaceutics
26	Sanap Sachin Nashik	Pharmaceutics
27	Pardeshi Snehal Anil	Pharmaceutics
28	Narwade Mahavir Gangadhar	Pharmaceutics
29	Chandra Mohan Marandi	Pharmaceutics
30	Garima Singh	Pharmacology & Toxicology
31	ShalabhPandey	Pharmacology & Toxicology
32	Prince Kumar	Pharmacology & Toxicology
33	Pujari Anil Kumar	Pharmacology & Toxicology
34	ShaheenQuamar	Pharmacology & Toxicology
35	KarumuriShadrakBabu	Pharmacology & Toxicology

List of 10th batch (2017-19) Students

S.No	Name of Students (Mr/Ms)	Department
1	Mukesh	Medicinal Chemistry
2	Shivam Kumar Vyas	Medicinal Chemistry
3	Anjali Kumari	Medicinal Chemistry
4	Patil Pooja Bhaugonda	Medicinal Chemistry
5	Anirudh Baluni	Medicinal Chemistry
6	Gavin Pereira	Medicinal Chemistry
7	Itishree Sahu	Medicinal Chemistry
8	Juhy James	Medicinal Chemistry
9	Ankita Kumari	Medicinal Chemistry
10	VikramSinha	Medicinal Chemistry
11	Deepak Prajapati	Medicinal Chemistry
12	Surjeet Kumar Sinha	Medicinal Chemistry
13	Dushyant Kumar Dewangan	Medicinal Chemistry
14	Rashmi Kumari	Medicinal Chemistry
15	Karne Komal Ankush	Medicinal Chemistry
16	Triloki Prasad	Medicinal Chemistry
17	Raghukul Tilak	Pharmaceutics
18	Geetanjali Pant	Pharmaceutics
19	Dheeraj Kumar	Pharmaceutics
20	Bolla Siva Likesh	Pharmaceutics
21	Walse Abhay Ashok Rao	Pharmaceutics
22	Raghu Raj Singh	Pharmaceutics
23	Dinesh Choudhary	Pharmaceutics
24	Nidhi Singh	Pharmaceutics
25	Nikhil Chauhan	Pharmaceutics
26	Chetan Rajak	Pharmaceutics
27	Kanchan Kashyap	Pharmaceutics
28	Baspure Mahesh Govind	Pharmaceutics
29	Swami MarutiSidayappa	Pharmaceutics
30	AakashSaini	Pharmaceutics
31	Judy Lalrengpuii	Pharmaceutics
32	Harish Sharma	Pharmacology & Toxicology
33	Archana	Pharmacology & Toxicology
34	Manish Tomar	Pharmacology & Toxicology
35	PawanJaiswal	Pharmacology & Toxicology
36	MukeshMandal	Pharmacology & Toxicology
37	Hoshiyar Singh	Pharmacology & Toxicology

Ph.D. Students at NIPER Raebareli (Batch- 2017)

Medicinal Chemistry

- Mr. Chandran. R
- Ms. Ashima Thakur

Pharmaceutics

- Mr. Pardhi Vishwas Pritichand
- Mr. Gudeti Manoj

Pharmacology & Toxicology

- Mr. Jayant Kumar
- Mr. Kshirod Bihari Sathua

Project Titles of III semester (2016-18)
M.S. (Pharm.) Students

- "Synthesis of Aryl-Glycoside as an Anti-oxidant " - **Kausar Jahan**
- "Synthesis and Characterization of Ub2 Derivatives as Anti-mycobacterial Agents" - **Puja Kumari**
- "Design, Synthesis and Biological Evaluation of Tetra substituted as an Anti-tuberculosis Agents" - **Kallure Priya Somnath**
- "Phytochemical Investigation of Asparagus Racemosus for its Bioactive Constituents"- **Santosh Kumari**
- "Synthesis of Nature Mimicking Isoflavones and Pterocarpans as Anti-osteoporotic Agents" - **Piyush Vasta**
- "Synthesis and SAR of Hetrocycle Based Chalcone for Their Anti-malarial Activity" - **Mane Rajendra Uttam**
- "Design, Synthesis and Biological Evaluation of Chrysin Based Derivatives as Activity Agents" - **Amit Kumar**
- "Synthesis of Quinoxaline Derivatives as Anti -cancer agents"- **Anam Fatima**
- "Design And Synthesis Of Xanthenedione Based Novel Derivatives as Bioactive Agent" - **Chetananda Patel**
- "Design and Synthesis of Newer Isoquinolines and Quinolines as Anti-cancer Agents"- **Illa Siva Kalyani**
- "Synthesis of Nitrogen Containing Heterocycals as an Anti- parasitic Agents" - **Jondhale Yogesh Tanhaji**
- "Synthesis and Evaluation of Spiro-Pyran Oxindoles as Anticancer Agents" - **Vaneet Kumar**
- "Design, Synthesis and Evaluation of Cyclic Enaminone Based 3-Hydroxyocindoles as Anti-convulsant Agents" - **Thakar Snehal Rajendra**
- "Design, Synthesis and Biological Evaluation of a Novel Class of Densely Functionalized Aminopropanols as Anti- malarial Agents" - **Shintu Mathew**
- "Synthesis and Biological Evaluation of Nitropheny (Phenyl) Sulphane Derivatives as Anti-hypercholesterolemic Agents" - **Shanu Singh**
- "Design, Synthesis and Anti-microbial Evaluation Terahydro-1'Spiro [Indoline-3.4'-Quinoline] Derivatives" - **Prabhakarna S. M.**
- "Therapeutic Efficacy of MiADMSA on Copper Induced Neurotoxocity and Associated Biochemical Changes and its Comparison with D-Pencillamine" - **Shaheen Quamar**
- "Comparative Therapeutic Efficacy of Bulk Mi-Admsa and Nanoencapuslated Mi-Aadmsa on Arsenic Induced Neurotoxicity in Rats" - **Prince Kumar**

- "Effect of Different Anti-depressants in chronic Unpredictive Mild Stress: Role of Oxidative Stress and Neuroinflammation" - **Shalabh Pandey**
- "Protective Value of Edaravone on Zinc Oxide Nanoparticles induced Neurobehavioural and Oxidative Stress Disorders on Rats" - **Pujari Anil Kumar**
- "Co-Exposure to Arsenic and Lindane on Some Neurobehavioral Parameters and Oxidative Stress in Rats" - **Garima Singh**
- "Preclinical Pharmacokinetic study of CDRI Candidate Drug 96/261 (98-288 M284)"- **Shubhankar Jha**
- "Amphiphilic Block Co-Polymer Micelles as Drug Delivery System for Treatment of Visceral Leishmaniasis" - **Uday Titame**
- "Enhancement Of Bioavailability Of Trans- Resveratrol Through Nanoparticulate as Drug Delivery System" - **Thombre Ganeshkumar Sitaram**
- "*In-vitro* Pre-Clinical Pharmacokinetic Study of CDRI -2016-1726"- **Narwade Mahavir Gagadhar**
- "Development of Erlotinib Liposomes for Pancreatic Cancer" - **Snehal Pardeshi**
- "Development and Evaluation of Statin Loaded Nanocarriers for the combination Chemotherapy" - **Shainky Patidar**
- "Formulation of a Fixed-Dose combination Of Vancomycin and Isoniazid against Multi Drug Resistant Mycobacterium Tuberculosis (Mtb) "- **Sanap Sachin Nashik**
- "Development and Evaluation of Solid Lipid Nanoparicles for Topical Delivery of Amphotericin" -B. **Srikanth K**
- "Pharmacokinetic of CDRI Drug Candidate 4655k-09, Anti-hyperlipidemic Agent" **Chandra Mohan Marnadi**
- "Preclinical Pharmacokinetics, Bio distribution and Excretion Studies of S011-2111 having Anti-Cancer Activity" - **Kusuma Sushma Praveena**
- "*In-Vitro* Pre-Clinical Pharmacokinetic Study of CDRI candidate drug S017-0536"- **Ashish Kumar**
- "Polyphenol Grafted Colloidal Lipid Nanocarrier for the Cancer Therapy" - **Ajit Singh**
- "Preparation, Physicochemical Characterization and Evaluation of Anti-Oxidant Activity of Diphenyl Diselenide : Loaded Lipid Nano-Carriers" - **Tejesh Varma Lanke**

Various Research Program at NIPER Raebareli

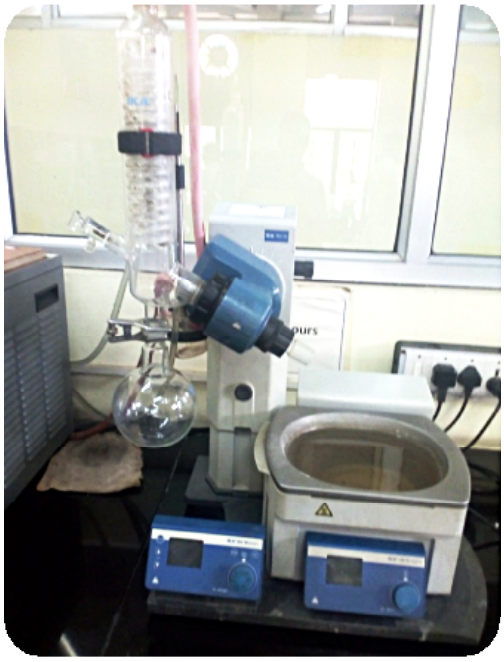
Research programs at NIPER Raebareli were initiated in the year 2016 after the joining of a regular Director. To begin with, Department of Pharmaceuticals (DoP) approved 6 PhD students in the current years, 2 each in three disciplines. Small animal house facilities were created which were approved by CPSCEA and an incinerator was installed for disposal of experimental animals. Current area of research interest in these divisions are given below -

Department of Medicinal Chemistry

FT-IR Apparatus

The research programme in the Department of Medicinal Chemistry is mainly focused on development of synthetic methods and protocols for construction of isatin based spiro-fused compounds. Since, the spirocyclic compounds have attracted the attention of researchers due to their wide application as potential therapeutic agents applicable in the treatment of various diseases like Cancer, Tuberclosis and Influenza. For the development of more efficacious and useful drugs or drug intermediates, the spirocyclic derivatives are modified structurally. To develop protocols for the synthesis of spiro-fused molecules in economic and environment is always a challenging task due to structural complexity; we are engaged in designing and developing of one step assembly of spirocyclic framework. As a result, we have development the synthesis of spirooxindole-pyrrolizidine framework by cycloaddtion reaction of azomethineylide in water (Tetrahedron Lett. **2016**, 57, 2286-2289). We have also demonstrated an efficient synthesis of 3-hydroxyoxindoles as a useful precursor in aqueous media (Synth. Commun.**2016**, 46, 620-625). The cyclic enaminones are one of the most important electron rich olefins widely applied in several synthetic transformations. They are also found to exhibit pharmaceutical activities such as anticonvulsant agents. We have demonstrated the high yielding synthesis of enaminones in water by a simple protocol (Synth. Commun.**2017**, 47, 1013-1019).

Melting point apparatus



Rotatory Evaporator

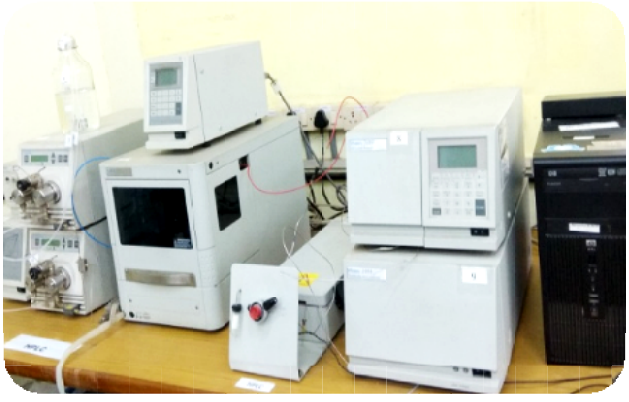
Flash Master

Xanthene functionality is a key structural element of many biologically active compounds and its derivatives have been reported to possess various pharmacological properties such as antibacterial, antiviral, anti-inflammatory and CCR1 antagonist. Xanthenes are of great interest in the lead optimization process of drug discovery. Some evidence suggests that xanthene core structure also may be useful in the design and development of pharmacological agents. Thus synthesis of xanthene derivatives is of immense interest. The naturally occurring polyphenolic compounds that are ubiquitous in plants and present in the many food items. So in this direction we are involved in the design and synthesis of xanthenedione and chrysin based compounds and their biological evaluation. These compounds are evaluated for acetyl cholinesterase inhibition. We are also involved in the synthesis of hybrid scaffolds for improved bioactivities and catalyst based synthetic methodologies for organic compound synthesis.

Department of Pharmaceutics

Research program in Pharmaceutics at NIPER, Raebareli prepare students for research in the development of novel dosage forms and their evaluations, including investigating interactions of drugs with excipients in formulations, stability of drug products, metabolism and pharmacokinetics studies. The students of MS (Pharm.) Pharmaceutics carry out their research project in the following domains of Pharmaceutical Sciences:

1. Development and validation of analytical/bio-analytical method.
2. Pre-formulation studies.
3. Formulation development based on nanoparticulate dosage forms or other novel drug delivery systems (liposomes).
4. Polymer based drug delivery.
5. Drug metabolism and Pharmacokinetic studies (DMPK).
6. Pharmacodynamic/Pharmacological studies of developed formulation.
7. Pharmacodynamic/Pharmacological studies of developed formulation.



