



# **SYMBIOSIS SCHOOL OF BIOLOGICAL SCIENCES**

## **Symbiosis International University**

(Established under section 3 of the UGC Act, 1956)

Re-accredited by NAAC with 'A' grade

Founder: Prof. Dr. S. B. Mujumdar, M. Sc., Ph. D. (Awarded Padma Bhushan and Padma Shri by President of India)

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### **7.2.1\_SSBS\_Best Practices (1)\_2019-2020**

#### **Index**

<b>S.No.</b>	<b>Name of Practice</b>
1	Industry Academia Collaboration



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### 7.2.1 Best Practices 1 (2019 – 2020)

#### 1. Title of the Practice: Industry Academia Collaboration

#### 2. Objectives of the Practice:

- Intense interactions with biotechnology industries at various platforms mutually beneficial and to create springboards for students and faculty.
- Visit of Industrial and Academic Experts to SSBS and Interaction with students and also students visit to Industries
- Students dissertation work in Industries and joint publications between Industries and SSBS
- To create awareness among students about the current developments, job opportunities and start-ups and to establish new contacts with food and bio-tech industries

#### 3. The Context:

The post graduate students in Biotechnology and Nutrition and Dietetics are offered courses such as Bioprocess Engineering and Food Science. In these students are exposed to theoretical and experimental aspects. As a part of practical sessions students visit to Industries and Industrialists visit to SSBS provides students with unique experience of understanding industrial sector that can be replicated in practice.

#### 4. The Practice:

Visit to Industries such as Serum Institute of India, National Centre for Microbial Resource, Vasant Dada Sugar Institute and other food industries exposed the students to techniques and technologies used in processing and manufacturing various products such as food, nutraceuticals, pharmaceuticals, biopharmaceuticals, vaccines etc. In-depth analysis of scientific research problems by students and faculty.

#### 5. Evidence of Success:

Students showed improved interests in equipping their skills in laboratory techniques. These visits have fueled the student's interests to take up internships and dissertation work in various industries and institutes. Students have joined in companies like Serum Institute of India Pvt Ltd. Students have also joined in prestigious Government Institutes such as IISER, NCMR, CDRI, etc. Ph.D. students work had resulted in collaborative research publication with industries. Research Grants from Industries to carry out collaborative research work in SSBS.

#### 6. Problems Encountered and Resources Required:

Traffic related issues during Industrial visits.



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5/9/19

### 1a. Report on visit to National Centre for Microbial Resource (NCMR)

**Programme:** Visits to Industries and CSIR labs

**Date:** 5/9/19

**Venue:** National Centre for Microbial Resource, Pashan, Pune, Maharashtra-411021

**Number of Participants:** 32 M.Sc (Biotechnology, 18-20 batch) students, 1 Faculty member and 1 Scientist

**Concerned Subjects:** Microbiology, Bioprocess Engineering and Emerging Technologies

**Coordinators:** Dr. Pooja Singh and Dr. Selvan Ravindran

National centre for microbial resource (NCMR) is one of the largest culture collection with more than 180000 microorganisms. NCMR is focused on microbiome research and offers services in deposit of organisms, identification of organism and supply of microbial cultures.

Students visited NCMR and interacted with Scientists to know the key research areas. Scientists gave an overview of the ongoing work in respective laboratories and explained the working principles of various technologies. Student's visits include anaerobic culture laboratory, microbiome and disease, protein sequencing, genetics and molecular biology laboratories.

Report prepared by: Dr. Selvan Ravindran



*Selvan*





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### Visit to National Centre for Microbial Resource (NCMR) on 5/9/19



### Symbiosis School of Biological Sciences

Attendance sheet for M.Sc (Biotechnology, 18-20 batch, Sem III)

