JSS ACADEMY OF HIGHER EDUCATION & RESEARCH, MYSURU

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JSS COLLEGE OF PHARMACY, OOTY

(ISO 9001:2015 CERTIFIED)

ALL INDIA COUNCIL FOR TECHNICAL EDUCATION & RESEARCH, NEW DELHI

Sponsored

QUALITY IMPROVEMENT PROGRAMME (QIP)

on

PROSPECTIVE APPROACH ON ADVANCED BIOTECHNOLOGY, CELL CULTURE AND BIOINFORMATICS IN MODERN RESEARCH

1st – 14th March 2019

Venue: Dept. of Pharmaceutical Biotechnology, JSS College of Pharmacy, Ooty

PROGRAM REPORT

ORGANIZED BY

Department of Pharmaceutical Biotechnology

JSS College of Pharmacy, Ooty

Report on

ALL INDIA COUNCIL FOR TECHNICAL EDUCATION & RESEARCH (AICTE), NEWDELHI

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Date: 1st – 14th March 2019 **Venue: Dept. of Pharmaceutical Biotechnology, JSSCoP**

Program Organized By:

Dept. of Pharm. Biotechnology
JSS College of Pharmacy
Ooty

Program Report Submitted By:

Dr. Ashish Wadhwani
Assistant Professor & Head,
Dept. of Pharm. Biotechnology
Program Co-Ordinator

DAY 1 (1st March 2019)

All India Council for Technical Education (AICTE), New Delhi sponsored Quality Improvement Program on Prospective Approach on Advanced Biotechnology, Cell culture and Bioinformatics in Modern Research was inaugurated by the President of the function Dr. C.G Betsurmath, Executive Secretary, JSS Mahavidyapeetha, Mysuru. Dr. Smita Kulkarni, Scientist F and Deputy Director, National AIDS Research Institution (NARI), ICMR, Pune; Dr.K.Bangarurajan, Joint Drugs Controller, CDSCO, New Delhi; Dr. Hiriyan Ravikumar, Joint Director of Health Services, The Nilgris; Dr. Easwaramurthy, Principal, Govt. Arts College, Ooty; Dr. Srinivas Reddy, Managing Director, TANTEA, Ooty; Prof. K. Chinnaswamy, President, Indian Association of Colleges of Pharmacy, Chennai were the guests of honor. Dr. B Suresh, President- Pharmacy Council of India, New Delhi & Vice Chancellor, JSS Academy of Higher Education and Research, Mysuru was the chief guest of the program and provided keynote address. During his keynote address, he emphasized about the importance and objectives of continuing education for the pharmacy professionals and different pedagogies to be used for the teaching of pharmacy students. Dr. Ashish D Wadhwani, Program Coordinator of the QIP program briefed about the objectives of the program such as:

- To expose and train academic practitioner(s) and teachers with advanced and state of the art techniques enabling them to carry out research in frontier area of science and technology.
- To provide a solid understanding of modern biotechnology, cell culture and bioinformatics through expert presentations and hands on wet and dry lab training.
- To help the participants to gain experience through integrated learning methods, utilizing hands on training to reinforce lecture material, participants will learn the biological basis and relevance of the process of culturing cells and 3D cultures.
- To give participants a combination of lecture and hands on laboratory experience using RT-PCR methods and bioinformatics tools.
- Participants will gain experience using DNA binding dyes and hydrolysis probe chemistries as well as 2 plex real-time PCR.
- Lectures will include an overview of gene expression, drug design and optimization, template preparation, analysis of results, additional applications of advanced bio technology, and more.

Dr. Wadhwani also emphasized on hands on teaching and learning on all the experiments scheduled for the fourteen days long program and requested the participants to translate the knowledge they gain to their parent institutions.

Dr. S.P Dhanabal, Principal, JSS College of pharmacy, Ooty thanked all the participants for their interest to participate in the program.

Immediately after inauguration the program started with the keynote address by Dr. Smita Kulkarni. Dr. Ashish Wadhwani, Program Co-Ordinator welcomed all the participants and congratulated them for their decision on attending the program and being part of this learning process.

Lecture 1:

Dr. Smita Kulkarni, Scientist F and Deputy Director, National AIDS Research Institution (NARI), ICMR, Pune

IN VITRO TESTING AND DRUG DISCOVERY: ICMR-NARIS EFFORTS IN ANTI-HIV1 DRUG DEVELOPMENT

Adverse reactions and drug resistance are the known barriers for long term use of anti-retrovirals (ARVs) in the management of HIV infection. Additionally, absence of preventive vaccine and microbicide necessitate the search for newer and safer anti-retroviral drugs. Considering the need, Indian Council of Medical Research (ICMR)-National AIDS Research Institute (NARI), Pune, India has taken an initiative in the area of preclinical testing of indigenously developed ARVs that has strengthened the anti-HIV drug development in India.

An in vitro pre-clinical evaluation algorithm for screening indigenous anti-HIV entities has been developed. The algorithm includes an initial screening using a high throughput cell based assay followed by confirmation in primary HIV target cells. The potential microbicide candidates are further assessed for toxicity to the endometrial epithelial cells, cervical explants and activity against sexually transmitted and reproductive tract pathogens.

These attempts resulted in evaluation of several herbal/synthetic preparations with HPLC/ HPTLC and chemo profiles and promising new chemical entities. Assessment of an indigenously developed ploy herbal microbicide formulation showed inhibition of HIV-1 primary isolates belonging to different clades. Our continuous scientific endeavor has thus established one of a kind pre-clinical anti-HIV testing platform which is of national use and accelerated anti-HIV drug/microbicide development.

Brief Biography

Awards and honors:

1. Outstanding Researcher for 2017, Antiviral Research Society, India.
2. Letter of Appreciation from Union of Iranian Students Islamic Association (UISA) & Iranian Embassy, November 2017
3. Research Scholar, Duke University Medical Centre, Durham, USA, August-September 2006.
4. Fogarty AITRP Fellowship in HIV Immunology/Virology, Johns Hopkins University, Baltimore, MD; National Institutes of Health, Bethesda, MD; New York University Medical Centre, NY, USA, March-August 2000.
5. Colombo Plan Health General Fellowship in HIV Plus Microbiology Screening (AIDS/Blood Screening Technology), Regional Blood Transfusion Centre, New Castle Upon Tyne; Edinburgh University, Edinburgh and Dundee University, Dundee, January-March1992.

Trainings acquired:

1. Training on CDC Dried Tube Specimens (DTS) for HIV-1 viral load proficiency Testing (PT) Programme Technology Transfer, HIV laboratory, Centre for Disease Control & Prevention, Atlanta, USA from 23-27 October 2017.
2. Training on "Cultivation of Orentia tsutsugamushi" at the Rickettsial Zoonosis branch, Centre for Disease Control & Prevention, Atlanta, USA from 30th October to 3rd November 2017.
3. Training in Flow Cytometry (CD4/CD8 estimation), Becton Dickinson, San Hose, CA, USA, 1991.

Affiliations:

1. Recognized Research Guide for M.Sc., M. Phil. and Ph. D. Microbiology, Biotechnology, Health Science, Biomedical Sciences, Pune University, Symbiosis International University, Pune, India and Maharashtra University of Health Sciences, Nasik, India.
2. Ph. D. Co-Guide, Manipal College of Pharmaceutical Science, MAHE, Manipal.
3. Coordinator and Faculty for HIV / AIDS course, M.Sc. Virology, Pune University, Pune, India.

Experience and Achievements:

1. **HIV Virology and Molecular Virology (1987-2019)**
   - Establishment of HIV-1 RNA estimation, accreditation by NABL, international agencies and WHO prequalification laboratory
   - Member of the Viral Load Expert Committee constituted by NACO, In-Charge of the Apex laboratory for HIV-1 viral load estimation developed in support to the National AIDS Control Programme (NACP). HIV-1 Viral load proficiency testing (VLPT) panel development and provider for external quality assurance.
   - Validation of newer technologies and point-of-care assays for HIV viral load estimation, Standardization of dried blood spot (DBS) as a sample type for HIV-1 viral load estimation
   - Development of *in vitro* anti-HIV testing platform. Testing of several herbal and synthetic preparations for anti-HIV activity under various projects as a support to

Indian researchers.

- Initiated studies on HIV coinfecting viral pathogens (HSV-2, HTLV-II, HHV-8).
- Establishment of assays for determining neutralizing antibody responses using GHOST and TZM-bl cell lines. Characterization of neutralization responses and neutralization phenotypes in recent HIV-1 infection.
- Establishment of repository of Indian HIV-1 and HIV-2 strains, isolation and characterization of Indian HIV-1, HIV-2 and recombinant strains. First report of HIV-2 isolation from India.
- HIV diagnosis and kit evaluation, establishment of CD4 and CD8 estimation.