HPLC System

Malvern Master Sizer

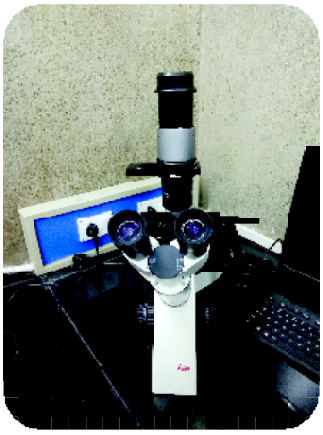
Eight station Franz Diffusion cell apparatus

Bench Top Freeze Dryer

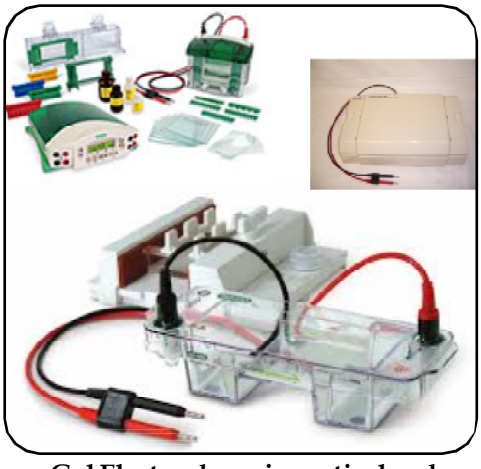
Department of Pharmacology & Toxicology

Research program in the Department of Pharmacology & Toxicology of NIPER Raebareli has started recently and principally focused onfollowing major areas,

1. Nanoencapsulation of drugs for achieving increased efficacy and targeted delivery of a drug.
2. Safety studies related to use of nanometallic particles (zinc oxide and gold nanoparticles) in medical and cosmetic industries.
3. Toxicity of arsenic and copper (relation with Wilson disease) and possible therapeutic measures.



Inverted Phase Contrast Microscope



Gel Electrophoresis, vertical and horrizontal with blotting assembly

4. Toxicity of organophosphorus related neurobehavioral changes and parameters using rodent models.

NIPER Raebareli has excellent instrumental and animal facilities, to understand the mechanism of the above mentioned diseases/ toxicity by studying and identifying oxidative stress, changes in neurotransmitter levels, biochemical markers, amino acids and inflammatory and immunological markers etc. These markers are further supported by neurobehavioral changes using modern instrumental techniques.

CO_2 Incubator

Passive/Active Avoidance Test Apparatus

Research Collaborations / MOUs

The NIPER, Raebareli partners with organizations and research centre across the India and globe. Many Institutions in India have a Memorandum of Understanding (MOU) with us for teaching, reserach and reciprocal exchange.

MOU signed between NIPER Raebareli and Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGI), Lucknow:

NIPER-Raebareli has signed MoU for research collaboration with Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGIMS), Lucknow. Under this collaboration, NIPER-Raebareli will establish joint research projects and training programs in collaborations with SGPGIMS, Lucknow.

MOU signed between NIPER Raebareli and Fragrance and Flavour Development Centre (FFDC), Kannauj:

Under this MOU NIPER, Raebareli and Fragrance and Flavour Development Centre (FFDC) Kannuaj will work in Pharmaceuticals aspects of natural & synthetic fragrant raw materials, fragrance & flavour for research and education.

MOU signed between NIPER Raebareli and Indian Institute of Technology (IIT) Kanpur:

Under this MOUNIPER, Raebareliand IITK will share interests in basic sciences and research in the areas of Medicinal Chemistry, Drug Design, Pharmaceuticals, Biomaterials and Biological Sciences and Bioengineering.

MOU signed between NIPER Raebareli and Delhi Pharmaceutical Sciences & Research University (DPSRU), New Delhi:

The objective of MOU between NIPER, Raebareli and Delhi Pharmaceutical Sciences & Research University (DPSRU), New Delhi is mutual collaborate in basic sciences and research in the areas of Medicinal Chemistry, Drug Design, Pharmaceuticals, Biomaterials and Nanotechnology.

Research Publications

1. Abha Sharma, Keerti Jain and S. J. S. Flora "Vitamins Based Novel Target Pathways/ Molecules as Possible Emerging Drug Targets for management of Tuberculosis" Medicinal Chemistry, In Press, 2017.
2. S.J.S. Flora, Arsenic: Exposure, Toxicology, Use, and Misuse". "*Encyclopedia of Anthropocene*. Elsevier/Academic Press, USA, 2017
3. S.J.S. Flora, Shruti Agrawal. Arsenic, Cadmium, and Lead. *In Reproductive and Developmental Toxicology*. Elsevier/Academic Press, USA, 537-566, 2017
4. Abha Sharma and S.J.S Flora Nutritional Management May Assist a Significant Role In Allevation Of Arseniosis. *Journal of Trace Element in Medicine and Biology* 45, 11-20, 2018.
5. S.J.S. Flora "History of Biological Warfare Agents" in Textbook on Preparedness in Biological Warfare (Ed. S.J.S. Flora and D.T. Selvam Eds), Elsevier/ Academic Press, 2018
6. S.Ali Bhat, Ruby Goel, S. Shukla, R. Shukla, Kaushif Hanif, Angiotensin Receptor Blockade by Inhibiting Glial Activation Promotes Hippocampal Neurogenesis Via Activation of Wnt/ â-Catenin Signaling in Hypertension, *Molecular Neurobiology,* 2017, pp 1–17
7. Garg A., Bhalala K., Tomar D.S., Wahajuddin. Nanomedicine: Emerging Trends in Malaria. In *Antimicrobial Nano architectonics. Elsevier Press,* USA, 2017, 475-509 (2017).
8. Abha Sharma, Illa Siva Kalyani, and Anam Fatima. Bio-based material as medium, mild and reusable catalyst for PaalÞ%ôKnorrpyrrole synthesis with and without ultrasonic irradiation. *Letters in Organic Chemistry*, In Press 2017
9. Nityanand Rai, Abha Sharma. Chemoselective Synthesis of 1,1-diacetates under solvent-free condition using efficient heterogeneous eco-friendly catalyst -P2O5/Kaolin. Press, *IJC-B*, In Press, 2017.
10. Garg A, Bhalala K, Tomar DS, Wahajuddin. In situ single pass intestinal permeability and pharmacokinetic study of developed lumefantrine loaded solid lipid nanoparticles. *International Journal of Pharmaceutics*, 516, 120-130, 2017.
11. Garg A. Therapeutic application of nanobiomaterials. In *Novel approaches for drug delivery*, Kesarvani Raj K, Sharma Anil K and Kesharvani Rajesh K Ed. Hershey PA, United States, 2017
12. K.N. Tiwari, Mane Rajendra Uttam, Puja Kumari, Piyush Vatsa, S.M. Prabhakaran. Efficient synthesis of acridinediones in aqueous media. Synthetic Communication, 47, 1013-1019, 2017

Poster Presented by NIPER M.S (Pharm.) Students in 9th NIPER (RBL)-CSIR-CDRI Symposium

- Design and Synthesis Of Hetrocyclic Linear Amides As Pcsk9 Inhibitors For The Treatment Of CVS Disorders -**Kavita Sharma**
- Bioflavonoid Hesperetin Overcome Bicalutamide Induced Toxicity By Delivery In Novel Snedds Formulations -**Sonali Singh**
- S015-728 An Anti tubercular CDRI Candidate Drug: Preclinical Pharmacokinetic Assessment-**Bishwajeeban Barik**
- A Study On The Role Of **B** Adrenergic Receptors In Vascular Autophagy-**Prasanna Kumar Sahu**
- Mannose Ligated Docetaxel/Frankincense Oil Nanocapsules For Improved Chemotherapeutics - **Namita Gowtham**
- Copper (I) Bromide Mediated Homocoupling Of Terminal Alkynes in Water **Prabhakaran SM**
- Synthesis, And Biological Evaluation Of HydridImidazo [1,2-A] Pyridine-Xanthenedione Derivatives As Acetylcholinesterase-**Amit Kumar**
- Design, Synthesis And Biological Evaluation Of A Novel Class Of Quinoxaline as Glucagon-Like Peptide-1 Receptor Agonists - **Gaurav Bharti**
- Genotoxicity Evaluation of a Novel Phytopharmaceutical-**Dharmendra Kumar**
- An Efficient Synthesis of Acridinediones In Aqueous Media - **Rajendra Mane**
- Design And Synthesis of Novel *N*-Substituted Maleimide Derivatives as Sperm Function Modulator - **Suyash Pant**
- Rnai Induced Knockdown Of *Npr-10*, The *C.Elegans* Ortholog of Human Y4 Receptor, Modulates Endpoints Associated With Parkinson's Disease: Studies Employing Transgenic *C.Elegans* - **Parth Upadhyay**
- Synthesis and Bone Anabolic Activity Of 9-Demethoxymedicarpin and Its Derivatives - **Garima Chauhan**
- PLGA Coated Dl- A -Tocopherol Acetate Nanoemulsion For Co- Delivery Of Centchroman With Cabazitaxel For The Management Of Breast Cancer - **Anuj Gautam**
- Isolation of The Bioactive Compounds From Indian Medicinal Plant *Eclipta Alba* **Saumya Shukla**
- Glycogen Synthase Kinase- 3β (Gsk-3β) Inhibition Enhance Mitochondrial Biogenesis And Dopaminergic Neurogenesis Lowered By 6-Hydroxydopamine- Induced Neurotoxicity In Rats - **Jignesh Soni**
- Development and *in vitro* Characterization of Chrysin Loaded Solid Lipid Nanoparticles to enhance The Bioavailability - **Shahadali K**

- LC-MS Method Development and Pre-Clinical Pharmacokinetic Study Of S-014-1030, A Novel Anti-Leishmanial Compound -**Femi Maria Francis**
- *In Vitro-In Vivo* Correlation Model In Nz Rabbit For Extended- Release Capsules Of An Anti-Epileptic Drug-**Rajesh Pradhan**
- Efficient Synthesis of Xanthenedione Derivatives Using Cesium Salt Of Phospho tungstic Acid as Heterogeneous And Reusable Catalyst In Water-**Ashima Thakur**
- Three Component Synthesis of Spiroindole-Pyrrolizidine.-**P Sreelekha**
- Synthesis And Characterization of Dispirooxindole-Piperazine -**Snehal Thakar**
- An Efficient Synthesis of Á-Amino Ketones In Aqueous Media-**Shintu Mathew**
- Development and Physiochemical Characterization of Amphotericin B Loaded Solid Lipid Nanoparticles- **Lanke Tejesh Varma**
- Synthesis and Characterization of Azine Derivatives in Aqueous Media- **Vaneet Kumar**

Distinguished Visitors to NIPER Raebareli

Joint Secretary visit to NIPER Raebareli:

Shri Rajneesh Tingal, Joint Secretary, Department of Pharmaceuticals, Ministry of Chemicals & Fertilizers, Govt. of India visited NIPER, Raebareli on September 9, 2017. He inaugurated the newly created CPSCEA approved Animal House facility at NIPER and also interacted with the faculty, staff and students at NIPER Raebareli campus at Raebareli and CSIR-CDRI Lucknow.

Inauguration of Animal House Facility by Shri Rajneesh Tingal, Joint Secretary, Department of Pharmaceuticals, Ministry of Chemicals & Fertilizers, Govt. of India

Shri Rajneesh Tingal, Joint Secretary, Department of Pharmaceuticals, Ministry of Chemicals & Fertilizers, Govt. of India with Dr. S. J. S. Flora, Director, NIPER, Raebareli, Faculty and Students of NIPER, Raebareli

Prof. Serge Mignani, Former Head of Medicinal Chemistry Department and Scientific Director, Sanofi, France

Prof. V.M. Katoch, Former Director General, Indian Council of Medical Research (ICMR)

Prof. R.K. Goyal, VC, Delhi Institute of Pharmaceutical Sciences and Research University (DPSRU)

Dr. W. Selwamurthy, Former Chief Controller, R&D for Life sciences DRDO and President, Amity University.

Prof. (Dr.) V. Nagarajan, Director, V. N. Neuro Care Centre, Madurai

Dr. P.V.L. Rao, Joint Director and Head, Division Virology & Bioprocess, (DRDO) Gwalior

Dr. Arun Maseeh, Vice President, Cadila Pharmaceuticals, Ahmedabad

Dr. Vikas Vaishnavi, Pharmacovigilance Lead Novartis Healthcare Pvt. Ltd.

Dr. Purav Thakkar, General Manager, Cadila Pharmaceuticals Limited, Ahmedabad

Dr. Sanjay Kumar, General Manager, Zydus Cadila Research Centre (ZRC Ahmedabad)

Sports Activities

Facilities for indoor and outdoor sports are provided to the students of NIPER and they also participated in the competitive Annual Sports Tournament held during the academic session 2016-2017 under the supervision of Dr. Awanish Mishra and Mr. Manoj Mishra. The students participated with full enthusiasm in all the sports activities and secured position in **Badminton** (Men single-Mr.Vaneet Kumar, Doubles – Mr. SubhakerJha &Mr.Vaneet Kumar, Women Singles- Ms. Kausar Jahan, **Chess** (Men-Mr. Ashish Kumar) **Table Tennis** (Singles Man- Vaneet Kumar , Doubles- Mr. Shubhankar Jha &Mr. Vaneet Kumar)**Carom** (Boys Single Mr. Titame Uday Arun).**Volley Ball** and **Cricket matches** were also organised. Institute congratulates those who won the prizes and wishes good luck to all others for their future endeavours. Students were given awards by Mrs. Gurpriya Flora for their participation in various extracurricular activities on Annual function day which was held on November 29, 2017.

Annual Day Celebration

NIPER, Raebareli celebrated its 8th Annual Day on November 29, 2016. Function started with lighting of the lamp and Sarsawati Vandana. Dr. S.J.S. Flora, Director, NIPER, Raebareli welcomed the Chief Guest, Hon'ble Vice Chancellor, Prof. Ramesh K. Goyal, Delhi Pharmaceutical Sciences & Research University DPSRU, New Delhi, Guest Speaker, Dr. Purav Thakkar, General Manager, Clinical Research, Cadila Pharmaceutical Ltd., Ahmedabad, Associated scientist from CSRI-CDRI, Lucknow and other organizations. Dr. SJS Flora, Director, NIPER Raebareli presented the annual progress report of the year 2015-16.

