

Department of Biochemical Engineering and Biotechnology
Departmental Research Committee Minutes
(DRC-09/2021-2022)

05 May, 2022

The Ninth meeting of the *Departmental Research Committee* for the academic session 2021-2022 was held on Monday, May 2, 2022 at 3:00 pm via Microsoft Teams (DRC channel).

The following members were present:

Prof. Ritu Kulshreshtha (Chairperson)
Prof. D. Sundar
Prof. Atul Narang
Prof. T. R. Sreekrishnan
Prof. Preeti Srivastava
Prof. Ishaan Gupta

Invited members:

Prof. Ravikrishnan Elangovan
Prof. Lucinda E. Doyle

1. Confirmation of the minutes of 8th meeting of the DRC for the session 2021-2022 held on April 04, 2022.

The minutes were confirmed as circulated.

2. To report the matters arising from the minutes of Meeting No. 08/2021-2022.

Item 4. Request received from Prof. Ashish Misra to add Dr. Shyam Kumar Masakapalli (from IIT Mandi) as a co-supervisor for his PhD student Ms. Palistha Tuladhar (2020BEZ8568).

The Committee approved the inclusion of Dr. Shyam Kumar Masakapalli (from IIT Mandi) as a co-supervisor for the PhD student Ms. Palistha Tuladhar (2020BEZ8568). The decision was made based on the details provided by Prof. Misra outlining the specific objectives of Palistha's thesis project and the role of Dr. Shyam Kumar Masakapalli as co-supervisor (Annexure I).

3. To discuss shortlisting criteria and other modalities for the upcoming PhD/MSR selections

The Committee decided the syllabus and the shortlisting criteria for PhD/MSR selections, 2022-2023, Sem I (see Appendix II- IV).

4. Synopsis Approval of MSR and PhD students

a) Synopsis of the MSR thesis of Ms. Shravya Velamala (2019BEY7513) held on 18 April, 2022

The Committee discussed and approved the synopsis submitted by the MSR student Ms. Shravya Velamala (2019BEY7513). The Committee also approved the panel of Examiners and authorized the Chairperson to forward the same to Dean (Academics).

The committee approved the change in title of the thesis from “NeuroD2/NeuroD6 regulated ncRNA network in Glioblastoma” to “Identification of potential biomarkers and prominent players among bHLH family genes in Glioblastoma” as per recommendations of her SRC.

b) Synopsis of the MSR thesis of Mr. Rajat Anand (2019BEY7511) held on 18 April, 2022
The Committee discussed and approved the synopsis submitted by the MSR student Mr. Rajat Anand (2019BEY7511). The Committee also approved the panel of Examiners and authorized the Chairperson to forward the same to Dean (Academics).
The committee approved the change in title of the thesis from “Targeting non-coding RNAs for GBM therapy” to “Identification of key genes and ncRNAs associated with temozolomide and radiation response in GBM” as per recommendations of his SRC.

c) Synopsis of PhD thesis of Ms Aakanksha Ahlawat (2017BEZ8292) held on April, 22, 2022

The Committee discussed and approved the synopsis submitted by the PhD student Ms Aakanksha Ahlawat (2017BEZ8292) on the PhD topic “Laccase and Manganese Peroxidase Diversity in *Cyathus bulleri* and their Role in Delignification, Degradation of Dyes”. The Committee also approved the panel of Examiners and authorized the Chairperson to forward the same to Dean (Academics).

d) Synopsis of PhD thesis of Ms Shefali Singh (Entry no. 2016BEZ8558) held on April, 27, 2022

The Committee discussed and approved the synopsis submitted by the PhD student Ms Ms Shefali Singh (Entry no. 2016BEZ8558). The Committee also approved the panel of Examiners and authorized the Chairperson to forward the same to Dean (Academics).

The committee approved the change in title of the thesis from “Development of Method for Rapid Isolation of Exosomes for Diagnostic Applications” to “Development of liquid biopsy methods for lung cancer detection” as per recommendations of her SRC.

(Action: 1 Thesis supervisor to send the following documents to the DRC Chairperson: (a) Filled-in form for Ph.D. synopsis submission & Appointment of Examiners (b) 2 hard copies of the Synopsis and (c) soft copy of the Synopsis by email) (Action 2: Upon receipt of the above documents, Chairperson DRC to forward it to Dean-Academics)

5. Request received from Mr. Shubham Sharma (2020BEZ7520) for the extension of his PhD registration date by 3 months after 28th September, 2022 to complete his credits requirements.