2. **Rickettsiology: (1981-1987)**
   - Diagnosis of rickettsial infection, development of rickettsial antigen using chick embryo and immue sera using guineapigs. Establishment of an *in vitro* method for isolation and confirmation of *Coxiella burnetii* from acute infection in an animal model.
   - Establishment of Rickettsiology laboratory at ICMR-NARI (ongoing).

Research Support:

Principal Investgator: 9 (funded by DBT, ICMR, NACO, etc)
Co-Investigator: 23 (institutional & collaborating institutes)

Total publications: 76 (Patents: 2, publications in peer reviewed scientific journals: 71, Proceedings & book chapters: 3)

Interaction Session

After the presentation by Dr. Kulkarni the ice breaking session was organized at the department for knowing each other better and going forward in this program.

Followed by that Dr. Wadhwani and Ms. Divyabharathi M. took the participants to the cell culture laboratory and briefly explained about the instrumentation used in the cell culture laboratory.

The day ended with the fruitful interaction and discussion among the participants.

DAY 2 (2nd March 2019)

Lecture 2: **Dr. Ashish Wadhwani, Assistant Professor and Head, Dept. of Pharmaceutical Biotechnology, JSS College of Pharmacy, Ooty**

IN VITRO CELL CULTURE MODELS FOR HIGH-THROUGHPUT DRUG SCREENING AND

Many areas of biomedical research focus on the study of human-specific diseases and medical concerns for which induced animal models are seldom, if ever, appropriate or scientifically relevant. This largely reflects obvious species-specific differences in anatomy, biochemistry, physiology, pharmacokinetics, and toxic responses. Use of replacement alternative methods, especially incorporating human cells and tissues, avoids such confounding variables.

A specific example of a basic research alternative method, and one that potentially has saved up to one million animals, is the in vitro production of monoclonal antibodies (MAbs), which are used in nearly every field of biomedical research and critical areas of clinical practice. Cell culture is highly desirable, as it provides systems for ready, direct access and evaluation of tissues. The use of tissue culture is a valuable tool to study problems of clinical relevance, especially those related to diseases, screening, and studies of cell toxicity mechanisms (Antiviral, Anticancer, Antihyperlipidimic, Hepatoprotective, Antidiabetic etc.). Ready access to the cells provides the possibility for easy studies of cellular mechanisms that may suggest new potential drug targets and, in the case of pathological-derived tissue, it has an interesting application in the evaluation of therapeutic agents that potentially may treat the dysfunction.

Commonly employed methods of in vitro testing, including dissociated, organotypic, organ/explant, and 3-D cultures, are studies for specific focus on retaining cell and molecular interactions and physiological parameters that determine cell phenotypes and their corresponding responses to bioactive agents. Distinct advantages and performance challenges for these models pertinent to cell-based assay and their predictive capabilities required for accurate correlations to in vivo mechanisms of drug toxicity are compared.

Brief Biography

Dr. Ashish Wadhwani completed his Ph.D. from JSS University, Mysuru during 2010-2013. He worked as CSIR- Senior Research Fellow, Govt. of India, New Delhi. Dr. Wadhwani was associated with National AIDS Research Institute (A unit of ICMR), Pune for his Post Doc joint proposal for DBT-ICMR - HIV/AIDS and microbicides project.

Dr. Wadhwani presented his research findings and won several awards at International conferences at Amsterdam, Malaysia, and USA which was sponsored by Government National & International agencies. He has twenty three papers published in peer reviewed journals and two chapter in a book to his credit.

Dr. Wadhwani is former DST International Research Fellow and Quality of Life Member of the Kyushu University of Health and Welfare, Japan, Technical Expert for the Molecular Diagnostic Unit of National Institute of Biologicals, Ministry of Health and F&W., Govt. of India, New Delhi, Member of Antimicrobial Resistance (AMR) for drafting antibiotics' use guidelines and articles for media sensitization from Pharmacy Council of India, New Delhi and Mentor of Change by Atal Thinkering Lab an initiative of Govt. of India. Recently Dr. Wadhwani received "Antiviral Research Fellow 2017" Award by Antiviral Research Society, India.

• Focused Area of research on;

✓ Developing cell based assays for screening natural products and small molecules;

✓ Discovering new chemical entities against HSV and HIV; and other enveloped and non enveloped viruses;

✓ Biological mechanisms undergoing viral entry and pathogenesis;

✓ Cancer Biology: Understanding the mechanism of Nano materials for active targeting and enhancing apoptosis activity in colorectal and breast cancer in vitro and angiogenesis assays.

Dr. Wadhwani has two ongoing and one completed project from Department of Biotechnology, Govt. of India to his credit.

Currently he is serving as an Assistant Professor and Head at Department of Pharmaceutical Biotechnology, JSS Academy of Higher Education & Research – College

Day 2 - Practical 1

Demonstration and Hands on- HAT CAM Assay (Dr. Ashish Wadhwani, Ms. Janani K.A)

Dr. Wadhwani explained about the importance of the method and how this method has replaced the *in vivo* method. Ms. Janani demonstrated experiment part of the HAT CAM method and assisted the participants for the hands-on training. (Protocol available in study material)

Day 3 (3rd March 2019)

Being Sunday, the Local Sight Seeing was arranged for the participants to Exploring the beauty of Ooty.

DAY 4 (4th March 2019)

Although it was Mahashivarathree holiday, some of the participants were interested in observing the on going cell culture work and they were present for half a day to witness the experiments in the cell culture laboratory.

DAY 5 (5th March 2019)

Lecture: 3 Dr. R Rajesh Kumar, Lecturer, Department of Pharmaceutical Biotechnology, JSS College of Pharmacy, Ooty

PREDICTING THE PROTEIN STRUCTURE FROM SEQUENCE

The protein structure prediction can be categorized into template-based modelling and free modelling depending on whether similar structures are found in the PDB library. While threading is an effective tool for detecting structural analogues, progress in the development of methodology has reached a steady state. Encouraging progress is observed in the refinement of structures aimed at drawing template structures closer to the native; this was driven mainly by the use of multiple structure templates and the development of hybrid knowledge-based and physics-based force fields. Exciting examples in folding small proteins into atomic resolutions have been witnessed for free modelling. But predicting protein structures greater than 150 residues remains a challenge, with both force field and conformational search bottlenecks (1).

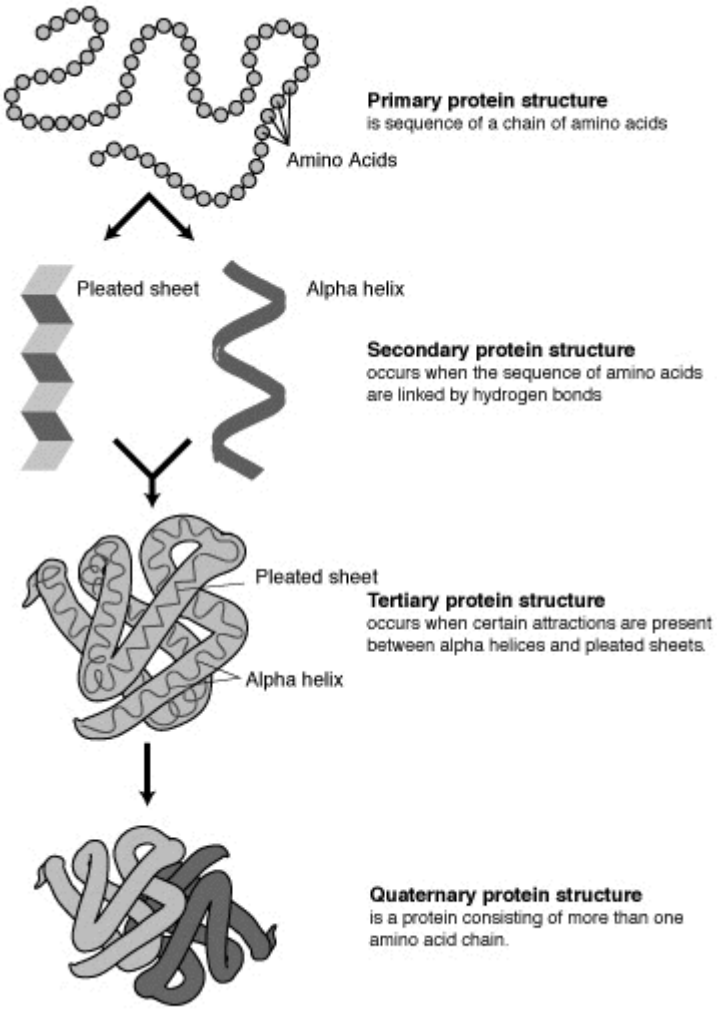


Fig 1. Steps in Protein Structure Prediction

```
        190       200       210       220       230       240
....:....x....:....x....:....x....:....x....:....x....:....x
HNCWRICGDECLLSKFQQLQAPYQDQLPAPAARLLPLGLLTLLQAIPRVIMAIRQCFGV
EEEECCCCCCCCHHHHHHHHHHHCCCCHHHHHHCCCCCHHHHHHHECCCCCCCCCCCCC
ECEEEEECCHHHHEHHHHHHHCCCCHCCHCHHHHHCECEEEHHHHECEEEEHEHHEECC
CCCCCCCCCCCHHHHHHHCCCCCCCCCCCHHHHHHHHHHHHHHHHHHHHHHHHHCCCC
CCEEEECCCCCCHHHHCCCCCCCCCCCCCHHHHHCHHHHHHHHHHCHHHHHEEEEEEEC
CCCCCCCCCCCHHHHHHHCHCCCCCCCCCHHHHHHHHHHHHHHHHCHCEEEEEEECCCC
CCCCCCCCCHHHHHHHHHCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCHHHHHHHCCCC
EEEEECCCCCCEECCCECCCCCCECCCCCCCCCCCCCEEEEEEEEEECEEEEEEEECCCC
CCEECCCCCCCHHHHHHHCCCCCCCCCCCHHHHHCCCCHHHHHHHCCCCCCCECCCCCC

H — Alpha-helices
E — Beta-strands
C — Coil
```