NIPER, Raebareli Annual Magazine 2015-16 was released by Hon'ble Vice Chancellor, Prof. Ramesh K. Goyal, Delhi Institute of Pharmaceutical Sciences and Research University DPSRU, New Delhi. He addressed the audience on "Changing Paradigm in Pharmacy: What are the academic needs" in which he discussed the paradox between the Rising of Indian Pharmaceutical Market upto US $ 32 Billion and unemployment in Pharma student. He emphasised that this can be overcome with changing in Pharmacy curriculum according to need of Pharma industry. The Invited speaker Dr. Purav Thakkar General Manager, Clinical Research, Cadila Pharmaceutical Ltd gave Annual day lecture on "Subject Missing in Pharmacy Curriculum". In his annual lecture, he discussed the role of Emotional Intelligence in professional and personal life. Dr. S.J.S. Flora, Director, NIPER Raebareli felicitated Chief Guest, Hon'ble Vice Chancellor, Prof. Ramesh K. Goyal, and Guest speaker, Dr. Purav Thakkar, by presenting them with mementos. Smt. Gurpriya Flora distributed awards to the winners of various sports events. Comparing was done by Dr. Keerti Jain. In the end, Ex Dean Dr. R.P. Tripathi, NIPER, Rae Bareli proposed the vote of thanks.

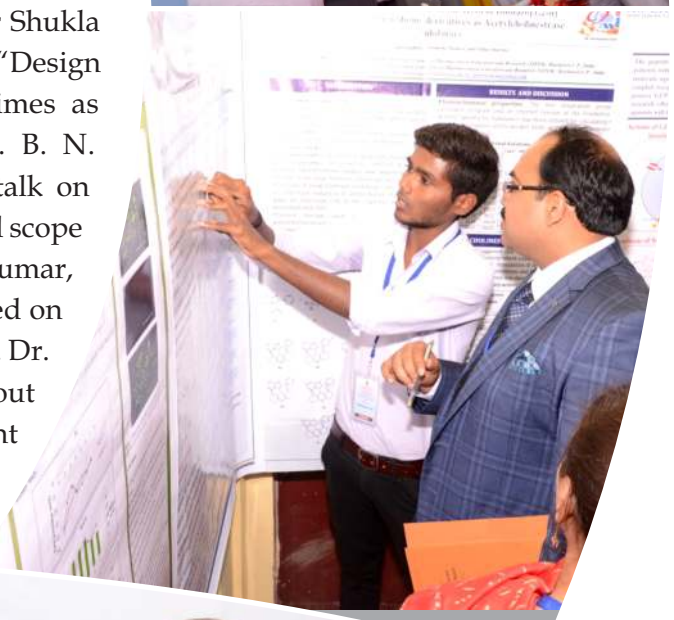
9th NIPER (RBL)-CSIR-CDRI, Lucknow Symposium

Indian Pharma industry has to focus more on R&D, so as to enable India to maintain its status in the world Pharma market and move ahead to become a global leader. Keeping this focus in view, NIPER, Raebareli has initiated the series of NIPER (RBL) - CSIR-CDRI Symposium to groom its students with core competencies, ethics and values to evolve in rapidly changing scenario of the Pharma sector. The 9th annual event of NIPER (RBL)-CSIR-CDRI Symposium with its focal theme ***Empowering Drug Discovery by Pharmaceutical and Clinical Research*** was organized from March 24-25, 2017 at NIPER, Raebareli. The symposium also provides platform to students to share their research work and innovative ideas through poster presentation and scientific session. Inaugural session of the symposium started with the lamp lightening and chanting hymes of Goddess Saraswati, followed by welcome of Chief Guest Prof. V. M. Katoch, former Director General of Indian Council of Medical Research (ICMR) and other dignitaries. In his Keynote Address he focused on how empowering Eco-System will help drug discovery and development.

Dr. W. Selvamurthy, Former Chief Controller R&D for Life sciences, DRDO and President, Amity University discussed about current scenario of Drug Discovery in India. First scientific session of symposium was based on Nanomedicine and was embraced with Dr. B. N. Dhawan, Late former Director, CSIR-CDRI and Dr. C. Nath former chief scientist CSIR, CDRI as chair of this session. In this session Dr. Sanyog Jain, Assoc. Prof., NIPER, SAS Nagar delivered his talk on "Implications of nanotechnology in oral bioavailability enhancement". Lecture of Dr. M. Samim, Jamia Hamdard University, New Delhii on "Role of herbal nanomedicine in drug discovery". Dr. Minni Singh discussed her expertise on "Biomass to Biovalue through Nanotechnology Interventions". Second scientific session was based on Theme Drug Development and Pharmacology and was chaired by Dr. C. Nath, and Dr. V. Ravichandiran, Director NIPER, Kolkata. In this session Dr. C. Nath, Ex Chief Scientist, CSIR-CDRI, Lucknow delivered his expertise on "Preclinical regulatory toxicity studies in development of new drug". Dr.Vidhu Pachauri, Asst. Prof., Amity University, Noida who shared her experiences while developing the first drug for arsenic poisoning. Dr. Sudhir Mehrotra, Professor Lucknow University delivered his talk on "Xenobiotic Biotransformation". Dr. Kashif Hanif, Senior Scientist, CSIR-CDRI, Lucknow discussed about "effect of hypertension on neurodegeneration". Third scientific session included around 10 oral presentations and 39 Poster presentations. Students were awarded best oral and poster presentation in each category. The judges of oral presentation were Dr. Atul Kumar, Dean NIPER, Raebareli and Dr. S. C. Pant, Former Jt. Director and Head, DRDE, Gwalior, while judges for Poster Presentation were Dr. Minni Singh and Dr. M. Samim.

There were two joint First Prize winners in oral presentation session (Dr. Naveen Mangla, PGIMS, Rohtak and Dr. Mohini Chaurasia, Amity University, Lucknow) and second prize winner was Dr.Arvind Narwat from PGIMS, Rohtak. In poster presentation session First Prize winner was Mr.Upadhyay Parth Rajendra kumar, Second Prize winner was Mr. Sahad Ali K and third Prize winner was Ms. Sonali Singh.

Second day of symposium began with Plenary lecture of Prof. P. K. Seth, Former CEO, Biotech Park, Lucknow focused on "Present and future prospects of Toxicity Testing Strategies".Fourth scientific session was comprised of four lectures and was chaired by Prof. P. K. Seth and Dr. V. P. Kamboj, Ex Director, CSIR-CDRI, Lucknow. Dr. Swasti Tiwari, Associate Professor, SGPGI, Lucknow discussed her research expertise on "Insulin receptors in kidney". Dr. Smrati Bhaduria, Senior Scientist, CSIR-CDRI, Lucknow discussed about "Upstream regulation of MTROC2: Role of RAS via direct physical interaction with mTORC2 constituent protein mSIN1. Dr. Yogeshwar Shukla, Chief Scientist, CSIR-IITR, Lucknow delivered his expertise on topic "Phytochemicals in cancer research: Bridging prevention to therapy". Dr G. T. Kulkarni, Amity University delivered his talk on "Herbal Drug Delivery System".Fifth scientific session was chaired by Dr.Rakesh Shukla and Dr. Yogeshwar Shukla where Dr. D. K. Dubey Scientist G delivered his talk on "Design Synthesis and Evaluation of Novel Pyridinum Oximes as antidotes for organophosphorous nerve agent. Dr. B. N. Acharya Scientist D, DRDE, Gwalior delivered his talk on "Medical management of Chemical Warfare agents and scope of drug discovery". Followed by talk of Dr. Atul Kumar, Senior Principle Scientist CSIR-CDRI, Lucknow focused on design and synthesis of new lead anticancer molecules. Dr. K N Tiwari, Asst. Prof. NIPER Raebareli talked about "Creation of Isatin Based Pharmaceutically relevant scaffolds". Sixth scientific session was focused on Clinical Trials and was chaired by Dr. D. K Dubey. In this session Dr. Vikas Vaishnavi, Novartis Health care Pvt. Ltd. talked about Predictive safety database: Can India Lead here as well. It was followed by talk of Dr. Arun Maseeh, Vice President, Cadila Pharmaceuticals based on "Follow your heart Careers in Drug Discovery and clinical research in India: Myth or Reality".



EVENTS

Skill Development

NIPER, Raebareli started an initiative of summer training program for graduate and postgraduate students from various Universities/Institutions in the academic year 2016-2017. The application for this programme was invited in the month of April and May 2017. A large number of applications were received and after screening four students from universities like Jamia Hamdard, New Delhi, Amity University, Jaipur CSJM University, Kanpur and Jiwaji University, Gwalior were selected for their training at NIPER, Raebareli. The training of these students was started by demonstration of instruments in various departments and a short term research project under the supervision of faculty members of NIPER, Raebareli. The students expressed their satisfaction at the end of the training programme and found it quite useful for their future prospective. After successful completion of training, the students were awarded with certificate of training by Dr. S. J. S. Flora, Director, NIPER, Raebareli.

Constitution Day

The Constitution day was celebrated at NIPER, Raebareli on November 26. 2016. Programme begun with pledge on constitution taken by Faculty, Staff and students. Dr. SJS Flora, Director, NIPER Raebareli emphasized on the responsibility, duties of citizen and the rights provided by the constitution. He elaborated the role of citizen in following the constitutional principles and laws in order to make a better society. On this occasion, Dr. K. N. Tiwari, Asst. Prof. NIPER Raebareli delivered a lecture on "Constitution of India and our Responsibilities". Dr. Tiwari briefly described about various aspects on need and functions of Constitution.

Yoga Day

World Yoga Day was celebrated on June 21, 2017 at NIPER, Raebareli. On this occasion yoga class was organised by senior yoga instructor Shri Uday Bhan Singh. During this event Director, NIPER, Raebareli, Faculty, staff and students participated and learned the basic of yoga. During this event the benefit of Yoga was emphasized by the instructor. The importance of Yoga in modern and healthy life was enlightened. The Director, NIPER-Raebareli shared his view on Yoga and its role in science. In concluding session Director NIPER, Raebareli felicitated senior Yoga instructor by presenting a momento.

World Environment Day

The World Environment Day was celebrated on June 5, 2017. During this occasion all the faculty and staff members vowed to protect environment. On this occasion the plantation was done by faculty and staff members of NIPER, Raebareli.

Swachh Bharat Abhiyan

In NIPER, Raebareli "Swachh Bharat Abhiyan" Pakhwara was organized from June 12- 30, 2017. Special derive has been carried out for cleanliness of Offices, Laboratories, Library, Computer room, Guest house, Dining Hall, Boys hostel & Girls hostel to up keep the maintenance standard. Garden and NIPER premises drainage have also keep cleaned to avoid rainwater stagnation in running rainy season. The appropriate disposal of old tube lights, chemicals bottles was implemented. The nearby and outside area of NIPER main gate also cleaned and maintained.

Rx Pharmacy Day

The International Pharmacy day was celebrated on September 25, 2017 at NIPER Raebareli. The event began with welcome of Chief Guest Prof. V. Nagraajan, Director, V N Neuro Care Centre, Madurai, Guest of Honour, Dr. P.V.L. Rao, Scientist G and Associated Director, DRDE, Nagpur and invited speaker Dr. Sanjay Kumar, General Manager, Zydus Research Centre, Ahmadabad by Director, Dr. S. J. S. Flora, Director, highlighted various research activities going on at NIPER, Raebareli and discussed the contribution of NIPERs towards Pharmaceutical Sciences.

Prof. V. Nagarajan in his speech emphasized on the discovery of drugs for central nervous system diseases and highlighted the importance of Green Pharmacy. Dr. P. V. L. Rao, Joint Director and Head, Division Virology & Bioprocess, DRDO explained the role of biotechnology in the creation of various aptamers in the diagnosis of various diseases like H1N1 and production of plant based vaccines. Dr. Sanjay Kumar shared his experiences in the discovery of a novel anti-cancerous drug candidate and the challenges and opportunities in industries as a pharmacy professional.

The Pharma Quiz was organized in the wake of Pharmacy Day and winners and runners were awarded by the Chief Guest Prof. V. Nagarajan and Director, Dr. S.J.S. Flora. The Director, NIPER, Raebareli felicitated Prof. V. Nagarajan, Dr. P.V.L. Rao, and Dr. Sanjay Kumar by presenting them with a memento.

The program concluded with Vote of Thanks followed by National Anthem.

Placement Activities

NIPER-Raebareli facilitates the student's placements through Placement cell. A common placement brochure for all branch were published, highlighting core competencies and achievements of students to facilitate placement. M.S. (Pharm.) students got successful placement in various pharmaceutical Industries including Curadev Pharma Pvt. Ltd., Noida. Jubliant Chemsys Ltd., Noida. Innodata Inc., Noida Nector Life Sciences, Chandigarh.

Placement cell at NIPER Raebareli has taken several initiatives to strengthen campus placement. Personality development classes have been started to groom NIPER Raebareli Student. Dr. Shalini Gupta, Professional Advance & Placement Officer, NIPER Raebareli has given presentation on vision and objective of NIPER Raebareli in 41st meeting of the Executive Committee of Confederation of Indian Pharmaceutical Industry (CIPI) which was held on June 17, 2017 at New Delhi.

The Indian pharmaceutical industry is now growing consistently and has emerged as a leading industry in the complex field of new drug manufacturing technology. This invited attraction of multinational giants to open their subsidiaries in India. New areas like clinical trial conducting agencies, contract research organizations, and R&D sectors are attracting huge foreign investment. NIPER, Raebareli is grooming its students with an eclectic mix of academics, core competencies, ethics and values to evolve and succeed in every sphere of this complex and rapidly changing scenario of the Pharma sector.