Date: 5/9/19

Sr. No.	PRN	Name of Student	Attendance
1	18040342001	ANDREA DIANA	Present
2	18040342002	ARJUNA SURTRY	Present
3	18040342003	BENITABHAPLE	Present
4	18040342004	BEPAVALANIKITA	Present
5	18040342005	BHADYASHREEPATIL	Present
6	18040342006	BHANDARI TRUPTI	Present
7	18040342007	CHITNIS AKHILESH	Present
8	18040342008	DESAI VEDIKA	Present
9	18040342009	DUBEY RACHNA	Present
10	18040342010	G T ALSHADAN	Present
11	18040342011	GARGIJE ANUSHREE	Present
12	18040342012	GRESH KUMAR SAHJ	Present
13	18040342013	OLPA NANDIRA	Present
14	18040342014	JACOUES AVIL	Present
15	18040342015	JACOUES DEN	Present
16	18040342016	JOYLEEN FERNANDES	Present
17	18040342017	KOLKARI AJINKYA	Present
18	18040342018	KULKARNI HIRJANI	Present
19	18040342019	KUMBHAR YASHI	Present
20	18040342020	KOPINACHHARE	Present
21	18040342021	MUSKAN THAKUR	Present
22	18040342022	OZA VISHNU	Present
23	18040342023	PANKHOLI BHUTADA	Present
24	18040342024	PAPIN VYAS	Present
25	18040342025	PATIL SHIVANI	Present
26	18040342026	PRABHU SIVARI	Present
27	18040342027	SHETALE POOJA	Present
28	18040342028	SHREYA MISRA	Present
29	18040342029	SHUBEKA GILLI	Present
30	18040342030	SURABHI AGARWAL	Present
31	18040342031	SUSHANTA JOSHI	Present
32	18040342032	VAIDYANATHAR MASALI	Present



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3/10/19

### 1b. Report on visit to Serum Institute of India PVT.LTD.

**Programme:** Industrial visits

**Date:** 3/10/19

**Academic year:** 2019-2020

**Venue:** Serum Institute of India PVT.LTD., Hadapsar, Pune,  
Maharashtra – 411 028

**Number of Participants:** 32 M.Sc (Biotechnology, 18-20 batch) students and 3  
Faculty members

**Concerned Subjects:** Bioprocess Engineering, Virology & Vaccinology and  
Emerging Technologies

**Faculty Coordinators:** Dr. Selvan Ravindran, Dr. Santosh Koratkar and Dr.  
Bishnudeo Roy

Serum Institute of India Private Limited is the manufacturer of vaccines. Manufactured vaccines are accredited by World health organization, Geneva and distributed to more than 150 countries around the world.

Students had an opportunity to visit the vaccine manufacturing facility, storage facility and quality control laboratories housed with sophisticated analytical technologies. Students also interacted with the scientists and were able to understand the challenges involved apart from hands on technical knowledge.

Report prepared by: Dr. Selvan Ravindran



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Visit to Serum Institute of India Pvt. Ltd on 3/10/19



Symbiosis School of Biological Sciences  
Attendance sheet for M.Sc (Biotechnology, 18-20 batch, Sem III)  
Date: 3/10/19

Sr. No.	PRN	Name of Student	Attendance
1	18040342001	ANDREA DIANA	Present
2	18040342002	ARMAANMISTRY	Present
3	18040342003	BENITABIAPUR	Present
4	18040342004	BERAWALANMITA	Present
5	18040342005	BHAGYASHREEPATIL	Present
6	18040342006	BHANDERI TRUPTI	Present
7	18040342007	CHITNIS AKHILESH	Present
8	18040342008	DESAI VEDIKA	Present
9	18040342009	DUBEY RACHNA	Present
10	18040342010	G T SUSIVADANI	Present
11	18040342011	GAIGORE ANUSHREE	Present
12	18040342012	GIRISH KUMAR SAHU	Present
13	18040342013	GUPTA MANDIRA	Present
14	18040342014	JACQUES AVRIL	Present
15	18040342015	JACQUES EDEN	Present
16	18040342016	JOYLEEN FERNANDES	Present
17	18040342017	KULKARNI AJINKYA	Present
18	18040342018	KULKARNI HIMANI	Present
19	18040342019	KUMBHAR ROHIT	Present
20	18040342020	MIRNACHCHHAE	Present
21	18040342021	MUSKAN THAKUR	Present
22	18040342022	OZA VISHNU	Present
23	18040342023	PANKHUDI BHUTADA	Present
24	18040342024	PARIN VYAS	Present
25	18040342025	PATIL SHIVANI	Present
26	18040342026	PRAHNU SINARI	Present
27	18040342027	SHEJALE POOJA	Present
28	18040342028	SHREYA MISHRA	Present
29	18040342029	SHWETA GULLA	Present
30	18040342030	SURABHI AGARWAL	Present
31	18040342031	SUSHMITA JOSHI	Present
32	18040342032	VAIJANAPUREKAR MANALI	Present