The committee approved the request received from Mr. Shubham Sharma for the extension of his PhD registration date by 3 months after 28th September, 2022 as a special case.

6. Request received from Mr. Anirban Jana (2016BEZ8004) for extension of his thesis submission date till 30 June, 2022.

The committee approved the request received from Mr. Anirban Jana for the extension of his PhD thesis submission date till 30 June, 2022.

7. Matters for ratification:

1. Request received from Ms. Priyanka (2016BEZ8005) for cancellation of her earlier request for Ex-India Leave and for Research Scholar Travel Award (RSTA) to attend a conference "FEMS Conference on Microbiology", to be held in Belgrade, Serbia from 30 June to 2 July 2022 was approved and forwarded.

2. Request received from Ms. Priyanka (2016BEZ8005) for Research Scholar Travel Award (RSTA) to attend a conference "Ecology of Soil Microorganisms, 2022" to be held in Prague, Czech Republic, from 19-23 June, 2022 was approved and forwarded.

3. Request by Ms. Shivani Khatri (2017BEZ8287) for maternity leave from 1 Feb, 2022-July, 2022 was forwarded to JR(Academics).

4. **(a)** Project proposals submitted by faculty members

S. No	Project Name	Investigator	Funding Agency
1	Development of a Novel Platform for Real-Time Antimicrobial Assessment	Prof. Lucinda E. Doyle (PI) Prof. Rahul Mishra, CARE, co-PI	SERB (CRG)
2	Development of 'Next generation bioformulations' using Actinomycetes for salinity stress mitigation in tomato	Prof. Shilpi Sharma	SERB (CRG)

The above projects were circulated to members, since no comments were received the projects were forwarded to concerned authorities, and the item was ratified.

8. Any other item with the permission of the Chair

The Head apprised the Committee of the note received from Associate Dean R&D regarding the mandatory teaching requirements of the PMRF fellows of the Department. The Chairperson was asked to convey the same to Departmental PMRF fellows (Aastha Singh (2019BEZ8182), Rewati Dixit (2019BEZ8187), Kolli Venkata Supraja (2020BEZ8516), Preetha Ganguly (2020BEZ8521) and send the final details of their teaching commitments to Associate Dean (R&D).

Distribution

All Faculty (by email)

Ritu Kulshreshtha

Ritu Kulshreshtha
DRC Chairperson

Outline of specific objectives for Palistha Tuladhar's thesis

1. Engineering of polyhydroxybutyrate (PHB) production in *Bacillus Subtilis*
 - A. Construction of heterologous pathway for PHB production from glucose in *B. Subtilis* by employing genes from *Ralstonia solanacearum*
 - B. Optimization of growth conditions for redirecting carbon flux toward PHB production and quantification/characterization of PHB
 - C. ¹³C labelling experiments and (metabolic flux analysis) MFA for flux characterization in strain engineered for PHB production

2. Engineering of TCA cycle derived organic acid (malate or fumarate) production in *Bacillus Subtilis*
 - A. Production of organic acids in *B. Subtilis* host by flux diversion from pyruvate/ phosphoenolpyruvate (PEP) to oxaloacetate for production of the organic acids.
 - B. Quantification of organic acid production in engineered strain
 - C. ¹³C labelling experiments and MFA for flux characterization in strain engineered for organic acid production

3. Metabolic modelling of engineered strains for predicting targets for improving product yield
 - A. Prediction of gene targets for improving product yields by coupling ¹³C MFA fluxes (from 1C and 2C) with genome scale models of *B. subtilis* using flux balance analysis
 - B. Implementation of predictions from 3A *in vivo* and quantifying its effects on improving yields of PHB and organic acids.
 - C. Characterization of *in vivo* fluxes in metabolically engineered strains developed in 3B by ¹³C-MFA

Justification for including Dr. Shyam Kumar Masakapalli as co-supervisor on Palistha's thesis

The specific objectives requiring Dr. Shyam Kumar Masakapalli's expertise are highlighted in red. These are the objectives specifically related to the PHB pathway; PHB production and analysis; and ¹³C labelling experiments and MFA.

Dr. Masakapalli's group has worked on PHB production from *R. solanacearum* and performed a detailed analysis of the pathway and conditions required for its production (1). They have also established ¹³C labelling experiments and MFA for bacterial species and studied flux distributions in *R. solanacearum* using ¹³C MFA (2).