Student, Staff & Faculty Geographic Location (%)

S.No	Geographic Location	9th Batch M.S.(Pharm.)	10th Batch M.S.(Pharm.)	Staff	Faculty
1	Andhra Pradesh	14.2			
2	Arunachal Pradesh				
3	Assam				
4	Bihar	14.2	10.8	4.0	14.3
5	Chhattisgarh		8.1		
6	Delhi		2.7		
7	Goa		2.7		
8	Gujarat				
9	Haryana		2.7		
10	Himachal Pradesh	5.7	8.1		
11	Jammu & Kashmir				
12	Jharkhand	2.85			
13	Karnataka				
14	Kerala	2.85			
15	Madhya Pradesh	8.57	2.7		42.9
16	Maharashtra	25.7	13.5		
17	Manipur				
18	Meghalaya				
19	Mizoram		2.7		
20	Nagaland				
21	Odisha (Orissa)	5.7	5.4		
22	Punjab				
23	Rajasthan				
24	Sikkim				
25	Tamil Nadu	2.85			
26	Telangana	2.85	2.7		
27	Tripura				
28	Uttar Pradesh	14.2	32.4	64.0	42.9
29	Uttarakhand		2.7	4.0	
30	West Bengal				

Financial Statement

Expenditure Statement - Year 2016- 17

Sl. No	Head		Sub Head of Accounts	Amount
Grant in aid General -GIA (Recurring Expenditure)				
A	Salary and allowances	1	Salary to Regular Staff	9612063.00
		2	Salary to Outsourced Staff	0.00
		3	Honorarium to Visiting Faculty	273500.00
B	Stipend	4	Stipend to M. Pharm Students	10081678.00
		5	Stipend to Ph. D Students	0.00
C	Lab Consumable	6	Lab Consumables/Chemicals	3595337.86
D	Office Expenses	7	Rentals (Campus/Hostel)	10373012.00
		8	Electricity/Water/Telephone/Generator fuel	1826175.00
		9	Examination/Convocation/Seminars	159820.00
		10	Vehicle rental	787122.86
		11	TA/DA	439149.00
		12	Housekeeping/Maintenance/Repair	3919186.00
		13	Printing and Publicity/Stationery	637375.00
		14	Contingency/Miscellaneous	1692471.99
		15	Security Deposit	2500.00
			Total	**43399390.71**
			Overhead charges for the F/Y 2016-17	5000000.00
			Total including overhead	**48399390.71**
	Balance carry forward from Previous year (2015-16)			**5999985.50**
	Receipt during current financial year (2016-17)			**55000000.00**
			Total Receipt	**60999985.50**
			Total Expenditure	**48399390.71**
	Closing Balance as on 31.03.17 out of Govt. Grant			**12600594.79**

Expenditure Statement - Year 2016- 17

Grant for Creation of Capital Assets-CCA (Non-Recurring Expenditure)		
Sl. No	**Head**	**Amount**
E	Books and Journals	2849669
F	Official Equipments (Xerox/AC/Computers)	411798
G	Lab Equipments	499186
H	Purchase of Furniture	304567
I	Others	0
	Total	**4065220**
	Balance carry forward from Previous Year (2015-16)	**1105085.00**
	Receipt during current financial year (2016-17)	**7500000.00**
	Total Receipt	**8605085.00**
	Total Expenditure	**4065220.00**
	Closing Balance as on 31.03.2017 out of Govt. Grant	**4539865.00**

Instruments and Facilities

Department of Pharmacology and Toxicology	Department of Pharmaceutics
Hot Plate Analgesiometer	Uv-Visible Spectrophotometer
Electronic Randall Selitto test system	HPLC with PDA/UVDetector
Digital Plethysmometer	Probe Ultra Sonicator
Microprobe thermometer	Eight Station Dissolution TestApparatus (USP Type I and II)
Rotarod Apparatus	Viscometer (Cone and plate type)
Passive/Active Avoidance Test Apparatus	High-Shear Homogenizer
Opto-Varimex-4	Refrigerated Centrifuge
Digital stereotaxis	Optical Microscope
Sociability Apparatus	Malvern Master Sizer (Hydro 2000)
Open field Apparatus	Friability Tester
T maze for Mouse and Rat	Stability Chamber
Elevated Plus maze for rat and mouse	Tablet Punching Machine
TSE Animal Respirator (Compact)	Tablet Coating Machine
Rodent shocker	Tablet Disintegration Tester
RandotiLagendorff system	Triple Distillation Assembly
Isolated tissue bath	Eight station jacketed Franz Diffusion cell apparatus
Invasive BP, ECG & HRV monitoring instrument	Bench Top Freeze Dryer
Gel Electrophoresis, vertical and horrizontal with blotting assembly	Cryocans
Microplate Reader	**Department of Medicinal Chemistry**
Rotary Microtome with Parafin dispenser, Slide warming table and tissue floating bath	FT-IR
Deep freezer (-20°C)	Rotatory Evaporator
Cook's Pole climbing Apparatus	Benchtop Chillers
Audiogenic Shock Chamber	Melting Point Apparatus
Histamine aerosol apparatus	Flash Master
CO_2 Incubator	Fuming Cupboard
Gradient Thermal Cycler	Digital Magnetic Stirrer
Inverted Phase Contrast Microscope	Ika High Vacuum Pump
-80°C Deep Freezer	
Microcentrifuge	

Clinical Chemistry Analyzer

CO_2 Incubator

Thermal Cycler

Microcentrifuge

-80°C Deep Freezer

HPLC

हिन्दी खंड

शैक्षिक गतिविधियाँ

नाईपर रायबरेली मे एम.एस. (फार्मा) तथा पी.एच.डी., औषधीय रसायन विज्ञान, औषध तथा औषध एवं विष विज्ञान विषयों मे उपलब्ध है। छात्रों को नाईपर रायबरेली के शिक्षकों तथा सी.एस.आई.आर.-सी.डी.आर.आई., डी.आर.डी.ओ. तथा अन्य शहरों के प्रख्यात वैज्ञानिकों द्वारा उत्कृष्ट अध्यापन और प्रयोगशाला सुविधायें उपलब्ध कराई जा रही है। दशम बैच के छात्रों ने नाईपर रायबरेली में अगस्त 2017 के प्रथम सप्ताह में नाईपर मोहाली द्वारा आयोजित संयुक्त प्रवेश परीक्षा के माध्यम से प्रवेश लिया। नवम् बैच के छात्रों ने अपने तृतीय तथा चतुर्थ सेमेस्टर के प्रयोगशाला कार्य हेतु नाईपर रायबरेली के शिक्षको तथा कुछ ने सी.एस.आई. आर.-सी.डी.आर.आई. के वैज्ञानिकों के निर्देशन मे कार्य प्रारम्भ किया है।

वर्तमान शैक्षिक सत्र के प्रथम सेमेस्टर की छात्र संख्या 37 तथा तृतीय सेमेस्टर की छात्र संख्या 36 है (सारणी -1)। अबतक 259 छात्र उत्तीर्ण हो चुके है।

पाठ्यक्रम	नवम बैच के छात्र (2016-18)	दशम बैच के छात्र (2017-19)	पी.एच.डी.
औषधीय रसायन विज्ञान	16	16	02
औषध	13	15	02
औषध एवं विष विज्ञान	6	6	02
कुल	**35**	**37**	**06**

संस्थानात्मक खेल : नाईपर रायबरेली में छात्रों को वाहय तथा आंतरिक खेलकूद की सुविधा उपलब्ध है तथा उन्होने सत्र 2016-17 के वार्षिक खेल कूद प्रतियोगिता में डॉ. अवनीष मिश्रा तथा श्री मनोज मिश्रा के सानिध्य में प्रतियोगिता में भाग लिया। छात्रों ने पूरे उत्साह के साथ सभी क्रीडा प्रतियोगिता मे भाग लिया तथा प्रथम स्थान **बैडमिटन** (पुरूष एकल वनित कुमार, डबल - शुभांकर झा और वनित कुमार, महिला एकल - कौशर जहॉ), शतरंज (पुरूष आषिश कुमार), **टेबल टेनिस** (पुरूष एकल वनित कुमार डबल - शुभांकर झा और वनित कुमार), **कैरम** (पुरूष एकल टिटामे उदय अरूण), **वालीबाल व क्रिकेट मैच** का भी अयोजन हुआ। संस्थान की ओर से पुरस्कार जीतने वालों को बधाई और अन्य सभी को भविष्य के लिए शुभकामनाएं। छात्रों को प्रतिस्पर्धा में भाग लेने के लिए 29 नवंबर 2017 को हुए वार्षिक समारोह में श्रीमति गुरप्रिया फ्लोरा द्वारा पुरस्कार दिये गये।

वार्षिक उत्सव

नाईपर रायबरेली ने अपना आठॅवा वार्षिकोत्सव मनाया। कार्यक्रम का शुभारम्भ दीप प्रज्जवलन तथा सरस्वती वंदना से किया गया। नाईपर रायबरेली निदेशक डा. एस.जे.एस.फ्लोरा ने मुख्य अतिथि माननीय कुलपति, दिल्ली फार्मास्युटिकल साइंस एवं रिसर्च युनवर्सिटी, नई दिल्ली के प्रो. रमेश के गोयल, मुख्य वक्ता कैडिला फार्मास्युटिकल, अहमदाबाद के महाप्रबंधक डा. पूरब ठक्कर, सी. डी.आर.आई. से संबंध वैज्ञानिक तथा अन्य संस्थानों से संबंध वैज्ञानिकों का स्वागत किया। डा. एस.जे.एस. फ्लोरा ने नाईपर रायबरेली का वार्षिक प्रतिवेदन 2015-16 प्रस्तुत किया। माननीय कुलपति महोदय प्रो. रमेश के गोयल ने नाईपर रायबरेली की वार्षिक पत्रिका का विमोचन किया। उन्होने "चैन्जिंग पैराडिगम इन फार्मेसी : वाट आर ट एकेडमिक नीड" पर वक्ताओं कों सम्बोंधित किया। उन्होंने अपने भाषण में भारतीय फार्मा उद्योग के 32 बिलियन होने पर तथा फार्मेसी छात्रों के बेरोजगार होने के विरोधाभास पर चर्चा की। मुख्य वक्ता डा. पूरब ठक्कर ने "सब्जेक्ट मिसींग इन फार्मेसी कुलीकुलम" पर वार्षिक व्याख्यान दिया। उन्होंने अपने वार्षिक व्याख्यान मे भावात्मक बुद्वि का व्यवसायिक तथा व्यक्तिगत जिन्दगी मे महत्व बताया। नाईपर निदेशक डा. एस.जे.एस. फ्लोरा ने माननीय कुलपति प्रो. रमेश के गोयल तथा डा. पूरब ठक्कर को सम्मानित किया। श्रीमति गुरप्रिया फ्लोरा ने वार्षिक खेलकूद के

विजेताओं को पुरस्कार प्रदान किया। कम्पेरिंग डा. कीर्ती जैन द्वारा की गई। अन्त मे धन्यवाद प्रस्ताव डा. आर.पी. त्रिपाठी, पूर्व डीन, नाईपर रायबरेली ने प्रस्तुत किया।

संविधान दिवस : नाईपर रायबरेली में 26 नवम्बर, 2016 को संविधान दिवस मनाया गया। कार्यक्रम का शुभारम्भ शिक्षक, स्टाफ तथा छात्रों के प्रतिज्ञा लेने से हुआ। नाईपर निदेशक डॉ. एस.जे.एस. फ्लोरा ने नागरिको की जिम्मेदारियॉ, कर्तव्य एवम् संविधान द्वारा नागरिकों को दिये गये अधिकारो पर बल दिया। उन्होंने बेहतर समाज बनाने के लिए संविधान द्वारा प्रदान किये गये अधिकारो के अनुसरण में नागरिक की भूमिका पर बल दिया। इस अवसर पर डॉ. के. एन. तिवारी, असिस्टेंट प्रोफेसर ने भारत का संविधान तथा हमारी जिम्मेदारियों पर व्याखयन दिया। डॉ. तिवारी ने संविधान की आवश्यकता तथा कार्य पर संक्षिप्त विवरण दिया।

