



हरियाणा केंद्रीय विश्वविद्यालय, महेन्द्रगढ़  
**CENTRAL UNIVERSITY OF HARYANA, MAHENDERGARH**  
(NAAC ACCREDITED 'A' GRADE UNIVERSITY)

**METABOLIC ENGINEERING**

[Course Code: 174040H09]

**November 25-29, 2019**

Sponsored by Ministry of Human Resource Development (MHRD)  
under the scheme of Global Initiative of Academic Networks (GIAN)



*Organised by*  
**Department of Biotechnology**  
**School of Interdisciplinary and Applied Life Sciences**

# Metabolic Engineering

## MHRD Scheme of Global Initiative of Academic Networks (GIAN)

### 1. Overview

This course provides an overview of metabolic engineering, focusing on both experimental techniques and computational tools for performing metabolic engineering. Students will learn about basic experimental techniques such as DNA cloning, PCR and current methods for performing cellular modifications and will learn about metabolic balance and metabolic flux analysis.

### 2. Objectives

The student who complete this course have :

- A knowledge of the quantitative and qualitative aspects of the cellular and biochemical processes related to metabolic pathways
- The ability to identify, formulate and solve problems of metabolic engineering
- The ability to use mathematical tools that further enhance their understanding
- The ability to critically read the metabolic engineering literature
- To propose new research questions and identify methods to test new hypotheses in the area of metabolic engineering

### 3. Teaching Faculty

#### Foreign Faculty

Prof. Mattheos Koffas  
Center for Biotechnology and Interdisciplinary Studies  
Rensselaer Polytechnic Institute  
Troy-New York

#### Host Faculty

Kashyap Kumar Dubey  
Department of Biotechnology  
Central University of Haryana  
Mahendergarh-123031