Fig 2. Protein Secondary Structure

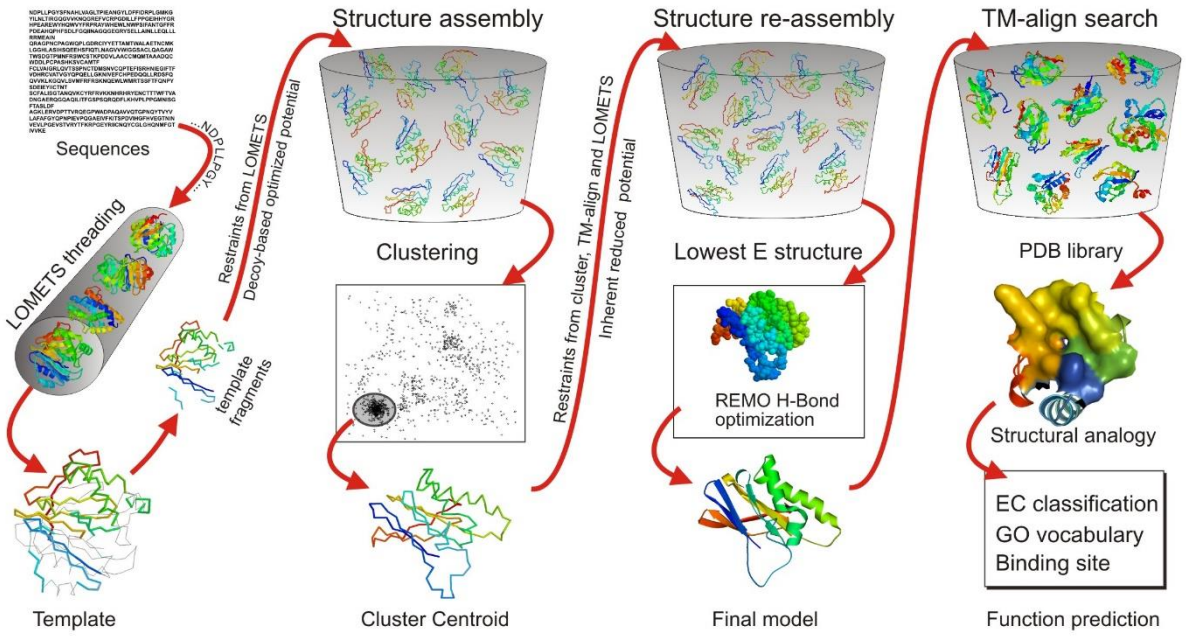


Fig 3. TASSER-Pipeline

Despite many debates in recent years, structure genomics is probably one of the most notable efforts in determining protein structure, which aims to obtain 3D models of all proteins through an optimized combination of experimental structure solution and computer-based structure prediction. The success of structure genomics will be dictated by two factors: experimental structure determination of optimally selected proteins and efficient algorithms for computer modelling. Based on about 40,000 structures in the PDB library (many are redundant), a simple combination of PSI-BLAST search and comparative modelling technique can obtain 4 million models / fold assignments (2). Developing more sophisticated and automated computer modelling approaches in the structure genomics project will dramatically expand the scope of modellable proteins.

The key problems in the field of protein structure prediction include: first, how to identify the correct templates and how to refine the template structure closer to the native for sequences of similar structures in PDB (especially those of weak / distant homologous relation to the target); second, how to build models of correct topology f In the recent CASP7 experiment under the

categories of template-based modelling (TBM) and free modelling (FM), the progress made along these lines was evaluated. I will review in these directions the new progress and challenges(3).

Practical 2: Demonstration and Hands-on tools used in Bioinformatics

Dr. Rajesh after his lecture started the demonstration of tools used in bioinformatics where he explained various tools used in bioinformatics and gave the training on designing protein structure for sequencing.

Reference:

1. Zhang Y. Progress and challenges in protein structure prediction. Curr Opin Struct Biol [Internet]. 2008 Jun [cited 2019 Apr 30];18(3):342–8. Available from: http://www.ncbi.nlm.nih.gov/pubmed/18436442
2. Zhang Y. Protein structure prediction: when is it useful? Curr Opin Struct Biol [Internet]. 2009 Apr [cited 2019 Apr 30];19(2):145–55. Available from: http://www.ncbi.nlm.nih.gov/pubmed/19327982
3. Rost B. Review: Protein Secondary Structure Prediction Continues to Rise. J Struct Biol [Internet]. 2001 May 1 [cited 2019 Apr 30];134(2–3):204–18. Available from: https://www.sciencedirect.com/science/article/pii/S1047847701943369

Brief Biography:

1. **Name** **:** Dr. Raman Rajeshkumar
2. **Date of Birth** **:** 08.07.1980
3. **Residential Address** **:** 119/9, Sakthi Illam, Nondimedu, Near HMT
4. **Phone** **:** 0423-2448932, Mobile: 8220194532
5. **Designation** **:** Lecturer, JSS College of Pharmacy,
   JSS Academy of Higher Education & Research, Mysore
6. **Department** **:** Pharmaceutical Biotechnology
7. **Qualification** **:** M. Pharm., Ph.D., BASM., PGDIB., TNSET.,C, C+, HTML
   UNIX, LINUX, BIOJAVA, BIOPERL, R SRIPTS etc
8. **Area of Specialization** **:** Free Radical Biology, Cancer Biology, *In Silico* Biology

9. Short Profile:

Dr. Raman Rajeshkumar is a lecturer in the department of pharmaceutical biotechnology. He received his Masters from Tamilnadu Dr. MGR Medical University, Chennai and Ph.D from JSS University, Mysore. Dr. Raman Rajeshkumar currently working on the application of computational biology, algorithms and mathematical models to predict differentially expressed genes in microarray datasets. He also has research experience in the field of free radical biology and cancer biology, microbiology, Advanced Bioinformatics, Protein formulations. Lifetime member in various societies such as IAENG computer scientist, SBTI and IPA. Recently he received the K.N. Narasimhiah award from society of biotechnologist (India).

10. Publications	**:** National: 8 International: 10
11. Presentations	**:** National: 15 International: 3
12. Scientific Talk	: 15
13. Guideship	: PG: 13 UG: 30 M.Sc/M.Phil: 12
14. Editor/Reviewer	**:** Asian Journal of Pharmaceutics
15. Member	: Indian Pharmaceutical Association, Society of Biotechnologist India, International Association of Engineers and Computational Scientist, Eurasia Research Group
16. Collaboration	: National Institute of Ocean Technology
17. Awards Received	: K.N. Narasimhiah award from SBTI
17. Experience	: 12 years
18. Contact	: bathmic@jssuni.edu.in

DAY 6 (6th March 2019)

Lecture 4: Dr. T K Praveen, Professor and Head, Department of Pharmacology, JSS College of Pharmacy, Ooty

Animal Testing: History and alternative methods

There are scientifically validated alternatives that are better than using animals in research. In 1959, Russell and Burch published *The Principles of Humane Experimental Technique*, which introduced the "3Rs" of alternative experimental methods. In addition to elucidating the concepts of humane research and the importance of alternatives, the 3Rs advocate for test methods that

- **Refine** animal use by lessening or eliminating pain or distress in animals, or enhancing animal well-being
- **Reduce** animal use by decreasing the number of animals required for testing while still obtaining the testing objectives
- **Replace** animal use with either non-animal methods or a less developed animal species (for example, replacing a mouse with a fish)

Simply stated, these alternatives exemplify a scale of varying degrees of decreased animal use and suffering and have come to be applied, not just in regulatory toxicity testing, but in all areas of research and testing. *Replacement* methods represent the ultimate goal of the alternatives approach to basic biomedical research, testing, and education—and it is the alternative that NEAVS is committed to realizing.

Today, there is a vast range of non-animal research methods available to researchers. Russell and Burch, Ethel Thurston, and others placed the concept of alternatives squarely on the doable scientific map. Alternatives are proving not only more humane, but more cost-effective, faster, and more relevant to humans.