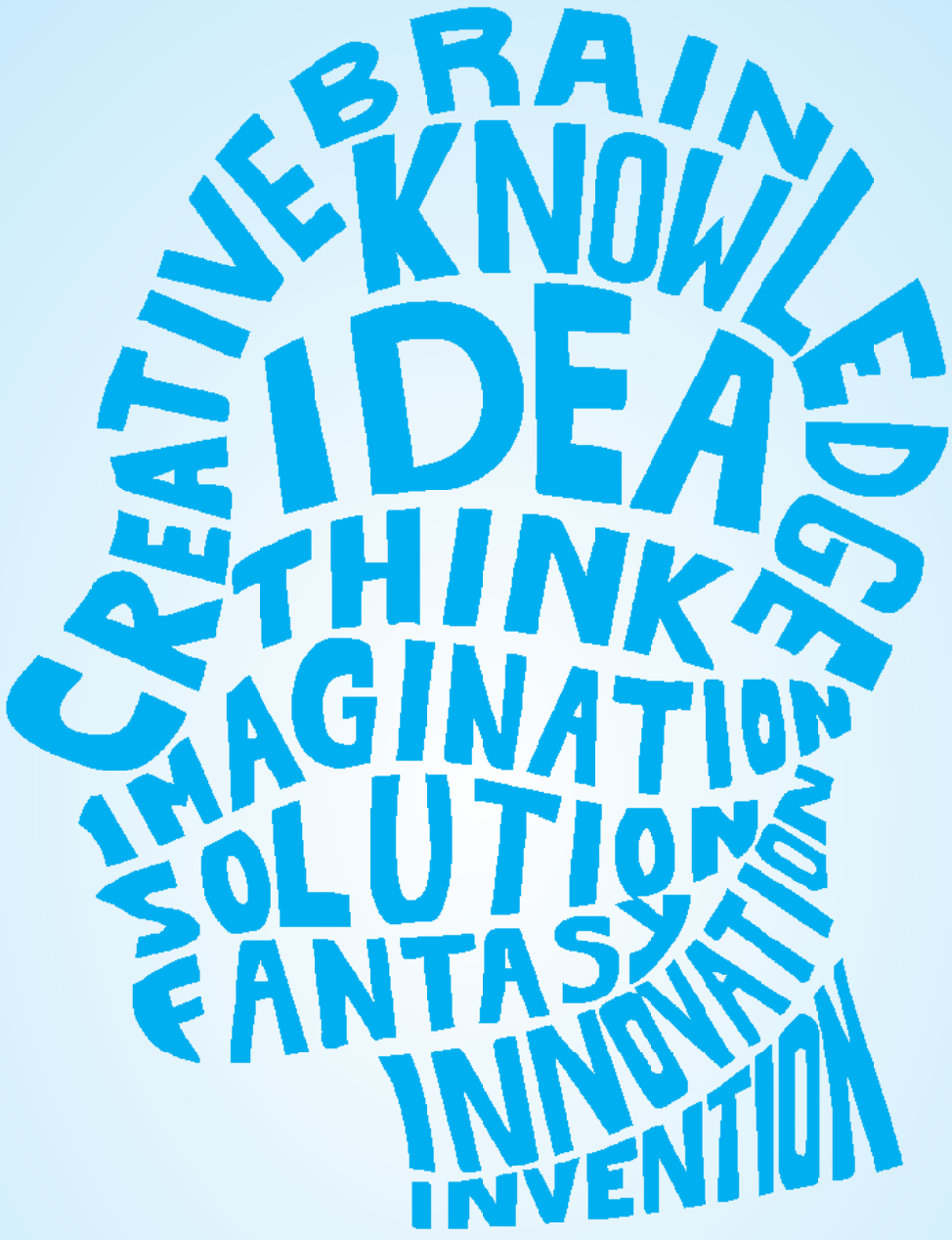
योगा दिवस : विश्व योगा दिवस को नाईपर रायबरेली मे 21 जून, 2017 को आयोजित हुआ। इस अवसर पर वरिष्ठ योग शिक्षक श्री उदय मान सिंह द्वारा योग कक्षा आयोजित की गई। इस अवसर पर नाईपर निदेशक, शिक्षक स्टाफ तथा छात्रों ने योग के आधार को समझा। इस अवसर के दौरान योग शिक्षक ने योग के महत्व को बल दिया। आधुनिक तथा स्वस्थ जीवनशैली मे योग के महत्व पर प्रकाश डाला गया। नाईपर निदेशक ने योग तथा विज्ञान मे इसके महत्व पर अपना मत रखा। अंत मे निदेशक, नाईपर रायबरेली द्वारा योग शिक्षक को सम्मानित किया गया।

विश्व पर्यावरण दिवस : विश्व पर्यावरण दिवस 5 जून, 2017 इस अवसर पर सभी शिक्षक तथा स्टाफ द्वारा पर्यावरण की रक्षा करने की शपथ ली। इस अवसर पर शिक्षक तथा स्टाफ द्वारा वृक्षारोण किया गया।

स्वच्छ भारत अभियान : नाईपर रायबरेली द्वारा स्वच्छता भारत अभियान पखवाड़ा आयोजित किया गया। आफिस, प्रयोगशाला, लाइब्रेरी, कम्प्यूटर रूम, गेस्ट हाउस, डाइनिग हाल, व्याज हास्टल एवंम गर्ल्स हास्टल को विशेष रूप से साफ किया गया। नाईपर के बाग तथा परिसर में जल निकास को भी साफ किया ताकि वर्षा के समय जल भराव न हो। पुरानी टयूब लाईट, केमिकल की बोतल का उचित निस्तारण किया गया। नाईपर के मुख्यद्वार के आस पास के स्थान को भी साफ किया गया।

हिन्दी – दिवस : राष्ट्रीय औषधीय शिक्षा एवं अनुसन्धान संस्थान, नाईपर, रायबरेली मे 14 सितम्बर 2017 को हिन्दी दिवस के रूप में मनाया गया। डा. केशरी नाथ तिवारी, सहायक व्याख्याता, अध्यक्ष राजभाषा समिति, नाईपर, रायबरेली ने हिन्दी दिवस पर प्रकाश डाला तथा हिन्दी दिवस के अवसर पर श्री जय प्रिय प्रकाश, सचिव, रसायन एवं उर्वरक मंत्रालय, भारत सरकार का संदेश दिया। निदेशक महोदय द्वारा सभी को हिन्दी दिवस की शुभकामनॉए दी गई तथा हमारा राष्ट्र हिन्दी के पथ पर किस प्रकार अग्रसर है इसके सम्बन्ध मे प्रकाश डाला। उसके उपरान्त छात्रों के बीच हिन्दी लेख की प्रतियोगिता करायी गई जिसका विषय था ''भारत की राज्यभाषा हिन्दी उपेक्षित

क्यों ?'' इस विषय पर अधिकतम अंक 10 थे। छात्रों को इस लेख के सम्बन्ध मे 100 शब्दों मे लिखना था। छात्रों ने इस विषय पर लेख लिखा। जिसकी जॉच नाईपर, रायबरेली के व्याख्याता द्वारा की गई। प्रथम स्थान पर सुश्री अर्चना, द्वितीय स्थान पर श्री आकाश सैनी एवं तृतीय स्थान पर श्री चेतन रजक रहे। विजेताओं को निदेशक, नाईपर, रायबरेली द्वारा प्रशस्ति पत्र व नगद धनराशि क्रमशः रू. 1000.00, 500.00 एवं 200.00 देकर सम्मानित किया गया। विजयी छात्रों से निवेदन किया गया कि वह हिन्दी की विशेषता आम लोगों को बतायें तथा यह भी अवगत करायें की हिन्दी भाषा किस प्रकार भारत को एक देश के रूप मे संगठित करने के लिए आवश्यक है।



Creative Section

Solid Lipid Nanoparticles in Brain Targeting

Srikanth Kummarapalli

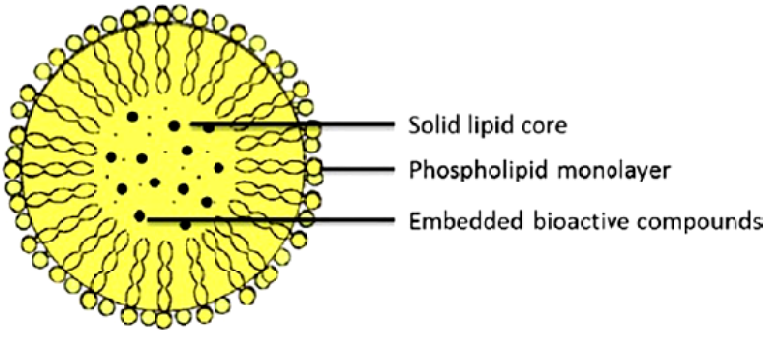
Introduction

For many neurological disorders there is no perfect treatment till the day due to the difficulty of the therapeutic moieties to enter into the brain through blood brain barrier (BBB) and brain cerebrospinal fluid barrier (BCSFB). For the delivery of the drug to the patient targeted drug delivery can play a major role. The absorption of the drug across a biological membrane can be helpful in targeted drug delivery. Different properties of targets, biological markers, carriers or vehicles can be considered during the preparation of the targeted drug delivery systems which can help the drug to recognise by specific receptors and ligands. The targeted drug delivery systems should have some identical properties like they should be biologically non-interactive, non-toxic, non-immunogenic, they must have the good stability in both *in-vivo* and *in-vitro* conditionsin the view of physical and biological stability, they can be able to deliver the defined drug distribution to targeted areas and their capillary distribution at the targeted sites should be uniform. The targeted drug delivery systems should have to provide the controllable and predictable rate of drug release and the therapeutic efficiency of the system should not be affected by the drug release. Targeted systems should have the minute drug leakage during transit and should have to provide the therapeutic amount of drug release[1]. For the improvement of targeting efficiency, the colloidal systems are much helpful and are considered to be effective. Solid lipid nanoparticles (SLNs) have recently been evaluated as potential drug delivery system for brain targeting among all colloidal drug delivery systems. SLNs are the colloidal solid lipid carriers which combine the advantages of polymeric nanoparticles, fat emulsions, liposomes and simultaneously avoid their disadvantages.

Structure of Solid Lipid Nanoparticles (SLN)

Advantages of SLN

SLNs can able to provide the controlled drug release, drug targeting, increased drug stability, high drug loading, incorporation of lipophilic and hydrophilic drugs, no bio toxicity of the carrier, avoidance of organic solvents, no problems with respect to large scale production and sterilization, increased Bioavailability of entrapped bioactive compounds.



Disadvantages of SLN

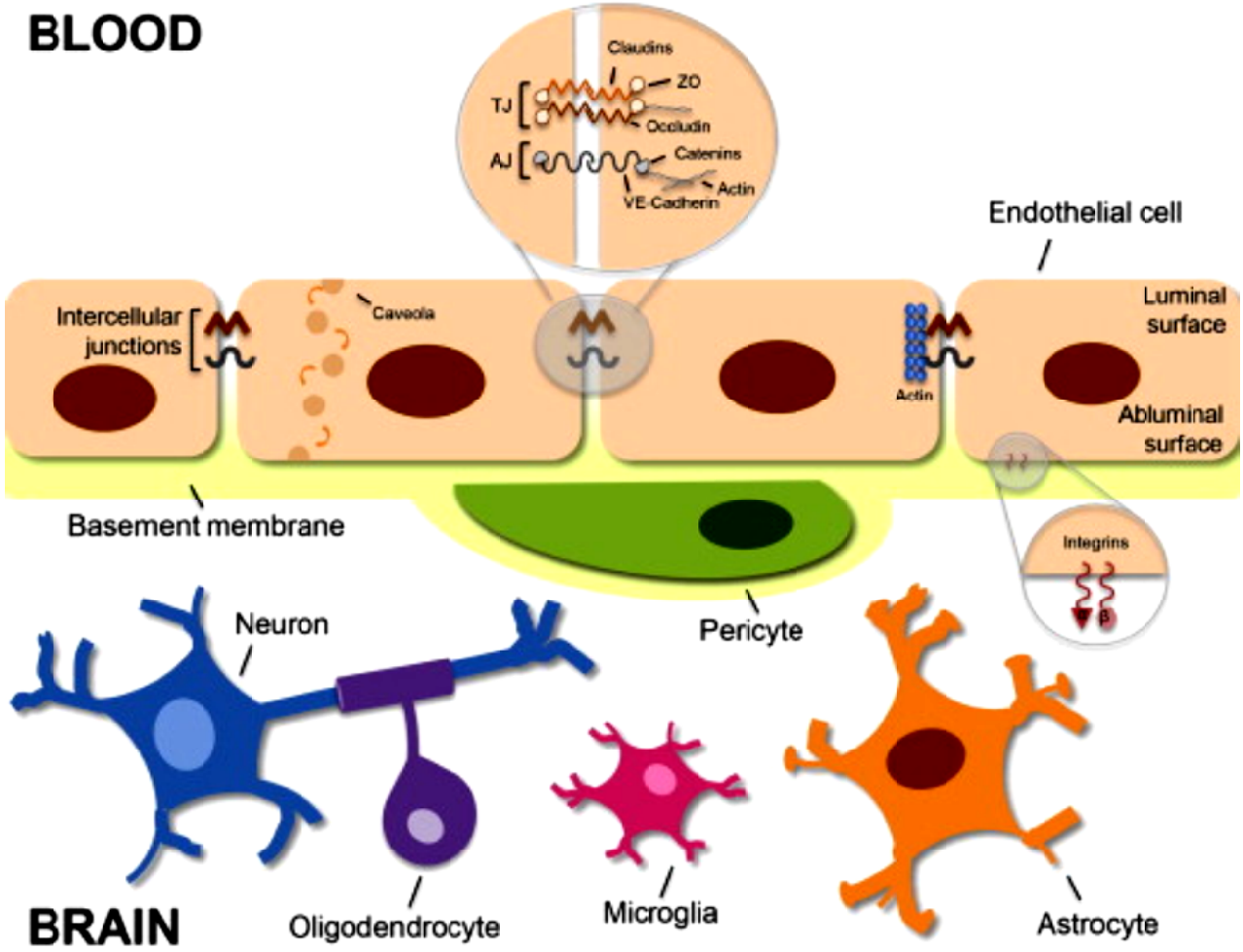
The few problems with SLNs are listed below such as Particle growth, unpredictable gelation tendency; unexpected dynamics of polymeric transitions, sometimes SLNs may leads to burst release.

Structure of Blood Brain Barrier (BBB)

BBB endothelial cells having the special feature unlike endothelial cells in the rest of the body by the absence of fenestrations, extensive tight junctions (TJs), and sparse pinocytic vesicular transport. These endothelial cell tight junctions prevent the entry of hydrophilic molecules across the BBB. But the small lipophilic substances such as O_2 and CO_2 diffuse freely across plasma membranes along with concentration gradient. Nutrients like glucose and amino acids enter into the brain via transporters, whereas the uptake of larger molecules including insulin, leptin, and iron transferrin can be mediated by receptor-mediated endocytosis. Along with endothelial cells, the BBB is composed of the capillary basement membrane (BM) with Pericytes, astrocytes and the end-feet that ensheathing the vessels. Pericytes are the leaststudied cellular component of the BBB but they can play a key role in angiogenesis, structural integrity, and differentiation of the vessel and formation of endothelial TJ. It is believed that all the components of the BBB are essential for the normal function and stability of the BBB.