We (Palistha and I) have been discussing about PHB production and ¹³C MFA with his group over the past year and have been working on these aspects of the projects with him over the past 4 months. Dr. Masakapalli's role as co-supervisor would be to provide expertise on these aspects of the project. Palistha would also travel to his lab at IIT Mandi to perform experiments as part of the highlighted specific aims. Consequently, I have asked for Dr. Masakapalli to be included as a co-supervisor because of the need for his substantial input on the project.

References

1. Jyoti P, Patil N, Masakapalli SK.. ACS Chemical Biology. 2021 Jun 18;16(7):1215-22
2. Jyoti, P., Shree, M., Joshi, C., Prakash, T., Ray, S.K., Satapathy, S.S. and Masakapalli, S.K., 2020. MSystems, 5(2), pp.e00091-20

The criteria used for shortlisting:**Shortlisting criteria for Admission to Ph.D. Program (Sem I, 2022-2023)**

The candidates must have first class (60% or 6.0/10 CGPA) in all examinations starting from 10+2 up to the qualifying exam and they must meet the following criteria based on their qualifying exam degree:

Table: 1 Minimum Qualification for Admission to full-time Ph.D. Programme

Qualifying exam	Acceptable majors	General Category	General Category (EWS)	OBC (Non-creamy layer)	SC/ST & PD
B. Tech/B.E.	Biochemical Engineering, Biotechnology, Bioinformatics, Chemical Engineering, Chemical Science and Technology, Environmental Engineering, Industrial Biotechnology, Pharmaceutical Biotechnology	(i) B.Tech 75% or 7.5/10 CGPA (ii) Valid JRF or GATE score of min. 650 in Life Sciences or Biotechnology or Chemical Engg.	(i) B.Tech 75% or 7.5/10 CGPA (ii) Valid JRF or GATE score of min. 650 in Life Sciences or Biotechnology or Chemical Engg.	(i) B.Tech 75% or 7.5/10 CGPA (ii) Valid JRF or GATE score of min. 600 in Life Sciences or Biotechnology or Chemical Engg.	(i) B.Tech 70% or 7.0/10 CGPA (ii) Valid JRF or GATE score of min. 550 in Life Sciences or Biotechnology or Chemical Engg.
M. Tech / M.E / MS(R) or equivalent	Biochemical Engineering, Biological Engineering, Bioprocess Engineering, Bioscience & Bioengineering, Biotechnology, Bioinformatics, Chemical Engineering, Chemical Technology, Chemical plant design, Computational Biology, Computational Biology & Bioinformatics, Environmental Engineering, Environmental Science & Engineering, Environmental Biotechnology, Genetic Engineering, Industrial Biotechnology, Pharmaceutical Biotechnology	(i) MTech 85% or 8.5/10 CGPA	(i) MTech 85% or 8.5/10 CGPA	(i) MTech 85% or 8.5/10 CGPA	(i) MTech 80% or 8.0/10 CGPA
M.Sc	Biochemistry, Biotechnology, Bioinformatics,	(i) M.Sc. 70% or 7.0/10 CGPA	(i) M.Sc. 70% or 7.0/10 CGPA	(i) M.Sc. 70% or 7.0/10 CGPA	(i) M.Sc. 65% or CGPA 6.5/10

	Biophysics, Biosciences, Chemistry, Chemical & Molecular Biology, Computational Biology & Bioinformatics, Environmental Science, Genetics, Industrial Biotechnology, Life Sciences, Microbiology, Microbial Biotechnology, Molecular Biology & Biotechnology, System Biotechnology, System Biology & Bioinformatics	(ii) Valid JRF or GATE score of min. 650 in Life Sciences or Biotechnology or Chemical Engg	(ii) Valid JRF or GATE score of min. 650 in Life Sciences or Biotechnology or Chemical Engg	(ii) Valid JRF or GATE score of min. 600 in Life Sciences or Biotechnology or Chemical Engg	(ii) Valid JRF or GATE score of min. 550 in Life Sciences or Biotechnology or Chemical Engg.
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For students from Centrally Funded Technical Institutions (CFTI)

Requirement of qualification in GATE / National Exam is waived for the following categories of applicants from CFTIs:

- 1) Currently registered students in Centrally Funded Technical Institutes (CFTIs) pursuing B.Tech./B.E./ Integrated M. Tech/ Integrated M. Sc. programmes, who have completed 6 semesters or more, and have CGPA of 8.000 or above (on a 10 point scale). Such students must obtain a CGPA of 8.000 or above at the time of graduation, and before they formally register for the Ph.D. programme (80% aggregate marks, if marks is the primary mode of evaluation);
- 2) Graduates of the CFTIs (in the programmes marked under (1)) with a final graduation CGPA of more than 8.000 (80% aggregate marks, if marks is the primary mode of evaluation);
- 3) M.Sc. graduates from IITs with CGPA 8.000 or above.