Some alternatives to the use of animals in research include:

Epidemiological studies

Epidemiology is the study of naturally occurring (versus experimentally induced) disease and health in human populations. Results of epidemiological data collected over years (longitudinal studies) have provided researchers and health practitioners with the understanding of causes,

treatments, and preventions of a range of human illnesses. Epidemiology exists in the interest of individual and public health. Epidemiological researchers are committed to the dissemination of preventative information, changes in policy that will affect health and well-being, and other aspects of public health medicine. Epidemiology is an extremely important method to identify risk factors for disease and to determine optimal treatment approaches to clinical practice, which typically will include lifestyle changes, and understanding of the role of genetics and potential environmental contributors to illness.

Epidemiological studies, for example, revealed that smoking is associated with lung cancer, and it was the first area of research to identify AIDS when rare infections and malignancies surfaced in patients in the late 1970s. Further, the famous Framingham Heart Study, ongoing for the last 60+ years, has given us more information about the causes, preventions, symptoms, and evidences of heart disease than any other single area of heart research.

Some recent research milestones discovered without animal testing from the Framingham Heart Study include

- Learning that sleep apnea is tied to increased risk of stroke
- Pinpointing additional genes that may play a role in Alzheimer's
- Finding that fat around the abdomen associates with smaller, older brains in middle-aged adults
- Detecting that genes link puberty timing and body fat in women
- Determining that having a first-degree relative with atrial fibrillation is associated with increased risk for this disorder
- Discovering hundreds of new genes underlying the major heart disease risk factors—body mass index, blood cholesterol, cigarette smoking, blood pressure, and glucose/diabetes
- Identifying first definitive evidence that occurrence of stroke by age 65 years in a parent increases risk of stroke in offspring by 3-fold

In vitro research and human cell and tissue cultures

In vitro (test tube or “in glass”) research and human cell cultures have proven superior to animal tests for a multitude of purposes. Human cells and tissue cultures studied “in glass” have advanced our knowledge of human disease. Some significant findings from *in vitro*testing include cancer-screening treatments, testing drugs with biochips, and replicating human skin for research. The primary advantage of *in vitro* research is that it permits simplification of the system or disease

under study, allowing the investigator to focus on a small number of components. *In vitro* models of the brain and the blood-brain barrier are being used for studies of neurotransmitter pathways, electrophysiological characteristics, morphological associations of human diseases (i.e., Alzheimer's, Parkinson's, Huntington's, and epilepsy), new drug designs, receptor targets, and modes of action of new pharmaceuticals.

In the lab, researchers culture cells or tissues obtained from human volunteers, surgical operations, biopsies, and post-mortem specimens and use them for *in vitro* studies. Tissue culturing is an important tool for the study of the biology of cells from multi-cellular organisms. It provides an *in vitro* model of the tissue in a defined environment for analysis.

Though surrounded by controversy because of potentially unethical procurement and uncompensated commercial use of the human cells, there are infinite possibilities of using human cell lines. For example, in 1951 Henrietta Lacks died of an aggressive form of cervical cancer. Researchers harvested her cells, called HeLa cells after (He)nrietta (La)cks, without family approval or knowledge. Henrietta's "immortal life" through her cells has been

> …part of researching the genes that cause cancer and those that suppress it; they helped develop drugs for treating herpes, leukemia, influenza, hemophilia and Parkinson's disease, and they've been used to study lactose digestion, sexually transmitted diseases, appendicitis, human longevity, mosquito mating, and the negative effects of working in sewers. Their chromosomes and proteins have been studied with such detail and precision that scientists know their every quirk. … Henrietta's cells have become the standard laboratory workhorse.2

Clinical studies

We cannot rule out the value of human volunteers in research, and carefully designed and managed clinical studies can yield significant results without the use of animals, or harm to humans. Many individuals with both ordinary and terminal illnesses are willing to volunteer for new drug or treatment trials, or be part of a study collecting data on their illness. The numbers of ongoing human clinical studies testify to the fact that there is no shortage of volunteers. Studies with humans—both clinical non-invasive research performed with the highest ethical standards, and longitudinal epidemiological research—may in fact be two of the best alternatives to animals.

For example, if we want to know how healthy aging brains function and how cognitive impairments affect real individuals and families, it is best to study people in different stages of their lives—from 18 to 80 and beyond, as is done in clinical and epidemiological studies. In fact, more than 300 human clinical studies of aging, cognition, and memory were underway in 2007. While some research programs conduct memory and cognitive testing, others help seniors figure out how they are doing and then engage them in appropriate support programs. The University of Illinois has developed one such program called *Senior Odyssey*, where group problem solving and puzzles help seniors learn coping skills and get a mental workout.3 Sadly, Yerkes National Primate Research Center is also conducting aging studies on a population of humans, chimpanzees, and monkeys—species who will contribute little to the data garnered from the humans in the study, but will contribute to Yerkes' justification of its animal laboratories and the research dollars they bring in.

Autopsies and post-mortem studies

Human autopsy is the examination, after death, of the tissues and organs of the human body to determine the cause of death or existence of pathological conditions.4 Autopsy research has been responsible for the discovery and description of thousands of diseases, including Legionnaire's disease, viral hepatitis, aplastic anemia, and fetal alcohol syndrome. The principal aim of an autopsy is to determine the cause of death, the state of health of the person before he or she died, and whether any medical diagnosis and treatment before death was appropriate.

As a result of people donating their bodies to research, organ banks now exist, giving researchers' access to the supply along with detailed information about the person's medical history. McLean Hospital in MA, for example, houses the Harvard Brain Tissue Resource Center. First funded by the National Institutes of Health (NIH) in 1978, their "Brain Bank" is now the largest brain tissue research center in the world. It currently has over 6,000 donated human brain specimens, most from donors who had neurological disorders. The center serves as an important resource for studying neurological diseases like Alzheimer's, Parkinson's, etc.

Computerized patient-drug databases and post-marketing surveillance

Computer technology can collect detailed comprehensive records and maintain cross references on the side effects of drugs, treatments, etc. Once stored in a central database, researchers can rapidly identify dangerous drugs or interactions. Post-marketing surveillance of patients can also

identify unexpected beneficial side effects. In fact, clinical observation of patient side effects led to the discovery of the anti-cancer properties of nitrogen mustard and actinomycin D, and the mood-elevating effects of tricyclic antidepressants.

Mathematical models and computer simulations

Computer-based alternative methods produce computational disease and treatment models, collect and manage millions of human research data points, and carry out human clinical trials virtually. Computer model programs are able to simulate sophisticated anatomical functions such as heart rate and, along with other data, can be used to determine disease or predisposition to certain illnesses. For example, computer simulations of cancer cells are now used to test drug targets within them, and "mathematical models have helped to further our understanding of HCV [hepatitis C] dynamics and clinical trial results in humans."[5]

Non-invasive imaging techniques

Non-invasive imaging is the method used to create images of the body for clinical purposes (medical procedures seeking to reveal, diagnose, or examine disease) or medical science (including the study of normal anatomy and physiology). Imaging technology such as the CT scan (computed tomography), MRI (magnetic resonance imaging), AMS (accelerator mass spectroscopy), MEG (magnetoencephalography), DTI (diffusion tensor imaging), ultrasound, and nuclear imaging are all alternatives to utilizing unreliable animal models to produce results specific to humans. These non-invasive techniques allow very sophisticated, real-time measurements of associations between structure and function in humans and are accurate with resolutions possible down to single cells. These imaging options have had their most extensive applications in the neurosciences, allowing direct, noninvasive studies of human neurophysiology.

Chromatography and spectroscopy

These are physical and chemical techniques that identify, isolate, and measure compounds in drugs, toxins, and bodily fluids, such as blood, urine, or saliva.

Conclusion

We cannot afford—in human health, tax dollars, and animal suffering—to repeat the past failures of animal experiments. Rather than wasting millions of dollars and precious time, and bearing the

ethical costs of experimenting on so many sentient and intelligent beings, we can and should turn to humane, human-based science that is more promising, effective, and reliable.

A compelling example is our war on obesity in the U.S. The federal government is currently funding an obesity study involving rhesus monkeys. Researchers, since February 2011, intentionally over-feed the monkeys with rich, fattening foods, and lock them in cages, allowing them no access to exercise or other stimulation. This unnatural diet and severe physical restrictions cause extreme stress in the animals, especially since they are typically very active by nature. The intent of the study is to examine obesity's causes and effects on the body, and potentially related diseases such as heart disease or diabetes. Instead, obesity solutions for humans should come from active medical and policy intervention (e.g. healthy meals at all publicly funded schools, regulation prohibiting additives known to be related to unhealthy diets, etc.) to help reduce or eliminate the psychosocial causes of obesity in our society. Further, the development of effective public health education programs regarding better food choices and healthier lifestyles should be a federal funding priority—not animal models of obesity. Thankfully, the federal government is making changes by stepping in to educate people and fund obesity programs on the local level in schools—a far better solution to the current obesity epidemic.