Composition of BBB:

Endothelial cells which can restrict the entry of microscopic objects (e.g., bacteria) andlarge or hydrophilic molecules into the brain and cerebrospinal fluid (CSF), while allowingthe diffusion of small hydrophobic molecules (O_2, CO_2, hormones).The high-density cells of the blood–brain



barrier are restricting the passage ofsubstances from the bloodstream much more than any other endothelial cells in the body.Hormones can penetrate into the brain only at circumventricular organs but not from the blood. The effective way to protect the brain from commoninfections is the blood-brain barrier, due to the large size of antibodies they can't cross the blood-brain barrier, so the treatment for the infections of the brainbecomes very serious and are difficult to treat.

Functions of BBB:

The BBB maintains many functions such as maintaining the internal environment of the brain i.e. maintenance of brain ISFand the CSF composition within the limits for the proper functioning of the complex integrative functions of the neurones. The three main CNS interface layers of the BBB are choroid plexus epithelium and the epithelium of the arachnoid mater, functions as a transport, metabolic, immunologic and physical barrier. The functions of the barrier are dynamic and can respond to the regulatory signals from both blood and brain. Presence of Multidrug transporters and Pgp-like proteins limitsthe access of drugs to brain tissue but also other toxic lipophilic molecules such as bilirubin which is the degradation product of haemoglobin and neurotoxic.Neuroprotection is the major function of the BBB. The alteration of the ionic composition which can disturb synaptic and axonal signallingthat occurs after a meal or exercise can be restricted by the tight junctions between adjacent cells. In addition,it also helps in keeping the centrally and peripherally actingneurotransmitters separate. The turnover and drainage of CSF and ISF by bulk flow helps to remove largermolecules and brain metabolites, thus maintaining the microenvironment of brain.

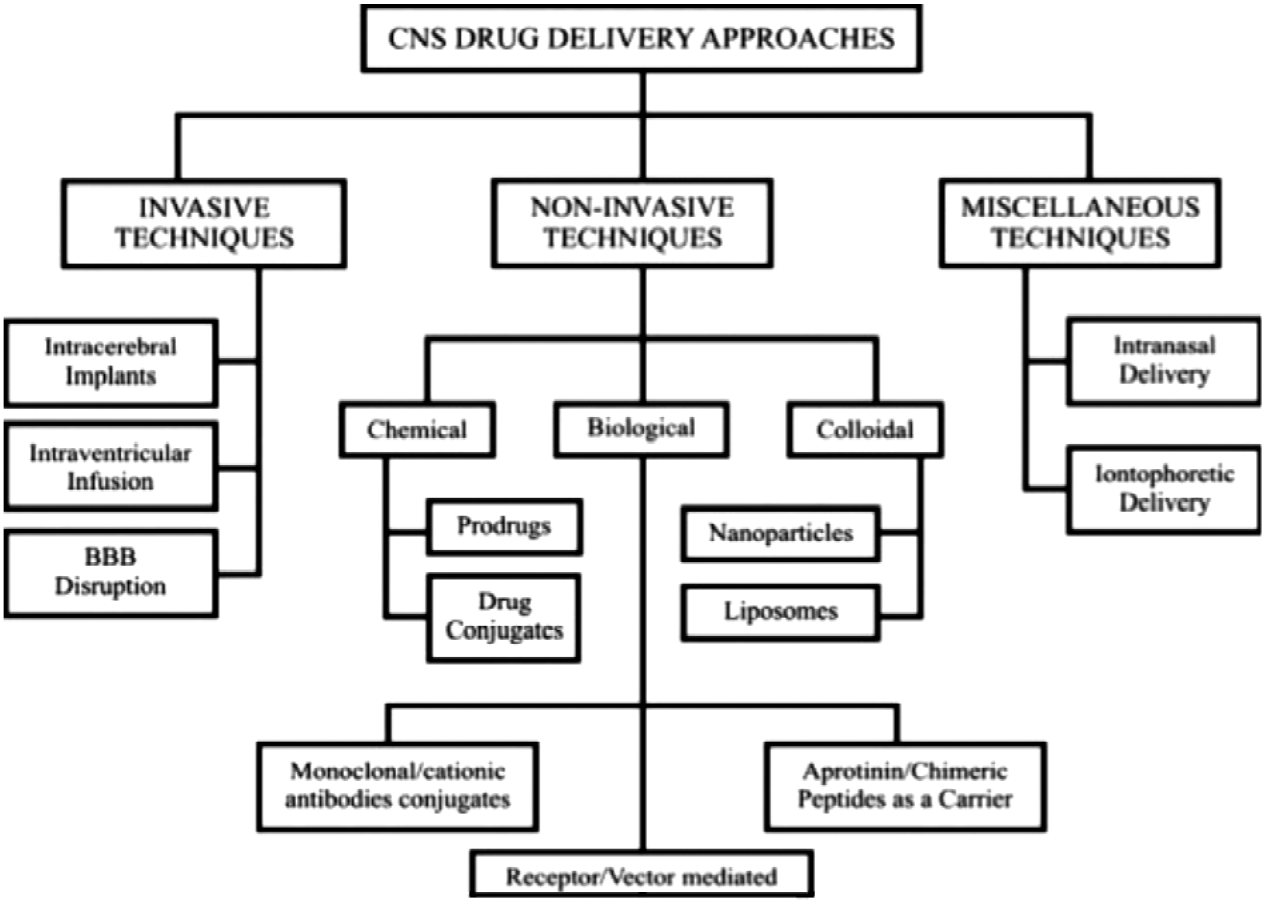
Mechanisms of Drug transport across BBB:

- Paracellular Diffusion
- Transcellular Diffusion
- Carrier Mediated Transport
- Receptor Mediated endocytosis

Different approaches for Drug Delivery across BBB

Required Modifications for SLN to enhance the brain drug delivery:

The body distribution of SLNs is strongly dependent on theirsurface characteristics like size, surface hydrophobicity, surface mobility etc. The SLNs have been proposed as suitablesystem to deliver hydrophilic drugs like diminazine and also forother BCS class IV drugs like paclitaxel, vinblastine, camptothecin, etoposide, cyclosporine etc. These carrierscan gain access to the blood compartment easily (because of their small size and lipophilic nature) but the detection ofthese particles by the cells of the reticuloendothelialsystem(RES), MPS cells of the liver (Kuffer) and that of spleen macrophages is a majorlimitation for their use. Uptake of nanoparticles by RES couldresult in therapeutic failure due to insufficient pharmacological drug concentration build up in the plasma and hence at the BBB.To overcome these limitations various researchers have tried toincrease the plasma half-life of SLNs by the following methods.



Particle size:

The particle size of particlesplays a critical role in their clearance by the sinusoidalspleens of humans. Particles must be either small or deformable enough to avoid the splenic filtration process at theinter-endothelial cell slits (IES) in the walls of venous sinuses. However, the slit size rarely exceeds 200 to 500 nm in width, even with anerythrocyte in transit. Hence, retention of blood cells andblood-borne particles at the IES depends on their bulk properties,such as size, sphericity, and deformability. The size of an engineered long circulatoryparticle should not exceed 200 nm ideally. If larger,then the particle must be deformable enough to bypass IES filtration. Alternatively, long-circulating rigid particles of greaterthan 200 nm may act as splenotropicagents and removed later on, if they are not rigid. Hence SLNs of size below 200 nm have an increased bloodcirculation and thus an increase in the time for which the drugremains in contact with BBB and for the drug to be taken up by the brain.

Surface coating with hydrophilic polymers/surfactants:

The high rates of RES mediated detection and clearance of colloidal carriers by liver,significantly reduce the half-life ofthe drug. The interaction of the colloidal carriers with bloodplasma proteins (opsonins) and thus with the membranes of macrophages (opsonization) is believed to be the major criteriafor clearance of these systems from the blood stream. Hence toprevent

this clearance and to increase their availability at the target site the RES removal of these particulate systems should be prevented .This RES recognition can be prevented bycoating the particles with a hydrophilic or a flexible polymerand/or a surfactant. The poly-alkylcyanoacrylate nanoparticles coated with PEG derivatives or PEG containing surfactants have shown better results in brain targeting, which gave an indication for changing or modifying the surface characteristics of the SLN for improved and enhanced brain targeting.

Surface modification of SLN:

Surface modification of SLN can give the potential drug delivery to the brain. Zara et al. prepared the stearic acid SLN loaded with camptothecin using micro emulsion technique and polaxomer 188 used for the surface modification. They identified that the targeting potential stearic acid SLN stabilised with polaxomer-188 loaded withcamptothecin or doxorubicin to the brain after both oral and i.v. administration in mice. After i.v. administration of camptothecin loaded SLN, high drug levels in the brain were maintained for a longer time which might be due to sustain release of camptothecin from the SLN or due to the surface modification using poloxamer 188. The maximum concentration (Cmax) increased by 180% as compared to the Cmax of the drug solution at the same dose.

Using Stealth natured lipids as carriers:

Non-stealth and stealth nature of lipid can also effects the delivery of SLN to brain, Zara et al. prepared non-stealth and stealth stearic acid loaded doxorubicin SLN. Stearic acid-PEG 2000 at three different concentrations (0.15, 0.30 and 0.45%) was used as the stealthing agent. Non-stealth SLN and stealth SLN with increasing amounts of stealthingagent, enhanced the transport of doxorubicin loaded nanoparticles through the BBB after i.v. administration. The amount of doxorubicinestimated in the rabbit brain after 30 min of i.v. administration of non-stealth SLN was 27.5ng/g and 242.0 ng/g for stealth SLN with 0.45% PEG. After 2 h, the amount of doxorubicin in the brain was lower as compared to that after 30 min. On the other hand, doxorubicin was not detected in the rabbit brain after administered as drug solution. At the end of 6 h, doxorubicin was only detected after i.v. administration of stealth SLN loaded with 0.45% PEG. There was an increase in the brain concentration of doxorubicin as there was increase in the concentration of the stealthing agent. Thus, by employing small amount of stealth agent not only improved the circulation time but also increase the amount of doxorubicin in the brain.

Modification of surface charge for SLN:

The surface charge of SLN can also affect the brain targeting with SLN. Many studies suggest that nanoparticle surface charge should be considered for the toxicity and high drug concentration in the brain.Lockman et al. has put forth some important considerations and the limitation to its usefulness, while applying the strategy of using surface charged SLN or nanoparticles in general, to cross the BBB. Neutral (-14 mV; 75 ± 53 nm), anionic (-60 mV; 127 ± 71 nm) and cationic (+45 mV; 97 ± 69 nm) SLN were prepared using emulsifying wax by micro emulsification method and their rat BBB permeability was studied using the in situ brain perfusion method. Neutral SLN or low concentration (10ìg/mL) of negatively charged SLN showed no acute effect on the cortical cerebrovascular volume, representing a good BBB integrity. While the higher concentrations of

negatively charged (anionic) SLN (20ìg/mL) or positively charged (cationic) SLN significantly increased the cortical cerebrovascular volume causing the BBB disruption within 60s. Theseresults suggest that nanoparticle surface charge should be considered for the toxicity and high drug concentration in the brain.

SLNs are very flexible to modify and can also be used as diagnosing agents for brain. Peira et al. introduced the superparamagnetic iron oxide nanoparticles in SLN which were prepared by microemulsion technique. Superparamagnetic iron oxide loaded SLN was a new type of NMR contrast agent. This study has revealed that after incorporation of endorem it becomes a new contrast agent with increased brain uptake as compared to the endorem which does not cross BBB. This suggested that SLN could be used as MRI agent for CNS.

Conjugation of SLN with bio-molecules:

Conjugation of SLN with bio-molecules can also enhance the Brain targeting. Transferring-conjugated *SLN* showed enhanced tissue uptake in brain as compared to unmodified SLN and drug solution. The biodistribution studies indicated that quinine hydrochloride concentration in brain was considerably higher in case of *transferring-conjugated SLN* as compared to unmodified SLN and quinine hydrochloride solution.

Advancements in SLN for Brain Targeting

NLCs

The pro-drug approach can be very useful in the developmentof SLN for brain drug targeting. Indeed, not all thetherapeuticmolecules possess suitable characteristics to be efficiently incorporated into a lipid matrix. Moreover, as aconsequence of the low particle uptake available at the surfaceof BBB, SLN drug content may become a crucial issue for the success of this strategy. For this reason, lipid drug conjugate (LDC) nanoparticles have been developed. The in vivostudies with the mice showed that the Nile red labelled LDCadhered to the endothelial cells of the brain.

Surfactant coated Nanocrystals

Another alternative to maximize nanoparticle drug loadingmay be the formulation of the sole drug into nanocrystals,successively coated with a proper surfactant (e.g., polysorbate). This technology would allow the delivery of thetherapeutic molecules to the target site, maximizing theamount delivered and avoiding all possible toxic effects from the carrier matrix.

Conclusion:

Brain targeted drug delivery is one of the major challenging issue due to presence of various obstacles especially the Blood Brain Barrier which is having tight junctions formed by endothelial cells differ from the rest of the endothelial cells in the body by lacking of fenestrations. This BBB is acts as a protecting membrane for the brain from the entry of foreign molecules and for the drug molecules which are hydrophilic in nature. Various approaches are there including invasive and non-invasive methods like BBB disruption, prodrug approaches etc. but due to unsuitability of these methods for the long-term treatment of the BBB diseases various types of nanoparticulate drug delivery systems havebeen utilized for brain-targeted drug delivery like polymeric NPs, solid

lipid nanoparticles (SLNs), nanospheres, pH-sensitive NPs etc. Currently SLNs are the major area of interest for the targeted drug delivery to the brain due to their advantages over other Nps like high drug loading, chance of producing controlled release, High permeability, chance of surface modification, ease of conjugation with bio molecules. By the simple modifications like surface modification, use of suitable surfactants and lipids, by conjugation with bio-molecules the SLNs are capable to deliver the drugs across the BBB. It is essential to complete andupdate our knowledge base of all the possible carriers and receptor mediated transport systems that are active at theBBB.