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4/10/19

### 1c. Report on visit to Vasantdada Sugar Institute

**Programme:** Industrial visits

**Date:** 4/10/19

**Academic year:** 2019-2020

**Venue:** Vasantdada Sugar Institute, Manjari Budruk, Pune,  
Maharashtra – 412307

**Number of Participants:** 29 M.Sc (Biotechnology, 18-20 batch) students, one Faculty member and one Research Associate

**Concerned Subjects:** Bioprocess Engineering, Molecular biology, Emerging Technologies and Environmental Biotechnology

**Coordinators:** Dr. Nuton Mhetras and Mr. Anil Thormothe

Students visited alcohol technology & biofuels, molecular biology & genetic engineering and environmental sciences departments. In the fermentation facility, students witnessed the production of wine from grapes with the aid of microorganism. Scientists from environmental sciences unit explained the students about the process of converting sugarcane waste to biofertilizers. Students also learned about the generation of drought tolerant and salinity tolerant variety of sugarcane from molecular biology & genetics department. Importance of analytical technologies such as chromatography, spectroscopy and mass spectrometry in research and development was also explained. All the students involved themselves in fruitful interactions with the industrial professionals.

Report prepared by: Dr. Selvan Ravindran



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### Visit to Vasantdada Sugar Institute on 4/10/19



### Symbiosis School of Biological Sciences

Attendance sheet for M.Sc (Biotechnology, 18-20 batch, Sem III)

Date: 4/10/19

Sr. No.	PRN	Name of Student	Attendance
1	18040342001	ANDREA DIANA	Present
2	18040342003	ARMAANMISTRY	Present
3	18040342003	BENTABDAPUR	Present
4	18040342004	BERAWALANIKITA	Absent
5	18040342005	BHAGYASHREEPATIL	Present
6	18040342008	BHANDEBI TRUPTI	Present
7	18040342007	CHITNIS AKHILESH	Present
8	18040342008	DESAI VEDIKA	Present
9	18040342009	DUBEY RACHNA	Present
10	18040342010	G.T.SUSIVADANI	Present
11	18040342011	GARGORE ANUSHREE	Present
12	18040342012	GIRISH KUNAR SAHU	Present
13	18040342013	GUPTA MANDIRA	Present
14	18040342014	JACQUES AVRIL	Present
15	18040342015	JACQUESDEN	Present
16	18040342016	JOYLEEN FERNANDES	Present
17	18040342017	KULKARNI AJINKYA	Present
18	18040342018	KULKARNIHIHLANI	Absent
19	18040342019	KUMBHAR ROHIT	Present
20	18040342020	NIRINACHCHHAR	Present
21	18040342021	NUSKAN THAKUR	Present
22	18040342022	OZA VISHNU	Present
23	18040342023	PANHUDI BHUTADA	Present
24	18040342024	PARNI VYAS	Present
25	18040342025	PATEL SHIVANI	Present
26	18040342026	PRABHU SINARI	Present
27	18040342027	SHEJALE POOJA	Present
28	18040342028	SHREYA MISHRA	Present
29	18040342029	SHWETA GULIA	Present
30	18040342030	SUFABHI AGARWAL	Absent
31	18040342031	SUSHMITA JOSHI	Present
32	18040342032	VAJANAPURKAR MANALI	Present



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### 2. M.Sc (Biotechnology) students dissertation work in Industries / CSIR labs