According to a July 2011 report by the Trust for America's Health Executive Director, Jeff Levi, "'We can't afford to ignore the impact obesity has on our health and corresponding health-care spending,' … A combination of fewer calories, healthier foods and more physical activity is needed to start cutting pounds, researchers report. Drastic solutions like weight-loss surgery and prescription drugs are costly, last-ditch efforts meant only for people already suffering complications from their weight—not a society-wide solution."6 As more and more clinical data confirms the short and long-term negative effects of lifestyle choices and sociocultural values that lead to things like obesity and smoking, the government and researchers need to prioritize routes to prevent the spread of these problems and treat those already suffering from them. Continued funding of "animal models" will not, because it cannot, decrease the ever-increasing risk of major and life-threatening complications that result from choices which can and should change.

[1] Russell, W., & Burch, R. (1959). *The Principles of Humane Experimental Technique*.

[2] Skloot, R. (2010). *The Immortal Life of Henrietta Lacks.* New York: Crown Publishers.

[3] Bailey, J. (2011). Bad medicine: Using elder chimpanzees in human aging research. Project R&R.

[4] Kapis, M. B. (1993). Human autopsies in biomedical research. In M.B. Kapis, & S.C. Gad, (Eds.), *Non-Animal Techniques in Biomedical and Behavioral Research and Testing.* Ann Arbor, MI: Lewis Publishers.

[5] Bailey, J. (2010). An Assessment of Chimpanzee Use in Hepatitis C Research: 2. Alternative Research Methods. *ATLA*, 38(6), 471-494.

[6] Metro News. (2011, July 7). Fat rising: obesity up by 90% in many U.S. states.

Brief Biography

His research career started in the year 2004 as a Research Associate/Study Director-Toxicology, R&D Center, The Himalaya Herbal Health Care, Bangalore. He underwent extensive training to conduct toxicity studies according to Good Laboratory Practice (GLP) at R&D Centre, The Himalaya Herbal Health Care, Bangaluru.

He joined JSS College of Pharmacy, Ooty, as a Lecturer in the year 2007. Since then besides his teaching responsibilities he has also interacted with many Pharmaceutical Industries and successfully completed more than 45 research projects worth around Rs. 80.0 Lakhs.

His arears of research interest include, Computer Aided Drug Discovery, Metabolic disorders-Diabetes Mellitus, Herbal drug research and Preclinical drug development. Under his guidance 6 Ph.D., Scholars are perusing their Ph.D., and 2 have completed their Ph.D. He has guided more than 28 M. Pharm., students till date. He has published 45 research papers, a Book chapter and successfully filed an Indian patent. He is one of the Expert Reviewer of ICMR for Extramural Projects.

He has received “Summer Research Fellowship-2014” from Science Academies, Govt. of India, for research training in Molecular biology at Institute of Life Sciences, Bhubaneshwar, Orissa, for 2 months with a stipend of Rs. 8000 per month. He has delivered 15 invited Speeches at various National Conferences and 3 speeches at International Conferences in USA and Malaysia. He received travel grants of Rs. 1,00,000/- (ICMR, New Delhi), Rs. 30,000/- (Tamilnadu State Council for Science and Technology, Chennai) and Rs. 25,000/ (CICS, Chennai) for attending these conferences.

He has received the following research grants from various funding agencies;

	Title	Role	Amount (Rs)	Agency and Sanction date

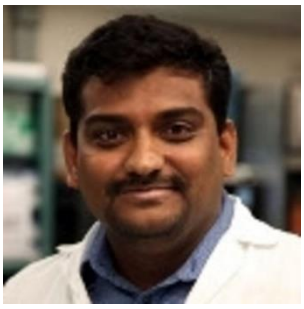
1.	Adipocyte specific delivery of oral thiazolidinedione nanoparticles functionalized with RGD and P3 peptides to reduce side effects and improve efficacy DST/NM/NB/2018/227	Principal Investigator	51.00 lakhs	DST, Nanomission, New Delhi
2.	Death receptor-5 targeted lipid nanoparticles of γ-secretase inhibitor for simultaneous targeting of breast cancer cells and cancer stem cells **BT/PR24607/NER/95/772/2017**	Principal Investigator	56.66 lakhs	DBT, NEW Delhi DBT-TWINING Project Feb, 2018
3.	Neuroprotection by nanoallosteric potentiators of M1 muscarinic acetylcholine receptors for reversal learning management in Alzheimer's disease"	Principal Investigator	72.20 lakhs	DBT-Nano biotechnology, New Delhi 27-3-2015
4.	Design synthesis and evaluation of some novel dipeptidyl peptidase IV inhibitors as antidiabetic agents	Co-Principal Investigator	10.88 lakhs	UGC- New Delhi

Practical 3: Basic techniques in experimental pharmacology

The entire day 5 was dedicated to experimental pharmacology where immediately after the lecture by Dr. Praveen, he demonstrated the gave the hands on training to the participants on animal handling techniques and various route of administration methods.

DAY 7 (7th March 2019)

Lecture 5: Dr. Suresh Mohan Kumar, Professor, Research Director & Coordinator-TIFAC CORE Herbal Drugs, JSS College of Pharmacy, Ooty



CELL CULTURE APPROACHES TO UNLEASH MOLECULAR DYNAMICS OF GLUCOSE HOMEOSTASIS AND INSULIN SIGNALLING

Dr. Suresh Mohan Kumar delivered a talk on the said topic which was well received by the participants.

Day 7 – Practical 4

After the lecture the practical session starter where the experimentation on isolation of primary culture from liver was carried out and the rat hepatocytes were isolated. The session started with the introduction of primary culture by Dr. T K Praveen and experimental part was carried out by Dr. Ashish Wadhwani (Protocol given in study material).

Same day afternoon the participants Ms. Anusha and Mr. S Karthikeyan performed the same experiment and isolated the primary hepatocytes.

DAY 8 (8th March 2019)

Lecture 6: Dr. S. P. MUTHUKUMAR Principal Scientist & Associate Professor, CSIR – CFTRI, Mysuru

CHICKEN IGY PRODUCTION AND ITS PHARMA APPLICATIONS

In the past two decades, biomedical research has been confronted with a growing public interest in the welfare of animals used in research. The resulting discussion has encouraged the search for ways to refine, reduce or even replace animal experiments. This also applies to the production of mono- and polyclonal antibodies in animals. These antibodies are important tools in bio-medical research, e.g. they are essential components of diagnostic methods for quantitative and qualitative determinations of a wide variety of biological molecules. Polyclonal antibodies are produced in rabbits and other rodents like mice, rats and guinea-pigs or in farm animals such as horses, sheep and goats. The production of polyclonal antibodies involves two stressful procedures, firstly the immunisation procedure with several injections and secondly the harvesting of the antibodies which involves bleeding of the animals. For more than a century it has been known that in immunised hens the concentration of antibodies is almost the same as in serum. However, there is conflicting evidence in the literature that the concentration of the IgY antibody was higher in yolk than blood concentrations. Although several classes of immunoglobulin are found in the serum of hens, only IgY is found in substantial amounts in yolk. Chicken IgY has sometimes been called IgG, since this Ig isotype exhibits properties quite similar to mammalian IgG. Moreover, IgY is sometimes called IgA, since the first immunological studies in chicken were first evaluated from a phylogenetical point of view. If hens are used for the production of antibodies, in comparison to mammals the painful step of blood sampling is replaced by antibody-extraction from egg yolk, which is abundant in comparison to blood. Thus the production of polyclonal antibodies in chicken is not only an improvement but also a valuable alternative in terms of the 3Rs principle of Russel and Burch. Although it is obvious that hens offer advantages as a source of antibodies, they are not yet widely used for this purpose. This seems to be due to a variety of factors, as e.g. the habits

of investigators, lack of experience and information. Generally two points seem to be of particular concern, first the keeping of hens, and secondly the harvesting of antibodies by extraction from egg yolk. Despite these, interest in IgY antibodies has been increasing, when judging either from the number of publications on IgY or from the number of secondary-antibodies, extraction-kits and diagnostics that are commercially available. Unfortunately, a real breakthrough has not yet occurred although avian antibodies have become known to potential users, which will eventually favour their application. Thus an essential step forward has been made during the last decade. Today there are two major directions in the application of the IgY technology: presence of neutralising antibodies in the yolk of eggs from immunised hens and second the application of the IgY technology driven by progress in immunology. It seems realistic to anticipate that the IgY -technology will be accepted as one of several methods for producing polyclonal antibodies since technical problems have been overcome and the method can easily be applied. However, since scientists are fairly conservative and usually stick to methods that have worked for them it is unrealistic to assume that polyclonal avian antibodies will generally replace mammalian ones in bio-medical research and diagnostic procedures. Thus it is more likely that IgY -antibodies will be used in immunology to study specific problems and they will, in addition, cover a small but constant part of the general production of polyclonal antibodies. The application of avian antibodies in human medicine for therapeutic purposes is currently beyond our imagination. Within the next decade the implementation of protection of animals used for experiments and other purposes will stimulate efforts to increasingly apply alternatives to experimental animals. Consequently, the hens rather than rabbits will be immunised, and in more general terms scientists may even be asked to produce antibodies without using animals. In the long run the application of molecular genetics may allow producing antibodies without using animals at the same quality and price as traditional polyclonal antibodies. Once this stage has been reached, classical polyclonal and monoclonal antibodies produced in animals will not be required any more. However, the properties of antibodies produced by gene-technology will first have to be shown in daily use. The first production of monoclonal antibodies was welcomed with high expectations, but were not met when the new technology was applied. In fact, polyclonal antibodies are still in use; and due to their immunological properties, they are quite often superior to monoclonals. For the reasons explained we may convince that under the present legal environment the immunisation of hens

should be encouraged by the government, scientists for possible applications in pharma and biotechnological research.