Self-Assembled Nano Particles: A Review

Lanke Tejesh Varma

Introduction

In the current research field, nanotechnology is a promising tool for technological advancement[1]. Nanoparticle like micelles, liposome, polymeric Nanoparticles, lipid nanoparticles especially those fabricated by self-assembly have potential biomedical and pharmaceutical applications. They have advantages like improving bioavailability, targeting, controlled release, long circulation, protecting a drug from the external environment, serving as carriers. Nanoparticles enter cells through an endocytotic path. Better delivery of therapeutics needs delivery systemsthat overcome intracellular barriers[2]. Nanoparticles can be targeted towards specific sites by size-dependant passive or active targeting[3]. Nanoparticles can penetrate well into the tissues due to their size and can be administrated intravenously with less irritation at the injection site.At present, various self-assembly nanostructures has been synthesized from biomaterials such as carbohydrates, nucleic acids, peptides etc, for many biomedical applications[7].

Self-Assembly

Self-assembly is a bottom-up process, in which molecules in general spontaneously, non-covalently assemble into stable and well-defined structures due to direct specific interactions and/or indirectly, through their environment. Thermodynamics and other limitations like energy, entropy, templates, applied external fields to some extent controls the self-assembly. It is a balanced process that maintains equilibrium between repulsive and attractive forces between molecules. The thermodynamics of the self-assembly process can be represented by a simple Gibbs Free-Energy equation. Most self-assembly processes are enthalpy driven but in certain cases, it is entropy driven[7].

Driving Forces For Self-Assembly Of Nanostructures

As discussed above self-assembly is a balanced process in which well-defined arrangements are spontaneously formed from building blocks. The most important forces that drive self-assembly are non-covalent interactions that include van-der-Waals interactions,steric and depletion forces, coordination bonding, hydrophobic forces, electrostatic interactions, hydrogen bonding, 5Øß-5Øßstaking interactions and solvation and hydration forces[8].

Various Nanostructures For Drug Delivery

Table.1 Types of Nanocarriers

Class of nanostructures	Examples
Polymeric based	Polymeric micelles, nanogels, dendrimers,
Lipid based	Liposomes, Cubosomes
Surfactant based	Niosomes
Inorganic based	Graphene, Carbon nanotubes, Fullerenes,
Biologicals based	Protein based, Nucleic acid based
Miscellaneous	Drug Based

Polymeric Nanostructures

In drug delivery field, polymeric nanostructures are the area of interest for scientists since a long time. Nano carriers fabricated by polymers can increase the solubility of hydrophobic drugs and reduce the toxicity of non-target tissues. They can also prolong the circulation time of drugs in blood and improve efficiency.These nanoparticles can stay unrecognized during circulation. They preferentially accumulate in solid tumors by the enhanced permeability and retention (EPR) effect when administered via intravenous route. When dealing with drugs that have peripheral toxicity,targeting will ensure high efficiency of the drug and reduce the side effects.

1. Self-Assembled Polymeric Micelles

First prepared drug NPs were the micelles and liposomes that mimics structures that are already present in the body and contain macromolecules with both hydrophobic and hydrophilic regions[9].Amphiphilic polymersinwater at above critical micelle concentration (CMC) and critical micelle temperature (CMT), spontaneously forms nanosized aggregates. Most of the self-assembled micelles of amphiphilic block copolymers have a diameter of 10 to 80 nm with ahydrophilic shell and a hydrophobic core which is a steric barrier for aggregation, prevent binding to proteins and opsonization during the systemic administration which blocks the RES uptake.

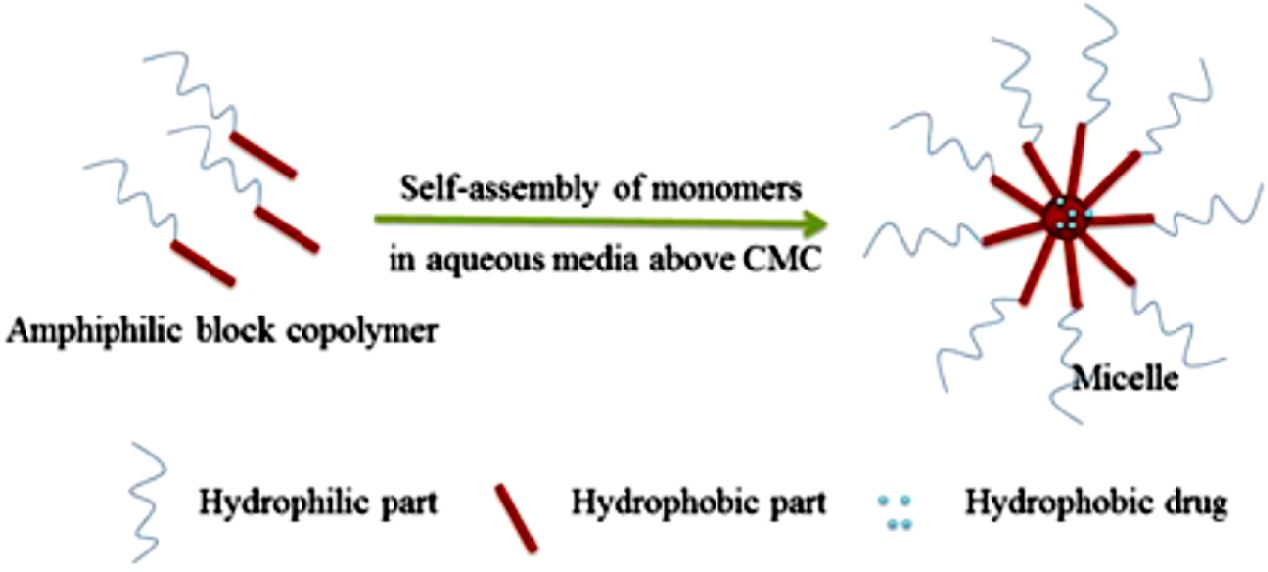


Fig.1 self-assembly of amphiphilic block copolymer in aqueous media

2. Self-Assembled Polymeric Vesicles

Like self-assembled polymeric micelles, polymers also tend to form polymeric vesicles and they can be formed from either by the self-assembly of polymers or from the polymerization of monomers following self-assembly. Block copolymers, random graft copolymers form polymeric vesicles. Polymeric nanomicelles and nanovesicle scary a main disadvantage i.e they are stable only above the critical micelle concentration, to avoid this dissociation of the self-assembled nanostructures, linking the polymers to obtain nanogels which are more stable has become an effective approach.

3. Polymeric Nanocapsule

Nanocapsules can improve the ora bioavailability of proteins and peptides. Encapsulation of drugs protect themfrom degradation by preventing the exposure to the external environment, reduce systemic toxicity, provide controlled release, and mask unpleasant taste[10].

4. Polymeric Dendrimers

Dendrimersare three-dimensional, hyper branched sphericall nanopolymeric structures. The major advantages are the nano size range, low polydispersity index (PDI), molecular structure can be well controlled and multiple functional groups are available at the periphery and cavities in the interior. Drugs can be incorporated into the interior or attached on the surface.

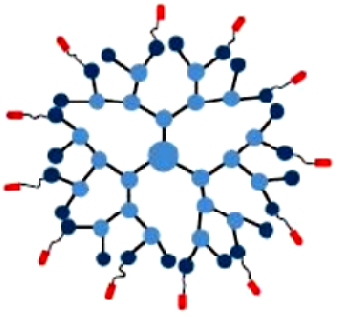


Fig.2 Polymeric Dendrimer

Lipid Based Nanoparticulates

1. Self-Assembled Liposomal Nanostructures

Nanostructures fabricated with liposome are the first drug delivery system on the nanoscale to make the transition from concept to clinical application. Liposomes incorporate both hydrophilicand hydrophobic materials in their respective cm partments by nature. Along with this unique advantage, biocompatibility and biodegradability are the added advantages that makesliposomes attractive as drug delivery vehicles. Liposomes can accumulate at sites with high vascular permeability, when their average diameter is in the ultra-filterable range (<200 nm). Liposomes in general are thin, fragile, and thus not stable and also limited by low encapsulation efficiency, rapid leakage and poor storage stability[11].

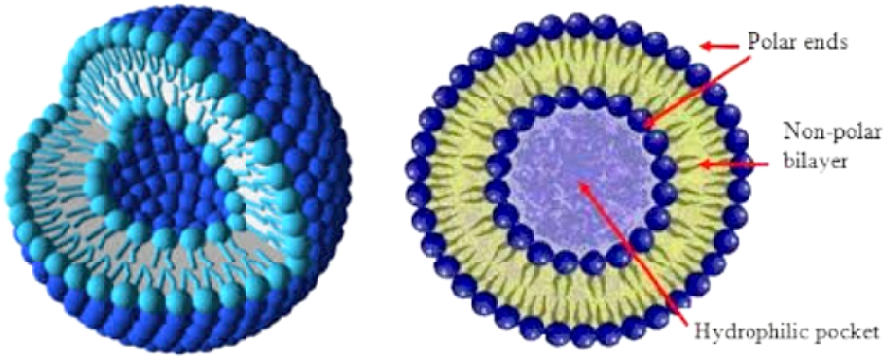


Fig.3 Self-assembled liposomes

2. Self Assembled Niosomes

The self-assembly of non-ionic surfactants into niosomes is dependent on the hydrophilic - hydrophobic balance of the surfactant and a CPP of between 0.5-10 enables niosomal self-assembly. Niosomes generally contain cholesterol as a membrane stabilizer.

Inorganic Metal Nanostructures

Inorganic based self assembled nanostructures include mainly carbon and silica based self assembled nanoparticles. Carbon based nanoparticles like graphene, fullerene and carbon nanotubes can be self assembled at nanoscale and can be utilized in drug delivery application. Interesting advantage of carbon nanotubes over spherical shaped nanoparticles are that small drug molecules can be loaded in their large inner volume and on their outer surface proteins and genes can be loaded by chemical modification.Fullerenes (C60) in water mutually attract to generate colloidal structure in the range of nanoscale, which is essentially crystalline in order with a simple hexagonal unit as shown in *Figure.4*

Fig.4 Schematic representation of a) Graphene, b) Carbon nanotube c) Fullerene

Likewise self-assembled silica based nanostructures can also be prepared using a simple low energy intensive and benign protocol under mild conditions (less than 100°C) using microwave irradiation and conventional heating.

Biologicals Based Nanoparticulates

1. Peptides-Based Nanostructures

Peptides have advantages like biocompatibility, biodegradability,low cost,tunable bioactivity, high drug loading capacities, chemical diversity, and specific targeting and stimuli responsive drug delivery at disease sites and various nano structures like nanoparticles, nanotubes, nanofibers, and hydrogels have been synthesized[4].Naturally occurring self-assembly motifs present in proteinssuch as -helices, -sheets, and coiled-coils can beused to drive the self-assembly process, peptides canform well-defined nanostructures of any size and shape,and additional peptide functionalization can easily be performedby introducing various compounds to the peptidestructure.

2. Nucleic Acids Based

Preparation of cationic lipid-nucleic acid nanoparticle from a liquid monophase containing water and a water miscible organic solvent where both lipid and DNA components are separately soluble prior to their combination was reported. Upon removal of the organic solvent, stable and homogeneously sized (70-100 nm) lipid-nucleic acid nanoparticles (Genospheres) were formed.

Drug-Based Nanostructures

Some small molecule drugs haveshown reversible self-assembly behaviour, which can be usedto form supramolecular nanostructures of well-defined size and shape.Amphiphilicprodrugs can be synthesised by conjugating hydrophilic polymers with hydrophobic drugs and these prodrugs can be used to prepare stable nanostructures spontaneously by self-assembly. In this way, a self-delivery system can be obtained and it can provide a sustained drug release.

Advantages

- Control and/or target drug release.
- Improve stability of pharmaceuticals.
- Feasibilities of carrying both lipophilic and hydrophilic drugs.
- Better bioavailability for poorly soluble drugs,
- Better penetration
- Wide application spectrum (oral, dermal, and intravenous)
- Their size allows delivery via intravenous injection.
- The nanoscale size of these drug delivery systems also minimizes the irritation.