		Batch (2019-2020)	
S.No	M.Sc (Biotechnology Students)	Industry / CSIR labs	Guide
1	Rachna Shobhnath Dubey	National Centre for Microbial Resource, Pune	Dr. Shrikant Pawar
2	Jacques Eden	National Centre for Microbial Resource, Pune	Dr. Om Prakash Sharma
3	Shivani Patil	National Centre for Microbial Resource, Pune	Dr. Shrikant Pawar
4	Sushmita Joshi	National Chemical Laboratory, Pune	Dr. Santosh Kumar Jha
5	Manali Vaijanapurkar Sudhir	National Centre for Microbial Resource, Pune	Dr. Om Prakash Sharma
6	Pooja Shejale	Serum Institute of India Pvt Ltd, Pune	Dr. Parikshit Tyagi
7	Mandira Gupta	Serum Institute of India Pvt Ltd, Pune	Dr. Asha Mallya



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### 2. M.Sc (BT) Student Pooja Shejale's six month Dissertation work from Jan 2020 to June 2020 in Serum Institute of India Private Limited, Pune



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**2. M.Sc (BT) student Mandira Gupta's Six-month dissertation work from December 2019 to May 2020 in Serum Institute of India Private Limited, Pune.**



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## SSBS Pune Lecture Series for graduating students

Symbiosis School of Biological Sciences, Pune Lecture

Finishing School for M.Sc. Biotechnology & M.Sc. Nutrition & Dietetics (Batch- 2017-19)

Date: May 30, 2019

Venue: SIT Seminar Hall, Symbiosis School of Biological Sciences, Lavale Campus, Pune

Schedule:

	Speakers	Topic	Time
1	Mr. Rajanish Prabhu, GM, Contract Design and Management at Sedoxo, India	"Finance for Entrepreneurs"	9.30 am – 10.25 am
2	Dr. Nishant Tikekar, Head, Health Tech, SCEI, SIU	"Entrepreneurial Opportunities in Symbiosis"	10.30 am – 11.00 am
			10 minute break
3	Dr. Amit Kumar Tiwari, Head, Intellectual Property, SCEI, SIU	"Career Opportunities in Intellectual Property Rights"	11.10 am – 11.40 am
4	ELTIS Team, SIU	"Writing Skills for better job opportunities"	11.45 am – 12.45 pm

M.Sc. students with the speakers



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### Ph.D. student's dissertation work at Industries, CSIR labs and ICMR labs

Students are also registered for Ph.D. in SSBS and work in Industries or at Council of Scientific and Industrial Research labs towards task-oriented projects to address practical problems.

All the Ph.D. students are mentored by SSBS Faculty members

S.No	Name of the Student	Year	Name of the Guide	Institute
1	Srividya Ravi	2014	Dr. Anuradha Vaidya	National Chemical Laboratory, Pune
2	Priyanka Patel	2014	Dr. Vinay Rale	National Institute for Research in Tribal Health, Indian Council of Medical Research, Jabalpur, M.P.-India
3	Vishal Nanasahab Pavitrakar	2016	Dr. Selvan Ravindran	Lupin Research Park, Pune
4	Amalesh Jayant Tambe	2016	Dr. Selvan Ravindran	Serum Institute of India Pvt Ltd (SIPL), Pune
5	Digamber Singh Chahar	2016	Dr. Selvan Ravindran	Serum Institute of India Pvt Ltd (SIPL), Pune
6	Santosh Balu Dumbare	2016	Dr. Selvan Ravindran	Lupin Research Park, Pune
7	Akshay Deshpande	2016	Dr. Sunil Saroj	Serum Institute of India Pvt Ltd (SIPL), Pune
8	Kunal Jani	2016	Dr. Vinaykumar Rale	Microbial Culture Collection (MCC), NCCS, India
9	Neihenuo Chuzho	2016	Dr. Neetu Mishra	National Institute of Pathology (NIP), New Delhi
10	Rohini Raman	2017	Prof. Kavitha Menon	Sanzyme-nutrus Ltd Hyderabad
11	Krunal Patel	2017	Dr. Vinaykumar Rale	Serum Institute of India Pvt Ltd (SIPL), Pune
12	Marshal Nikam	2018	Dr. Selvan Ravindran	Serum Institute of India Pvt Ltd (SIPL), Pune
13	Ritu Singh	2018	Dr. Anuradha Vaidya	ICMR - National Institute for Research in Tribal Health
14	Dr. Chakrapani Chatala	2018	Dr. Neetu Mishra	Novartis, Hyderabad
15	Kunal Dixit	2018	Dr. Sunil Saroj	Microbial Culture Collection (MCC), NCCS, India