Brief Biography

Dr. S. P. Muthukumar is basically a veterinarian, BVSc from Tamil Nadu, MVSc from Kerala and PhD from Indian Veterinary Research Institute (IVRI), Izatnagar, Bareilly UP. His specialization is Biochemistry, Nutrition, Genetics and Breeding. He started his career as Asst. Professor & Hatchery Manager at Kerala Agricultural University, Veterinary Surgeon at Government of Kerala, Technical Officer at Institute of Genomics and Integrative Biology (IGIB) and joined as Senior Scientist at CSIR-CFTRI Mysuru in 2005. At present he is working as Principal Scientist at Department of Biochemistry. Apart from taking care of the Animal House facility, he is involved development of animal models, value addition to agricultural and food processing wastes, isolation and characterization of nutraceuticals and studies on in vitro and in vivo bioavailability of phytochemicals and nutrients, etc. He has more than 35 research papers in peer reviewed SCI-indexed journals, 30 invited lectures and presented more than 70 papers in national and international conferences. At present, he has one PDF and 4 PhD scholars under his guidance in the area biotechnology, biochemistry, food science and nutrition. He had completed 19 projects and currently involved in 3 research projects. One of his students (Ms. Nidhina) has been awarded CII- DST (Govt. of India) Prime Ministers Fellowship for Doctoral Research for 4 years (2013-2017) under public-private partnership programme. He is a Fellow of Society for Applied Biotechnology. He is also member of Board of Studies at JSS University, Davanagere University, University of Mysore and CPCSEA Nominee of IAEC of several institutions including JSS Medical College, JSS College of Pharmacy and JSS College of Pharmacy, Mysuru.

Lecture 7:

DEVELOPMENT OF ANTI-CANCER AGENTS: THE ROLE OF CELL LINES AND CELL-BASED ASSAYS

A cell line is a permanently established culture, which proliferates indefinitely when appropriate fresh medium and space are provided. Cultured cells are critical tools in the discovery and development of anti-cancer agents. Since cancer cells are different from normal cells in terms of (a) proliferation rates; (b) lack of apoptosis and differentiation; (c) migration ability leading to metastasis; (d) angiogenesis and vascular mimicry; several assays have been developed to measure these processes. For instance incorporation of bromodeoxy uridine (BrdU) or radioactive thymidine in to cells is one of the sensitive methods of measuring proliferation rates. Likewise, while caspase-3/7 assay or annexin-V staining measures the apoptosis; Boyden chamber's assay estimates the migration rate of cancer cells. Therefore, in this talk, protocols of these experimental methods and key points to consider while working with cultured cells will be presented and discussed in detail.

Brief Biography

Dr. SubbaRao V. Madhunapantula is a Professor of Cellular and Molecular Biology, Department of Biochemistry, JSS Medical College, JSS AHER. Dr. Madhunapantula has published 84 articles in peer-reviewed journals. His H-index is 27 and i10 index is 44. Under his guidance 6 candidates have received Ph.D.s. Currently 6 candidates are working under his guidance for Ph.D. Currently Dr. Madhunapantula is serving as a PI in two projects funded by DST (FIST) and DBT. In addition, he is a co-principal investigator in 3 DST-funded projects. Furthermore, he has been involved in various collaborative research activities within JSS AHER as well as with various institutions nationally and internationally. Students under his guidance have received Best Oral Presentations and Best Poster Awards in various national level conferences.

DAY 8 – Practical 5

Demonstration and Hands on – *In vitro* cytotoxicity assays (MTT and SRB Assay) - Dr. Ashish Wadhwani and Ms. Smita Dey

The cytotoxicity assays were performed by MTT and SRB. Dr. Wadhwani briefed about the importance of this *in vitro* assays and mentioned that before any samples to be checked by *in vitro* assays, cytotoxicity studies must be performed to decide the IC_{50} values and to confirm the dose take for any further *in vitro* experiments. Ms. Smita demonstrated the experimental part of it.

DAY 9 (9th March 2019)

Lecture 8: Dr. N. Krishnaveni, Professor and Head, Department of Pharmaceutical Analysis, JSS College of Pharmacy, Ooty.

IMPURITY PROFILING OF PHARMACEUTICALS

Day 9 started with the lecture by Dr. Krishnaveni where she explained about the impurity profiling of Pharmaceuticals – which is one of the upcoming topic in the pharmaceutical research.

Brief Biography

Dr. Krishna veni Nagappan is presently working as Professor & Head in the Department of Pharmaceutical Analysis, JSS College of Pharmacy, A Constituent College of JSS Academy of Higher Education & Research, India with fifteen years of experience in teaching and research. She was awarded Doctorate in Pharmacy by the Tamilnadu Dr. M G R Medical University, Chennai in the year 2012. She has received her M. Pharmacy in Quality Assurance in the year 2003 (GATE 2000 – Ranking 465) from S N D T Women's University, Mumbai and Bachelors in Pharmacy from Sri Ramakrishna Institute of Paramedical Sciences, Coimbatore in the year 1999.

She has published more than 40 papers in national and international peer reviewed journals. Her research area of interest includes impurity profiling of drugs and pharmaceuticals particularly stress degradation studies, characterization of degradation products from pharmaceuticals', analytical method development & validation for various food constituents and contaminants. She has also presented papers in various national and international conferences. She has guided 36 post graduate students and presently guiding 05 doctoral candidates in the field of stress degradation studies and food analysis. She has received travel grants to attend various national and international conferences and seminar grant from government agencies and JSS University, Mysuru to attend and organize conferences and seminars. She is a mentor for DST-WOS A Project worth 18.00 Lakhs. She is also the principal investigator for the DST FIST project sanctioned to the department of Pharmaceutical Analysis worth 58.00 Lakhs. She had also organized various workshops and conference in the field of pharmaceutical analysis. She served as Board of Studies member for JSS Academy of Higher Education & Research, Mysuru and JNTU, Ananthapur.

Lecture 9: Dr. N. Manoj Kumar, Assistant Professor, Senior grade in Genetic Engineering Department, SRM Institute of Science and Technology

DESIGN OF EXPERIMENTS MADE EASY

The quickest and easiest way to learn design of experiments is to attend a one-day workshop. The workshop most suited to beginners is "Design of Experiments Made Easy." This computer-intensive workshop covers the practical aspects of DOE. You will learn all about simple, but powerful two-level factorial designs.

The workshop will examine how to design experiments, carry them out, and analyze the data they yield. If two or more factors are varied simultaneously; the experimenter wishes to study not only the effect of each factor, but also how the effect of one factor changes as the levels of other factors change. The latter is generally referred to as an interaction effect among factors.

Upon completion of this workshop, the participants will know:

(i) The fundamentals of experiments and its uses,

(ii) Basic statistics including ANOVA and regression,

(iii) Experimental designs such as RCBD, BIBD, Latin Square, factorial and fractional factorial designs,

(iv) Application of statistical models in analyzing experimental data,

(v) RSM to optimize response of interest from an experiment, and

(vi) Use of software such as Design Expert.

Brief Biography:

Objective: To enhance and develop technical skills, to learn more about the latest paradigm and processes to fulfill my thirst for knowledge and to discover innovative technology, benefiting the common man.

Work Experience:

- Worked in quality analysis and formulation sector in SPIC Health care Pvt. Ltd, At Maraimalainagar, for 6 months.(2004)
- Worked as **Lecturer in Bharath University**, Chennai, Tamilnadu, India
- Working as **Assistant Professor, Senior grade in Genetic Engineering Department, SRM Institute of Science and Technology**), Chennai, Tamilnadu, India.

Research Activities:

Enzyme Technology, Bioprocess Technology and Microbial Technology and Pharmacological studies.

Techniques Known:

***Pharmaceutical and Pharmacological Analytical Techniques*:**

Drug assays, Bioassays of drugs, Analysis of Analgesic, Anti-inflammatory, Anesthetics effect of drug on animals, preparation of tablets, capsules, Parentrals, Syrups.

***Microbial Technology*:**

Isolation, purification and characterization of microbes.

***Enzymology*:**

Enzyme assays, enzyme kinetics and enzyme characterization.