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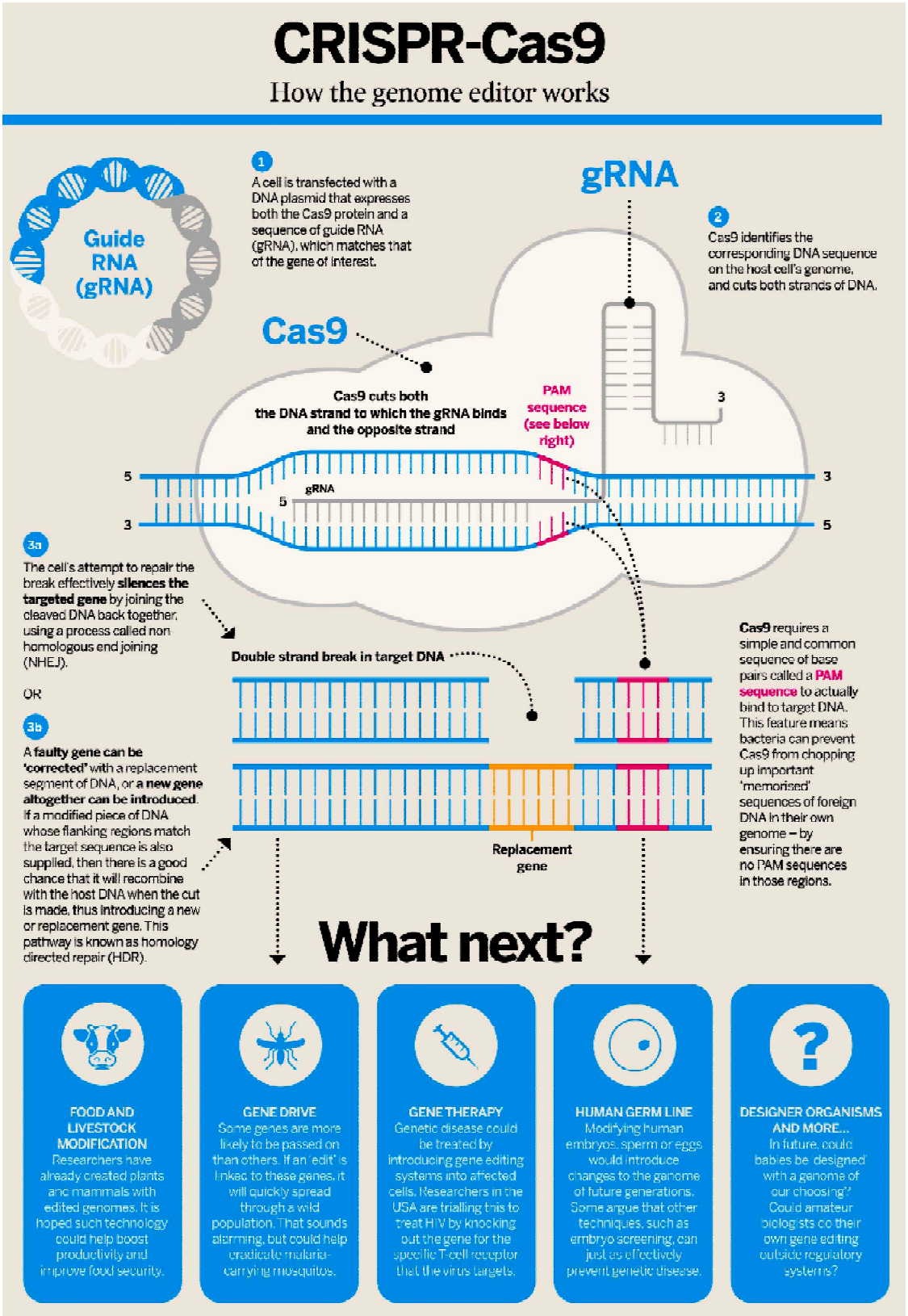
CRISPR-CAS Gene Editing Tool: Complete Eradication Of Human Inherited Disorders

Shalabh Pandey

Nowadays large number of people are affecting with inherited disorders. This inherited disorder can only be managed but can't be totally cured or eradicated until the CRISPR-Cas genome editing tool introduced by the researchers. Before CRISPR the "Gene Therapy" was extensively used which is done by administering the correct DNA sequence of the gene into the human body? Which is only a treatment for temporary purpose and it is for individual and it can't be inherited to children or offspring. After introduction of CRISPR, which is a gene or genome editing technique which has eliminated all of the demerits associated with "Gene Therapy" like it is good gene editing tool which can edit the genes so that it can be inherited to the future generations. In others words all of the disorders associated with DNA can be corrected once and for all. This technique come to know in researchers after seeing some bacteria have gene editing machinery in them and by this observations researcher modified this technique for humans.

During Infection(bacteria, viruses and other pathogens) body is protected by some immunological mechanism, the bacteria having the same mechanism to fight against the viruses and plasmids and with time they evolve themselves to protect themselves. This protection find by the researcher when they studied bacterial DNA sequences because bacteria are unicellular and they doesn't having immunological cells like white blood cells. Researchers have found some significant repetitions in the bacterial DNA sequences. This involves groups of many repeated DNA nucleotides sequences called palindrome sequences. (A palindrome is a sequence of the letters in a word or sentences, which when read front to back or back to front,it reads the same and makes the same sense. Allof thisrepetitions is followed by the short segments of nucleotides called 'spacer' in DNA sequences. DNA 'spacer' introduced by the DNA viruses, when they invaded into the bacterial cell with their viral DNA. This significant arrangement of the bacterial DNA is referred to as Clustered Regularly Inter-spaced Short Palindrome Repeats abbreviated as CRISPRs (pronounced as crispers). The CRISPR sequence is also attached with some others sets of genes that code for various enzymes, these enzymes responsible for cutting of the spacer DNA sequences. These genes are referred to ascas or crispr- associated sequences. Both of these CRISPR-Cas sequences were involved in the bacterial immune- machinery which can remember and then cut down accurately the invading viral DNA of viruses at specific places and prevent further propagation and assembly of the viral DNA.

Researcher now by using this knowledge of bacterial immune-machinery is able to cut and insert any specific gene inside many organisms including the humans. In a same way like that nowadays word processing used for editing of words or any other more reliable software tools for publishingthe manuscripts in scientific journals. Two researchers groups simultaneously and competitively used the CRISPR-Cas gene editing method to cure inherited gene mutations in humans' cells. One was the group of Jennifer Doudna and Emmanuelle Charpentier at Berkeley, San Francisco, while the other was that of George Church and Feng Zhang from Harvard and the Broad Institute, both in the Boston area. This is all a very brief overview about CRIPR-Cas genome



How the CRISPR-Cas9 genome editing system works. Image credit: Royal Society of Biology

editing tool history and contributions of researchers for developing of this gene editing tool, but what will be fate of this gene editing tool for us. What about the congenital inherited disorders that is running from our forefathers. May be one day we start correcting these congenital inherited disorders by doing it at embryonic developmental stage of human baby. So the child born without any inherited disorders. Which is running from the our generations and so our future generation will be free of inherited disorders like albinism, haemophilia, neurodegenerative disease and various types of congenital cancers (breast cancer, prostate cancer).

Chinese scientists from Yulin University genetically engineered goats using CRISPR to produce more meat and wool in hopes of bolstering the industry.

But a big debate started among the peoples when some Chinese researchers started experiment this technique on the human embryo. Like what then about humans? "We will be then become Gods" some ethicist may ask. What happened when any unknown serious pathologies have become developed when embryo become later stages human life cycle or may passed down to others generations and then it will show their detrimental effect.

But sooner or later, people also want to become "Designer Baby" like what will be the eye colour, hair colour, skin colour or overall body makeup of their babies. Scientific communities are seeing these future issues associated with CRISPR-Cas gene editing tool, and are taking strict supervision so that nobody whether researchers or governments will use this gene editing tool for illegal or unethical purpose around the world.

Women Empowerment

Garima Singh

Playing multiple roles in families, women have already proven their worth, but still their condition on social and economical fronts has not been up to the mark and in many parts of the world they are forced to lead a miserable life. In such a scenario, it calls for immediate attention to empower them and create conducive environment for their social and economic upliftment.

Women Empowerment is Urgent for Integrated Development:

Women empowerment is a must for the betterment of any country's future as they play dual responsibilities of managing their families while simultaneously juggling to earn to contribute in fulfilling the material needs of their families. No one can ever ignore the importance of the role of a mother, sister, or a daughter in their families. At the same time, women have also established themselves as equal contributors in managing the financial requirements of their homes. On international level as well, women have successfully created their unbeatable position, but they are just a handful in comparison to their not so fortunate counterparts.

Remarkable Performance in sports:

On various international platforms, women have successfully proved that if given a chance they can perform no less than their male counterparts and the recently concluded RIO Olympics bears a testimony to this fact. No one can ever forget the names of RIO stars – Sakshi Malik, PV Sindhu and DipaKarmakar – who became successful in breaking the barriers of gender to raise India's national flag high in front of the whole world. There is no denial to the fact that in a male dominated country like India, it would have been really hard for them to emerge out of the various prevalent taboos to achieve such positions of eminence.

Victims of Discrimination:

Due to long prevailing gender discrimination and dominance of men in the Indian society, women have been suppressed in their families and society at large. Even they have been prone to violence and various discriminations by the male members, even in their own families. The situation is no different in many other countries of the world. Except some European nations most of the other countries in the world are prone to serious gender discrimination, akin to India.

A Long Way to go:

In rural areas, the condition of women is far from satisfactory and their contribution to the economy is also negligible. Though they make for almost 50% of the population of the country, they have not been empowered enough to get equal opportunities in realising their fullest potential. In such condition, we can say that our country cannot become a developed nation unless we empower women in the true sense of the term. It is very necessary to pay proper attention to their development by providing them equal opportunities in all areas of human activity.

Winds of Change:

Though Women have been given a special place in every religion, many ill practices have been going on against women as a norm since ages. But positive changes are now visible and the patriarchal system of society has been gradually eroding. Women are now claiming the socio-political rights (right to work, right to education, right to decide, etc) for themselves.The successive governments have implemented various constitutional and legal rights to help women lead purposeful and meaningful lives. There is an increasing awareness about women's rights which is evident in the emergence of several NGOs and self-help groups. At the individual level too, women are now breaking the shackles of suppression and making their voices heard for their rights. The Parliament of India too has passed various legislations to save women from various forms of injustice and discrimination. Following are some of these laws to empower women: Equal Remuneration Act-1976; Dowry Prohibition Act-1961; Immoral Traffic (Prevention) Act-1956, Medical termination of Pregnancy Act-1971; Maternity Benefit Act-1961; Commission of Sati (Prevention) Act-1987; Prohibition of Child Marriage Act-2006; Pre-Conception & Pre-Natal Diagnostic Techniques (Regulation and Prevention of Misuse) Act-1994; and Sexual Harassment of Women at Work Place (Prevention, Protection and) Act-2013.More recently, in the wake of Nirbhaya case involving the rape and brutal murder of paramedical student in Delhi, the government has passed the Juvenile Justice (Care and Protection of Children) Bill, 2015. This Act makes a significant departure from the earlier Juvenile Justice (Care and Protection of Children) Act, 2000, as the juvenile age inviting punishment for offence now stands reduced from 18 to 16 years.

Conclusion:

If we want to bring about women empowerment in the true sense, there is a crying need for the elimination of the male superiority and patriarchal mindset. Also, women need to be given equal opportunities for education and employment without any sense of discrimination. Unless there is attitudinal change in society towards women, merely arming them with legal and constitutional rights will be simply inadequate.

Swachh Bharat Mission

Prince Kumar

India has registered a sustained economic growth in the last few years. But it still faces a huge economic loss due to poor hygiene and sanitation. A recent World Bank report has highlighted that India loses 6.4% of GDP annually because of this particular reason. Under the Swachh Bharat Mission (SBM) launched by Prime Minister NarendraModi, the Government of India aims at "**total sanitation**" by 2019. It means every household in India will have a toilet by the end of the year 2019, the 150th birth anniversary of **Mahatma Gandhi.**

Objectives of the Swachh Bharat Mission

Objectives of the Swachh Bharat Mission are – elimination of open defecation, conversion of insanitary toilets to pour flush toilets, eradication of manual scavenging, 10% collection and scientific processing/disposal reuse/recycle of municipal solid waste, to bring about a behavioural change in people regarding healthy sanitation practices. The programme aims to generate awareness among the citizens about sanitation and its association with health. It also calls for strengthening of urban local bodies to design, implement and operate systems to create conducive environment for private sector participation.

Menace of the Open Defecation

One of the major causes of lack of cleanliness in the country is open defecation. It refers to a practice whereby people go out in fields or other open spaces rather than using the toilets to defecate. This practice is quite rampant in India. A UN report says that India is home to the world's largest population of people who defecate in the open and so close to 65,000 tonnes of excreta is added into the environment each day.

The Open Defecation Free (ODF)

To become Open Defecation Free (ODF) is an uphill task for a country like ours. The age-old practices and a lack of awareness among people are posing severe challenges to health. Only three states have so far declared themselves as Open Defecation Free. These are: Sikkim, Himanchal Pradesh and Kerala. Sikkim is the first Indian state which was declared ODF state under the Swachh Bharat Mission.

In October 2016, Himachal Pradesh was declared Open Defecation Free (ODF) state under the SBM. After Sikkim, Himachal Pradesh got this status to have toilet for every individual household. Among bigger states, however, Himachal Pradesh is the first state to become ODF. All 12 districts of the state have been covered as ODF districts. It entitles Himachal Pradesh to receive the World Bank funding under Rs. 9,000 crore projects to sustain sanitation campaign. In November 2016, Kerala was declared as ODF state. States like Haryana, Gujarat, Uttarakhand and Punjab are likely to achieve ODF status for all rural areas by 31st March 2017. According to the official figures, about 113,000 villages in India have become ODF. But the full potential of this cleanness drive is yet to be realised.

Funding of the Swachh Bharat Mission

This mission is one of the leading centrally-sponsored schemes for which cooperation of all the states is quite important. The SBM receives funds through budgetary allocations, contributions to the Swachh Bharat Kosh and Corporate Social Responsibility (CSR). It also receives funding assistance from the international organisation like the World Bank. The Government of India introduced Swachh Bharat Cess (SBC) in 2015 which is used for financing and promoting the Swachh Bharat initiatives.

It is applicable on all taxable services. It is levied, charged, collected and paid to the Government of India, independent of service tax. It is charged as a separate line item in the invoice. SBC has been introduced for financing and promoting Swachh Bharat initiatives and has become effective since 15 November 2015 at the rate of 0.5% on all taxable services. SBC is collected in the Consolidated Fund of India.

The Union Government has already announced for Swachh Bharat Kosh (SBK) in 2014. Its Governing Council is chaired by Secretary, the Department of Expenditure, and Ministry of Finance. Secretaries from several ministries are part of it. Its instruction is to procure Corporate Social Responsibility (CSR) funds from the corporate sector and philanthropists. It accepts contributions from individuals also. The Kosh is used to achieve the objective of improving cleanliness levels in rural and urban areas.

Conclusion:

Though people have started to pitch in to help spread the message of 'Cleanliness is next to Godliness', we still have miles to go. The government needs to work on the entire sanitation value chain including water supply, safe disposal and treatment of waste, and maintenance of infrastructure. The construction of toilets as well as awareness campaigns needs the backing of the state for regular monitoring of the toilet use. Not only this, there is a need to engage the community also to address the age-old practices in the rural areas. At this juncture, every countryman should take a pledge that he/she will contribute towards making India clean in the true sense of the term.

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