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### 3. Joint Publication Between Serum Institute of India Pvt. Ltd and SSBS, Symbiosis

Ph.D student Digamber Singh Chahar is involved in this publication

Volume 10 | 2020 | 1-10

Content Not Available at Symbiosis



### Biologicals

Journal of Biotechnology | www.symbiosis.edu/biotechnology



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**Review**

**Monoclonal antibody purification and its progression to commercial scale**

**Digamber Singh Chahar<sup>1\*</sup>, Srinivas Raghavendra<sup>2</sup>, SK. Phad<sup>2</sup>**

<sup>1</sup> Serum Institute of India Pvt. Ltd, Faridkot, India  
<sup>2</sup> Symbiosis International (Deemed University), Pune, India

---

KEYWORDS	ABSTRACT
<p><b>Keywords:</b>                      Recombinant protein                      Bioprocess                      Purification                      Chromatography                      Monoclonal antibody</p>	<p><b>ABSTRACT</b>                      With the advancement of recombinant technologies, the capacity for monoclonal antibody (mAb) production has increased from a few milligrams to grams per liter. These rates lead to increased pressure on downstream processes (DSP), which need to be resolved to achieve higher efficiency and reduce utilization of available capacity. Various processes, such as upstream bioprocess, upstream purification and volume handling, need to be considered when designing a facility for commercial scale. Many of these critical parameters are defined during the facility design stage, which are not easily further modified by commercial DSP. The key design areas of the process from the bioreactor, purification through the quality control steps, the process requirements, space utilization, process efficiency and optimized downstream system need to be evaluated appropriately before implementation on a commercial scale.</p>

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**1. Introduction**

In the past few decades, monoclonal antibodies have become the therapeutic use and verified to be efficacious in human subjects [1]. The treatment of immunology and antibody specificity of monoclonal antibodies has led to their use as a tool for treatment of various diseases [2]. Highly purified monoclonal antibodies are essential to all those various ailments of patients. Upstream and downstream process parameters are well established in the manufacturing industry to meet antibody production requirements [3].

Commercial scale production of mAb requires the separation and culture, followed by cell harvest and protein purification. Various chromatography systems are employed in the purification process to obtain a product of the desired quality. The process and product being developed need to be defined in the design level [4,5]. Monoclonal antibodies are expensive, and the majority of those required for most patients is high. For example, Adalimumab [6] has a market of \$1 billion for various additional monoclonal antibodies. Hence, optimized and better need to be produced by their separation to meet the demand of the world population.

There is wide use of column and high flow volume purification will require to optimize parameters like pH, All these parameters process need to be investigated and defined within a stipulated time frame. Hence, it is always advisable to evaluate the various process parameters to identify the best process parameters and optimize them. From the design of all the parameters are optimized, the DSP required to

conversion to a higher scale can be assessed [5,6].

In most cases, antibody purification and mAb are not volume based off conditions and flow during processing. During the purification process, a few parameters have identified to optimize process. A mAb is ligated with other purification reagents for final to optimize the same quality of mAb as followed with Protein A affinity chromatography [7,8]. The advantage of using protein A affinity in the final stage of process is that the specific binding with the antibody molecules makes the ligand the cleavage and recovery process more efficient than can be achieved with other purification modes [9,10].

High performance liquid chromatography has been utilized by researchers to separate the various protein groups resulting in different. Large volumes of monoclonal antibodies are produced by the complex process. Upstream bioprocess and upstream control are too high for scale up and become during upstream and downstream processing [11]. To address this challenge, an integrated and continuous processing method has been proposed as an alternative [12]. An integrated and continuous processing method involves a dilution zone for processing, with sequential separation steps with the aid of ion exchange and hydrophobic [13,14]. Single pass sequential flow filtration [15] to flow filtration [16], multi-column system [17] and direct chromatography column loading [18] are part of the industrial scale operations required to implement strategies for an integrated continuous process. Various chromatography techniques are widely used in bioprocess industries for separation and purification of mAb, such as, Protein A chromatography, mAb can used for purification of

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Received 10 April 2020; Received in revised form 20 August 2020; Accepted 17 November 2020  
 Available online 22 November 2020  
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3. Joint publication between Serum Institute of India and SSBS. Scientists Amlesh Tambe and Digamber Singh from Serum Institute also registered for Ph.D in Symbiosis, Jitendra Suthar a Phd student from SSBS, Joyleen Fernandes and Vedika, M.Sc (BT) students from SSBS and Dr. Selvan Ravindran from SSBS jointly published the below article.