Minimum Qualifications for admission to Part-time and Sponsored (full-time) Ph.D. Programmes:

The following eligibility conditions apply for the Part-time and sponsored full-time programmes:

1. Only employees of Public Sector Undertakings or Government Departments or Research and Development Organizations or Private Industries (approved by Faculty Boards) are eligible for admission to these programmes.
2. The minimum full-time experience required *after* obtaining the qualifying degree and as on date of registration, is given below in Table 2:

Table 2: Experience required for admission to part-time Ph.D. Programmes

Programme	Qualifications	Work Experience (Post Qualification)
Ph.D.	M.E./M.Tech./M.S.(R)/M.D. or Equivalent	Nil
Ph.D.	B.E./B.Tech./M.Sc./M.A./M.B.A./MBBS or equivalent, from CFTIs/Central Universities	1 Year

Ph.D.	B.E./B.Tech./M.Sc./M.A./M.B.A./MBBS or equivalent, and working in IIT Delhi* (Project or Regular) *Through proper channel	1 Year
Ph.D.	B.E./B.Tech./M.Sc./M.A./MBA/MBBS or equivalent, from institutions other than CFTIs/Central Universities	2 Years

3. Minimum qualification for these candidates is the same as for full-time candidates (**Table 1**), except that the requirement of qualifying in a national examination is waived.

4. For part-time candidates from outside NCR (or at a radial distance of more than 50 km from IIT Delhi), there is a minimum residency requirement of 6 months. The Department may specify a higher residency requirement based on the courses recommended as well as the background.

The criteria used for shortlisting:**Shortlisting criteria for Admission to MSR Program (Sem I, 2022-2023)**

The candidates must have first class (60% or 6.0/10 CGPA) in all examinations starting from 10+2 up to the qualifying exam and they must meet the following criteria based on their qualifying exam degree:

Table: 1 Minimum Qualification for Admission to full-time MSR Programme

Qualifying exam	Acceptable majors	General Category	General Category (EWS)	OBC (Non-creamy layer)	SC/ST & PD
B. Tech/B.E.	Biochemical Engineering, Biotechnology, Bioinformatics, Chemical Engineering, Chemical Science and Technology, Environmental Engineering, Industrial Biotechnology, Pharmaceutical Biotechnology	(i) B.Tech 75% or 7.5/10 CGPA (ii) GATE score of min. 650 in Life Sciences or Biotechnology or Chemical Engg.	(i) B.Tech 75% or 7.5/10 CGPA (ii) GATE score of min. 650 in Life Sciences or Biotechnology or Chemical Engg.	(i) B.Tech 75% or 7.5/10 CGPA (ii) GATE score of min. 600 in Life Sciences or Biotechnology or Chemical Engg.	(i) B.Tech 70% or 7.0/10 CGPA (ii) GATE score of min. 550 in Life Sciences or Biotechnology or Chemical Engg.
M. Tech / M.E / MS(R) or equivalent	Biochemical Engineering, Biological Engineering, Bioprocess Engineering, Bioscience & Bioengineering, Biotechnology, Bioinformatics, Chemical Engineering, Chemical Technology, Chemical plant design, Computational Biology, Computational Biology & Bioinformatics, Environmental Engineering, Environmental Science & Engineering, Environmental Biotechnology, Genetic Engineering, Industrial Biotechnology,	(i) M.Tech 85% or 8.5/10 CGPA	(i) M.Tech 85% or 8.5/10 CGPA	(i) B.Tech 85% or 8.5/10 CGPA	(i) B.Tech 80% or 8.0/10 CGPA

	Pharmaceutical Biotechnology				
M.Sc	Biochemistry, Biotechnology, Bioinformatics, Biophysics, Biosciences, Chemistry, Chemical & Molecular Biology, Computational Biology & Bioinformatics, Environmental Science, Genetics, Industrial Biotechnology, Life Sciences, Microbiology, Microbial Biotechnology, Molecular Biology & Biotechnology, System Biotechnology, System Biology & Bioinformatics	i) M.Sc. 70% or 7.0/10 CGPA ii) GATE score of min. 650 in Life Sciences or Biotechnology or Chemical Engg.	i) M.Sc. 70% or 7.0/10 CGPA ii) GATE score of min. 650 in Life Sciences or Biotechnology or Chemical Engg.	i) M.Sc. 70% or 7.0/10 CGPA ii) GATE score of min. 600 in Life Sciences or Biotechnology or Chemical Engg.	i) M.Sc. 65% or 6.5/10 CGPA ii) GATE score of min. 550 in Life Sciences or Biotechnology or Chemical Engg.