Bioprocess Engineering:

Media optimization using *Design expert Software version 7.0*, SSF, SMF.

***Protein purification*:**

- Chromatography Techniques - Gel Permeation, Ion Exchange, Immobilized Metal Affinity, HPLC, GC, TLC
- Ultrafiltration and other protein techniques.
- SDS and Native PAGE.

***Nucleic Acid techniques*:**

Isolation of genomic DNA, plasmid DNA, restriction analysis, ligation, transformation, preparation of competent cells, conjugation and cloning, Agarose gel electrophoresis.

Funded Projects:

1. **N. Manoj Kumar**, "Detection of SNPs in SLC22A1 gene in Type 2 Diabetes Mellitus patients undergoing Metformin drug therapy in Indian population." (2013), Tamilnadu State Council for Science and Technology, India.

Day 9 – Practical 6

In continuation to his lecture Dr. Manoj Kumar also took a practical session on Design of Experiments Made Easy.

Day 10 (11th March 2019)

Lecture 10: Dr. K. Gowthamarajan, Professor and Head, Department of Pharmaceutics, JSS College of Pharmacy, Ooty

REGULATORY CHALLENGES FOR BIOLOGICS/ BIOSIMILAR- GLOBAL SCENARIO

A biological product is defined as "a virus, therapeutic serum, toxin, antitoxin, vaccine, blood, blood component or derivative, allergenic product, or analogous product, or any other trivalent organic arsenic compound, applicable to the prevention, treatment or cure of a disease or condition of human beings". Throughout the 20th century, the world witnessed great discoveries in the biological sciences. One of the earliest biological products introduced to the U.S. marketplace was a blood protein called Factor VIII first sold in 1966.The earliest FDA approval for a modern biotech product designed for human therapeutic use was given to human insulin in 1982, approval was given in 1985 to a human growth hormone (HGH) for the treatment of dwarfism. In the 1990s FDA granted approvals for vaccines against rabies, tetanum toxoids, and pertussis. The manufacturing process for a biological product usually different from the process for drugs. All biological products should be clearly identified by labels which should be approved by the national control authority. The evaluation of stability may necessitate complex analytical methodologies. Assays for biological activity, where applicable, should be part of the pivotal stability studies. Throughout the 20th century, the world witnessed great discoveries in the biological sciences, many of which led to the prevention or eradication of diseases that have devastated populations in the past. For 100 years, what is now known as FDA's Center for Biologics Evaluation and Research or "CBER," has played a significant role in ensuring the safety and efficacy of the fruits of these

scientific discoveries. CBER is responsible for the regulation of "biologics," which are medical products such as vaccines, blood and blood derivatives, allergenic patch tests and extracts, HIV and hepatitis tests, gene therapy products, cells and tissues for transplantation, and new treatments for cancers, arthritis, and other serious diseases. CBER reviewed the first vaccines to immunize persons against infectious diseases, such as polio, pertussis ("whooping cough"), and German measles. CBER research led to important discoveries to safely collect, prepare, and transfuse blood and blood plasma.

A biosimilar is a biological product that is highly similar to and has no clinically meaningful differences from an existing FDA-approved reference product. Minor differences between the reference product and the proposed biosimilar product in clinically inactive components are acceptable. For example, these could include minor differences in the stabilizer or buffer compared to what is used in the reference product. Any differences between the proposed biosimilar product and the reference product are carefully evaluated by FDA to ensure the biosimilar meets FDA’s high approval standards. As mentioned above, slight differences (i.e., acceptable within-product variations) are expected during the manufacturing process for biological products, regardless of whether the product is a biosimilar or a reference product. For both reference products and biosimilars, lot-to-lot differences (i.e., acceptable within-product differences) are carefully controlled and monitored.

FDA's regulatory authority for the approval of biologics/biosi
milars resides in the Public Health Service Act (PHSA). However, biologics are also subject to regulation under the Federal Food, Drug,and Cosmetic Act (FD&C Act) because most biological products also meet the definition of "drugs" cited within this Act. Similarly, some medical devices used to produce biologics are regulated by Center for Biologics Evaluation and Research (CBER) under the FD&C Act's Medical Device Amendments of 1976.

With continued advancements in medical research and medical technology, CBER will face new challenges - not just scientific and regulatory, but legal and ethical. In the 21st Century,CBER will continue its rich tradition of melding strong scientific research with innovative regulations that ensure timely access to safe and effective biological products. CBER's major challenge for the 21st

Century is to expedite approval of biological products for use by the public while, at the same time, maintain high levels of safety and quality. CBER's careful risk management of approved products already in the market also plays an important and essential role in protecting the public health.

Brief Biography:

18. Name **:** Dr. K. Gowthamarajan

19. Date of Birth **:** 29-5-1971

20. Residential Address **:** 137, Vijay Nagar, Near Rose Garden
Bombay Castle, Ooty-643001

21. Phone **:** 0423-2443393, Mobile: 9443089812

22. Designation **:** Professor & Head,
JSS College of Pharmacy, (JSS Academy of Higher Education & Research, Mysore)

23. Department **:** Pharmaceutics

24. Highest Qualification **:** M. Pharm., Ph.D.

25. Area of Specialization **:** Pharmaceutics

26. Awards & other Achievements **:**

Indian drug manufacturer association, (**IDMA) Best paper award for the year 2002**.
Received 09 best poster award (**03 International**)
Received DST, ICMR&CSIR fellowships for guiding PhDs

Received CV Raman Fellowship-2011, FICCI, DST, New Delhi

Research grants: Received from DST-SERB, DST-FIST, DST-TECH, DST-Nano Mission, DBT-NER,

DBT-CDSA, AICTE-RPS &JSSRG (**Around 400L**)

Patent: 21(Indian Patents)
Technology transfer: 03
Incubation centre: 01

27. Publications **:** National: 25 International: 48 (**IF range:2-14**)

28. Presentations **:** National: 36 International: 10

29. Books **: 04**

30. Scientific Talk **: 38**

31. Ph.D. Guideship **: 12**

32. Editor/Reviewer **:** Science Direct, Carbohydrate Polymer ,World Applied Sciences Journal (WASJ), etc

33. Contact Research : Apex, Tablet India, Biocon, Dr Reddy's , Phillips, ACG World Nextgenesis, etc

17. Collaboration : **Indian university**(Bharthiyar, Hyderabad,LPU):

: **Foreign University** (Ibdan, Pretoria)

: **Industry** ((Zim pharmaceuticals, Ceutics lab, USA)

18. Experience **: 23 years**

19.Professional Affiliations **:** AC , BOS ,DOC,RCC, RE, Syllabus framing etc JSSAHE, RGUHS, VMRF. DSU, PCI..

20. Contact **: gowthamasang@jssuni.edu.in**

Day 10: Practical -7

After one lecture session the entire day was dedicated to antiviral studies where Dr. Wadhwani gave the Introduction to antiviral assays followed by Demonstration and Hands on- *In vitro* Antiviral assays- Cytopathic inhibition assay (CEP), on- *In vitro* Antiviral assays- MTT Antiviral assay which was given by Ms. Divyabharathi M. The Herpes Smiples Virus was used for the assays where before the experimentation the virus pool and virus titration was explained to the participants (Protocol given in study material).

The practical session on antiviral was well received by the participants.

DAY 11 (12th March 2019)

Lecture 11: Dr. Prasanna Ramani

PEPTIDE NUCLEIC ACID AND ALTERNATE FORM OF LIFE

Mimicking nature is always a difficult task. Many chemical modifications were made on DNA/RNA nucleobase, phosphate unit, backbone, etc. to achieve stability on double/triple helix structure. Peptide Nucleic acid (PNA)[1] is one such modification made on backbone which tends to remain stable among all the modifications. PNAs are considered to be synthetic DNA/RNA which finds applications in therapeutics, DNA/RNA mutation detection/inducting[2], tools in biotechnology[3] and much more. In addition, PNA is found to be useful in various scientific disciplines, few includes medicinal chemistry, biochemistry, molecular biology, immunology and drug development. The synthesis of such PNA-polymer in laboratory requires lot of time which follows a sequential addition of PNA monomers. There exist various synthetic protocols to prepare PNA monomers. In our group we have made an attempt, successfully, to prepare such PNA monomer in a cheaper way in few synthetic steps[4].

In my lecture, I will start by introducing PNA/their applications and finally touch upon the current research on PNA. Major part of the talk will be devoted to discuss the chemical/physical properties, synthesis and possible applications of PNA. Towards the end of my lecture, I will briefly touch upon the research efforts undertaken in our research group in this area for the past five years.

Brief Biography

Education

- Doctoral Degree (2006), University of Milano, Italy
- PG in chemistry (2000), Bharathidasan University, Trichy
- UG in chemistry (1998), Bishop Heber College, Trichy.