Current Drug Metabolism, 2019, 26, 561-572



REVIEW ARTICLE

### Nanomedicine: Bioavailability, Biotransformation and Biokinetics



Selvan Ravindran<sup>1\*</sup>, Amlesh J. Tambe<sup>2,3</sup>, Jitendra K. Suthar<sup>4</sup>, Digamber S. Chidre<sup>1,5</sup>, Joyleen M. Fernandes<sup>6</sup> and Vedika Dhasal<sup>7</sup>

<sup>1</sup>Symbiosis School of Biological Sciences, Symbiosis International (Deemed) University, Pune, India; <sup>2</sup>Serum Institute of India, Gandhinagar, Pune, India

**Abstract:** Background: Nanomedicine is increasingly used to treat various ailments. Bioavailability of nanoparticle is primarily governed by its properties such as biocompatibility, biodegradability and biotoxicity. One of the major advantages of nanomedicine is enhanced bioavailability of drugs. Various nanotechnology approaches are employed to improve the pharmacological effects of drugs. This review includes the various nanotechnology and microtechnology of nanomedicine. Physicochemical parameters of nanoparticles have been discussed in terms of chemical, physical, biocompatibility and biotoxicity of nanomedicine.

**Keywords:** Biocompatibility, biotransformation, biokinetics, biodegradability, drug delivery, drug delivery systems.

**Article History:** Received November 01, 2018; Revised April 23, 2019; Accepted July 23, 2019.

**Check for updates**

**Keywords:** Nanomedicine, biocompatibility, biotransformation, biokinetics, drug delivery.

### 1. INTRODUCTION

Nanomedicine involves the design and development of novel or improved and efficient. Existing drugs in nanotechnology formulations have enhanced bioavailability, biodegradability of drugs is one of the important properties that determine the success of a drug. Delivery of drugs to the targeted sites and protection of drugs in the same are other benefits of nanomedicine [1]. Many routes of drugs in packaged for a period of time; it is worth mentioning that nanomedicine can reduce the dosage of drugs. Hence reducing the toxicity of a drug or other side effects, if any. While there are the major advantages of nanomedicine, one has to understand the biocompatibility [2, 3] of nanodrug and its biotoxicity to confirm the absence of any potential toxicities that could cause side effects during therapy. Generally, organic molecules are subjected through both *in vitro* and *in vivo* studies [4, 5] to estimate the biotransformation products of nanodrug. Structural analysis of nanodrug by liquid chromatography and mass spectrometry aids in identifying the potential metabolic pathways and biodegradability [6, 7]. Apart from nanodrug, nanobioactive molecule could also be subjected to biotransformation studies. Most of the biotransformation studies are either naturally derived compounds or peptide based ones. Biotransformation of naturally derived compounds as well as polymers are expected to undergo metabolism by CYP450 enzymes. Understanding the variability of biotransformation is essential to evaluate the possibility of interaction between any of the enzyme drugs and biotransformation systems. Apart from bioavailability and biotransformation, biokinetics is also very significant to understand the metabolism of action of nanomedicine. Toxicokinetics [8] encompasses both pharmacokinetics and toxicokinetics which together determine the absorption, distribution, metabolism, excretion and penetration properties of nanomedicine. Pharmacokinetics is the study corresponding to lower doses whereas toxicokinetics is the study of high doses. It can be said that toxicokinetics is pharmacokinetics of higher doses. In other words, pharmacokinetics of nanoparticles is the application of pharmacokinetic principles to understand the adverse effects of nanomedicine. It determines the rate at which the nanoparticles enter the body and also its half-life, it enters the target system. Hence, bioavailability, biotransformation and biokinetics of nanoparticles has been discussed in detail in the present review article.