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Requirement of qualification in GATE / National Exam is waived off for the following categories of applicants from CFTIs:

- 1) Currently registered students in Centrally Funded Technical Institutes (CFTIs) pursuing B.Tech./B.E./ Integrated M. Tech/ Integrated M. Sc. programmes, who have completed 6 semesters or more, and have CGPA of 8.000 or above (on a 10 point scale). Such students must obtain a CGPA of 8.000 or above at the time of graduation, and before they formally register for the Ph.D. programme (80% aggregate marks, if marks is the primary mode of evaluation);
- 2) Graduates of the CFTIs (in the programmes marked under (1)) with a final graduation CGPA of more than 8.000 (80% aggregate marks, if marks is the primary mode of evaluation);
- 3) M.Sc. graduates from IITs with CGPA 8.000 or above.

Department Of Biochemical Engineering And Biotechnology

SYLLABUS FOR FIRST ROUND OF INTERVIEWS FOR PhD SELECTIONS

2022-2023, Sem-I

SYLLABUS FOR BIOSCIENCES

BIOCHEMISTRY

Basic physical chemistry: Properties of gases, chemical equilibrium, pH, ionization of weak acids and bases; solubility and precipitation

Carbohydrates: structure and function (monosaccharides, disaccharides and common polysaccharides – starch and cellulose).

Proteins – primary, secondary, tertiary & quaternary structures; Ramachandran plots

Enzyme: chemical and functional nature of enzymes, Enzyme kinetics

Structure and function of nucleotides, DNA and RNA

Basic metabolic pathways (Glycolysis, TCA cycle, Glyoxalate cycle, Pentose Phosphate pathway).

Biological Membrane: structure and function

MOLECULAR BIOLOGY

Prokaryotic and eukaryotic genome organization

Basic mechanisms in replication, transcription and translation

Gene regulation in prokaryotes: lac, ara and trp operons

Mutations: Types of mutations, Isolation of mutants

Enzymes used in molecular cloning and their applications

DNA sequencing: chemical and enzymatic methods

Southern, Northern and western blotting and hybridization

Vectors: types and characteristic features

Directed evolution

MICROBIOLOGY

Structure and function of prokaryotic and eukaryotic cell

Microbial Growth – Measurement techniques; growth kinetics

Energy transduction (fermentation, aerobic respiration and anaerobic respiration).

Genetic recombination; basic features of transformation, transduction and conjugation.

Bacteriophages

SYLLABUS FOR BIOCHEMICAL ENGINEERING

Fundamentals of growth: Monod growth kinetics; growth cycle phases for batch cultivation.

Fundamentals of sterilization: Thermal death kinetics of cells and spores. Media sterilization: Concept of degree of sterility and decimal reduction time. Batch sterilization.

Enzyme kinetics: Kinetics of enzyme catalyzed reactions: Michaelis-Menten equation; Lineweaver-Burk plots; Eadie-Hofstee plots; substrate inhibition kinetics; competitive, non-competitive and uncompetitive inhibition; effect of pH and temperature.

Bioreactor kinetics: Batch, fed-batch and continuous (CSTR and PFR) reactors; conditions for “wash-out” and maximum cell production in chemostat cultures.

Analysis of rate data for batch/continuous flow reactors and development of rate equation; Introduction to the concept of yield, titer and productivity;

Principles of recovery operations: filtrations, centrifugation, solvent extraction, chromatography.

Suggested Reading

a) Molecular Biology of the Cell, 4th Edition, by Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter, New York: Garland Science; 2002.

b) Lehninger Principles of Biochemistry, 5th Edition, by David L. Nelson, Michael M. Cox, W. H. Freeman 2008

c) Microbiology, 7th Ed., by L.M. Prescott, J.P. Harley and D.A. Klein, McGraw-Hill, 2008.

d) Bioprocess Engineering: Basic Concepts”, M.L. Schuler and F. Kargi, Prentice Hall, 1992

e) Bioprocess Engineering Principles, Pauline Doran, Academic Press, 2013.