Experience

- Research Associate, University of Milan, Italy (Sep 2006-Feb 2007)
- Post-doctoral fellow, Centre for bio-molecular interdisciplinary studies and industrial application, Italy (Mar 2007-Feb 2009)
- Research chemist, Orchid chemicals and pharmaceuticals Ltd, Chennai (Sep 2000-June 2003)

Research interest

Peptide nucleic acids (PNA) – Artificial DNA/RNA; Medicinal chemistry; Natural product chemistry

Sponsored projects

MHRD – 2.5 crores (ongoing); DST – 26 lakhs (completed); Heutrey petrochemicals -1.5 lakhs (completed); Aventis pharma – 1 lakh (completed)

Publications

Books – 2; International Publications **–** 20;
Non-provisional Patents: Indian Patent: 3; US patent – 1

Awards/Honors/Recognition

- Young scientist award from DST (2013)
- UNESCO grant to pursue post-doctoral research (2007-2009)
- Young researcher award at Summer school held at Gargnano, Italy (2005)
- Financial assistantship under Non-EU category for doctoral research.

Student guidance

Ph.D – 4 (ongoing); PG chemistry – 2 (ongoing), 9 completed; UG (B.Tech/chemsistry) – 10 completed

Active Collaborators

CNR, Italy; University of Milano, Italy; Vera Salus Ricerca S.r.l. Catania, Italy; IIT-B, India, CECRI, Karaikudi, India; Aventis Pharma, India;

After the session by Dr. Prasanna, the combined session on Leadership Management was conducted where series of lecture and practical session were organized.

Lecture 12: Leadership and management skills for young teachers by Dr. Praveen Kulkarni, Assistant Professor, Dept. of Community Medicine, JSS Medical College, Mysuru

Lecture 13: Team working and team management by Dr. Praveen Kulkarni, Assistant Professor, Dept. of Community Medicine, JSS Medical College, Mysuru

Lecture 14: Student Relationship by Dr Pushpalatha, Professor and Head, Dept. of Community Medicine, JSS Medical College, Mysuru

Lecture 15: Conflict Management, by Dr Pushpalatha, Professor and Head, Dept. of Community Medicine, JSS Medical College, Mysuru

Day 12 (13th March 2019)

As a collaborative initiative, the visit to Pasture Institute, Coonoor was organized for the participants to understand and witness the manufacturing of various vaccines by Pasture Institute, Coonoor. During the visit various laboratories like Quality Control Lab, Centralized Animal House facilities and newly built vaccine development unit for Rabies vaccines and the museum were visited by the participants. Mr. Sai Akilesh from the JSS College of Pharmacy, Ooty accompanied the participants.

Day 13 (14th March 2019)

Lecture 16: Dr. Raghu Chandrashekhar H. Associate Professor, Manipal College of Pharmaceutical Sciences, Manipal

STRATEGIES FOR CONTROLLING HERPES SIMPLEX VIRAL INFECTION

Herpes simplex viruses (HSV) cause a variety of life threatening diseases, especially in immunocompromised patients. Infections with the two variants of this virus Herpes simplex virus type 1 (HSV-1) and type 2 (HSV-2) are common infections worldwide. HSV-1 causes oral ulcers colloquially called cold sores or fever blisters, an infection of the face or mouth, common in children. HSV-2 is the cause of most genital herpes and is almost always sexually transmitted. Recent studies supports that, HSV-2 infection may increase the susceptibility to HIV and existence of synergy between these infections. Most HSV-1 and HSV-2 infections are subclinical. No vaccine is available to prevent infections with HSV, which affects two in every five Indians. Acyclovir is the most commonly used drug for the treatment of HSV infections, followed by

penciclovir/famciclovir. However, a serious problem in the use of acyclovir and its analogs is drug resistance in treated patients. This can occur following mutation in either HSV thymidine kinase or DNA polymerase. Since there is a continuous increase in the number of sexually transmitted viral diseases in India including HSV, it is very essential to explore novel modes of antiviral treatment. HSV-1 and 2, belonging to alpha herpesvirinae is icosahedral, buildup of 162 tubular capsomeres surrounding a core of DNA. In this talk, strategies being tried in our laboratory to inhibit Herpes Viral Infections will be discussed.

Brief Biography:

Dr. Raghu Chandrashekhar H.

Associate Professor, Department of Pharmaceutical Biotechnology, Manipal College of Pharmaceutical Sciences, Manipal 576104, Karnataka State, India;
Email: raghu.c@manipal.edu
Phone: +91-820-2922482 (O); +91-9980336315 (M); **Fax:** +91-820-2571998 (O)

QUALIFICATIONS AND DEGREES

- **Doctor of Philosophy (PhD). 2007.** Dr.MGR Medical University, Chennai, Tamilnadu
- **M Pharm. 2000-02.** Dr.MGR Medical University, Chennai, Tamilnadu - First Class
- **B Pharm. 1992-96.** Kuvempu University, Karnataka – Tenth Rank

AWARDS AND PRIZES

- **Postdoctoral Research Fellowship**, University of Missouri, Columbia, Missouri, USA (2010-2012)
- **Best paper award and cash prize,** 2014, BioIndia Bangalore
- **Senior Research Fellowship**, DBT, Govt. of India, New Delhi
- **Junior Research Fellowship**, DBT, Govt. of India, New Delhi

RESEARCH GRANTS RECEIVED: 8

PUBLICATIONS: 40

INVITED LECTURES: 05

CONFERENCE PRESENTATIONS: 48

M PHARM DISSERTATIONS GUIDED: 21

SUPERVISION OF Ph.D. THESIS: 06

BOOKS: 01, Contributed Chapters: 01

Lecture 17: Mr. Senthil Nathan S. Senior Application Specialist, Qiagen, New Delhi

Rota Gene Q pure detection – RT PCR

Mr. Senthil Nathan from Qiagen gave the last talk of the program where he covered basics of RT-PCR and discussed on Roto Gene Q pure detection technique for the detection of the genes and gene expression analysis. Followed by his talk the hands-on training session was organized for the participants as well as department students to get familiarized with RT-PCR and gene expression analysis by RT-PCR. The response of the participants was overwhelmed and well appreciated.

Mr. Senthil Natha has 10 years of experience in corporate and academic R&D. He is trained in stem cell biology and flowcytometry. Currently he is working as application team manager and heading south and east application team of Qiagen.

Valedictory Function

The informal valedictory function was organized in department itself. Dr. P. Vijayan, Retired Scientist of Department of Biotechnology, New Delhi and Professor Emeritus of Department of Pharmaceutical Biotechnology, JSS College of Pharmacy, Ooty was the chief guest of the function. In this chief guest address Dr. Vijayan shared his 4 decades of experience working with *in vitro* system and cell culture technology. He also mentioned about his experience working at Pasture Institute, Coonoor way back in 1964 and also on his experience on established Department of Pharmaceutical Biotechnology at JSS College of Pharmacy, Ooty.

The participants were requested to give their feedback on the program where most of the participants appreciated the practical sessions and hands-on training provide during the course of the program and the support received from department PG students.

The certificates were distributed to the participants by the chief guest and the program ended with vote of thanks by Dr. Ashish Wadhwani, Co-Ordinator of the program.

AICTE Sponsored
QUALITY IMPROVENT PROGRAMME (QIP)

ON

Prospective Approach on Advanced Biotechnology, Cell Culture and Bioinformatics in Modern Research

1 – 14th March 2019

Program Feedback Form

NAME OF THE PARTICIPANT:

1. What is your opinion about the following (Please tick):

Sr. no.	Topic	Excellent	Good	Satisfactory
1.	Quality of Lectures			
2.	Quality of practical training			
3.	Our hospitality			
4.	Boarding & Lodging			

2. How do you rate the contents of the topics of Lectures?

a) Advanced b) Relevant c) Irrelevant

3. Do you find QIP program useful

YES NO

4. In your opinion, how the program could have been improved?

5. What other topics shall be included?

6. Would you like to participate in a similar program in future?

YES NO

7. Do you intend to implement the techniques learnt during this program at your institution? YES NO

8. Any other suggestions

Feedback Analysis of the participants

For betterment and self-assessment, the feedback was collected from all the participants. The consolidated report of the feedback is given below.

The feedback form is focused on,

- Objectives of the program
- Quality of lectures
- Quality of practical training
- Hospitality
- Boarding and Lodging
- Time management
- Remarks about the future topics proposed
- Other additional suggestions

The information gathered through the feedback form is to ensure that the needs of the participants were fulfilled and to understand the changes to be made in the services provide in forthcoming programs to be organized.

According to the feedback,

- All the participants of the program stated that the program was well organized
- Most of the participants found the speaker's knowledge and interaction with the audience excellent.
- Maximum of the participants stated that they would recommend the session to others.
- Most of the participants found the sessions of *In vitro* cell line study, anti-viral, HET CAM assay, bioinformatics, peptide nucleic acid, design of experiments particularly to be more informative and interactive.
- The most common suggestion on topics for further workshop were molecular biology techniques like western blotting, bioinformatics session can be given more time.
- 50% of the participants found the food provided during the program was good.
- Maximum of the participants appreciated the support and assistance by students of the department and the laboratory staff.