### 1.1. Bioavailability of Nanodrug

Most of the research focused on nanomedicine is conducted to increase the bioavailability of nanodrug [9]. Improving the bio-



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### 4. Dr. Sanjay Nene's Lecture as a part of Bioprocess Engineering course. Dr. Nene is a Chief Executive Officer of Innovation Biologicals Private Limited, NCL Venture Centre, Pune

Dr. Sanjay Nene, Chief Executive Officer, Innovation Biologicals at NCL venture Center was invited to deliver lectures for M.Sc (Biotechnology) students.

Dr. Nene gave lectures on Bioprocess Engineering from the perspective of industrialists. Bioprocess Engineering is a course taught for M.Sc. (Biotechnology) students. Few sections of the syllabus were taught by Dr. Nene. Apart from industrial applications, Bioprocess Engineering is also an important component of competitive exams such as GATE, UGC-CSIR and DBT-JRF. Bioprocess Engineering course is highly beneficial for students who would like to opt for industry based jobs or to continue for higher education.

Dr. Nene also contributed for a book chapter with SSBS faculty members Dr. Vinay Rale, Dr. Anuradha Vaidya, Dr. Selvan Ravindran and Scientists Dr. Pooja Singh and Dr. Nutan Mhetras. Book chapter on "Microbioreactors and perfusion bioreactors for microbial and mammalian cell culture" is a part of Book entitled "Biotechnology and Bioengineering". This book is very helpful for both M.Sc. and Ph.D. students.

*Microbioreactors and Perfusion Bioreactors for Microbial and Mammalian Cell Culture*  
DOI: [https://doi.org/10.1007/978-981-10-1111-1\\_11](https://doi.org/10.1007/978-981-10-1111-1_11)

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## Biotechnology and Bioengineering

Chapter

### Microbioreactors and Perfusion Bioreactors for Microbial and Mammalian Cell Culture

Selvan Ravindran, Pooja Singh, Sanjay Nene, Vinay Rale, Nutan Mhetras and Anuradha Vaidya

Author details

Selvan Ravindran<sup>1</sup>, Pooja Singh<sup>1</sup>, Sanjay Nene<sup>1</sup>, Vinay Rale<sup>1</sup>, Nutan Mhetras<sup>1</sup> and Anuradha Vaidya<sup>1</sup>

<sup>1</sup>Symbiosis School of Biological Sciences, Symbiosis International (Deemed) University, Pune, India

Innovation Biologicals Private Limited, Pune, India



*Nene CS*



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8/17/2025

Symbiosis School of Biological Sciences Mail - Bioprocess engineering lecture - By Dr. Nene



Dr. Selvan Ravindran <selvan.ravindran@ssbs.edu.in>

### Bioprocess engineering lecture - By Dr. Nene

1 message

Nutan Mhetras <nutan\_mhetras@ssbs.edu.in>

Thu, Jul 25, 2019 at 3:15 PM

To: batch18-20bt@ssbs.edu.in

For Bioprocess engineering student.

Dear all,

Please note that Dr. Nene Sir lecture is scheduled on 26.7.19 at 1.30 to 4.00.

-

Thanks & Regards.

Dr. Nutan C. Mhetras

Symbiosis School of Biological Sciences,

(Formerly called as Symbiosis School Of Biomedical Sciences (SSBS))

Symbiosis International (Deemed University)

Gram- Lavale Taluka- Mulshi, Pune - 412115.

Ph : 02039116472

Mobile No: 9763795134

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*Nutan CS*





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8112000

Symbiosis School of Biological Sciences Mail - Bioprocess engineering lecture by Dr. Nene



Dr. Selvan Ravindran <selvan\_ravindran@ssbs.edu.in>

### Bioprocess engineering lecture by Dr. Nene

1 message

Nutan Mhetras <nutanmhetras@ssbs.edu.in>

Mon, Aug 12, 2019 at 4:39 PM

To: batch15-2019@ssbs.edu.in

Cc: Vinaykumar <director@ssbs.edu.in>, Sanjay Nene <sanjay.nene@gmail.com>

For Bioprocess engineering student.

Dear all,

Please note that Dr. Nene Sir's lecture is scheduled on 13/08/19 at 9.30 to 12.00 in conference hall.

--

Thanks & Regards,

Dr. Nutan C. Mhetras

Research Associate

Symbiosis School of Biological Sciences

(Formerly called as Symbiosis School Of Biomedical Sciences (SSBS))

Symbiosis International (Deemed University)

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*Nutan C.*



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### 7.2.1\_SSBS\_Best Practices (2)\_2019-2020

#### Index

S.No.	Name of Practice
1	Training for competitive exams



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### BEST PRACTICE 2

#### 1. Title of the Practice: TRAINING FOR COMPETITIVE EXAMS

#### 2. Objectives of the Practice

- To facilitate students' participation in competitive exams such as UGC-CSIR, GATE, DBT-JRF, IELTS through training
- To train students for competitive exams

#### 3. The Context:

It is necessary for Masters' students to clear the competitive exams to be able to pursue Ph.D. program at national institutes and universities

#### 4. The Practice:

Training is given in the form of talks by the respective experts and also by qualified candidates pursuing Ph.D. at national institutes.

5. Evidence of Success: Students have shown keen interest to appear for exams such as GATE, DBT-JRF, IELTS, UGC-CSIR exams.

6. Problems encountered and Resources required: More books related to competitive exams is needed.



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6/17/2020

Symbiosis School of Biological Sciences Mail - Seminar on "Career Opportunities" by Biotechnika



Dr. Selvan Ravindran <selvan\_ravindran@ssbs.edu.in>

### Seminar on "Career Opportunities" by Biotechnika

3 messages

Dr. Selvan Ravindran <selvan\_ravindran@ssbs.edu.in>

Wed, Sep 18, 2019 at 11:32 AM

To: batch18-20bi@ssbs.edu.in, batch19-21bi@ssbs.edu.in

Cc: "Dr. Vinaykumar Rale" <director@ssbs.edu.in>, "Dr. Anuradha Vaidya" <dvdirector@ssbs.edu.in>

Dear All,

On 24/Sep/2019 there will be a talk by Dr. Saini (Biotechnika) about career opportunities. Mandatory for all of you to attend. Details below.

Title of the talk: "Career opportunities one can take after Life Sciences"

Speaker: Dr. Saini, Academic Support Specialist, Biotechnika

Place: 56 Classroom

Time: 11.30 am to 12.30 pm

Date: 24/Sep/2019

Regards,

Selvan

Dr. Selvan Ravindran

Associate Professor, Symbiosis School of Biological Sciences (SSBS)

Symbiosis International University

Symbiosis Knowledge Village

Lavale, Pune 412 115

India

Cell: 9049480567

Ph: 9673555665

Ph: 020-39116314

Email: selvan\_ravindran@ssbs.edu.in

Web: www.ssbs.edu.in



*Selvan*



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### 1a. Presentation by Biotechnika team on 24/Sep/2019 at SSBS



*Kare CB*



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5/17/2020

Symbiosis School of Biological Sciences Mail - Career Opportunities after M.Sc.



Dr. Selvan Ravindran <selvan\_ravindran@ssbs.edu.in>

### Career Opportunities after M.Sc

1 message

Dr. Selvan Ravindran <selvan\_ravindran@ssbs.edu.in>  
To: batch18-2018@ssbs.edu.in, batch19-2119@ssbs.edu.in


Fri, Oct 11, 2019 at 9:45 AM

Dear All,

Follow up on recent seminar on Career Opportunities in SSBS. Attached the slides for you to go through again.

Dr. Selvan Ravindran  
Associate Professor, Symbiosis School of Biological Sciences (SSBS)  
Symbiosis International University  
Symbiosis Knowledge Village  
Lavale, Pune 412115  
India  
Cell: 9049480587  
Ph: 9873555885  
Ph: 020-28116314

Email: [selvan\\_ravindran@ssbs.edu.in](mailto:selvan_ravindran@ssbs.edu.in)  
Web: [www.ssbs.edu.in](http://www.ssbs.edu.in)

 Career Opportunities after M.Sc.pdf  
536K



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