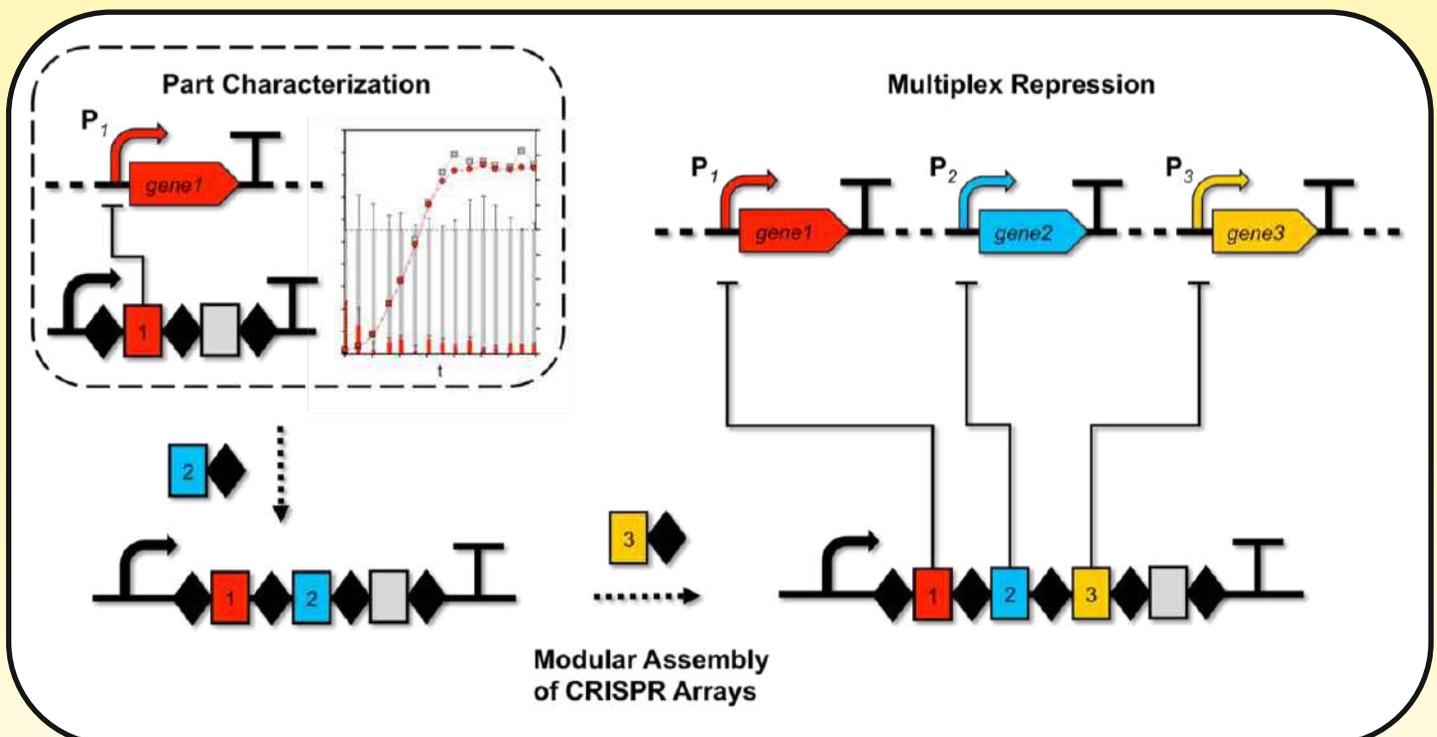


Figure taken from Koffas group

#### 4. Course Details

Duration: 5 Days (November 25-29, 2019)

##### Lecture Schedule

November 25, 2019		
Day 1	<b>Lecture 1</b> 09:00 a.m. - 10:30 a.m.	Introduction about metabolic engineering and genomic engineering using CRISPR (Cont..)
	<b>Lecture 2</b> 11.00 a.m. - 12.30 p.m.	Genomic engineering using CRISPR
	<b>Tutorials</b> 13.30 p.m. - 15.30 p.m.	Distribution of e-material among students for tutorial purpose
November 26, 2019		
Day 2	<b>Lecture 3</b> 09:00 a.m. - 10:30 a.m.	CRISPR
	<b>Lecture 4</b> 11.00 a.m. - 12.30 p.m.	Metabolic pathways overview
	<b>Tutorials</b> 13.30 p.m. - 15.30 p.m.	Discussion of material distributed among the students during tutorials
November 27, 2019		
Day 3	<b>Lecture 5</b> 09:00 a.m. - 10:30 a.m.	Comparative models for cellular reactions (cont.)
	<b>Lecture 6</b> 11.00 a.m. - 12.30 p.m.	Material balance and data consistency
	<b>Tutorials</b> 13.30 p.m. - 15.30 p.m.	Activity based problem discussion using online software tools
November 28, 2019		
Day 4	<b>Lecture 7</b> 09:00 a.m. - 10:30 a.m.	Regulation of metabolic pathways
	<b>Lecture 8</b> 11.00 a.m. - 12.30 p.m.	Control of enzyme levels
	<b>Tutorials</b> 13.30 p.m. - 15.30 p.m.	Activity based problem discussion & how metabolic engineering based project formulate?
November 29, 2019		
Day 5	<b>Lecture 9</b> 09:00 a.m. - 10:30 a.m.	Tools of metabolic engineering
	<b>Lecture 10</b> 11.00 a.m. - 12.30 p.m.	Methods for measuring metabolic fluxes using isotopes labeling and metabolic control analysis
	<b>Tutorials</b> 13.30 p.m. - 15.30 p.m.	Examination and participants presentation and discussion

#### 5. Who can attend?

Engineers and researchers from manufacturing, service and government organizations including R&D laboratories. Students at B.Tech/MSc/MTech/PhD levels. Faculty from academic and technical institutions.

##### The participation fees:

- Participants from abroad: **US \$ 150**
  - Faculty/Scientists: **INR 2000/-**
  - Industry Participants: **INR 4000/-**
  - Students: **INR 1000/-**-(OBC/UR); **INR 500** (SC/ST); **INR 0/-** (PWD)
- The above fee includes all instructional materials, computer use for tutorials, and assignments, laboratory equipment usage charges, 24 hrs free internet facility. The participants will be provided accommodation on payment basis.

## Message from Vice-Chancellor



I am happy to share that Central University of Haryana is a forerunner in organizing the programmes under Global Initiative of Academic Networks (GIAN) scheme of Ministry of Human Resource Development. In last three years, the University organized 14 GIAN programmes to tap the talent pool of international academicians, scientists and entrepreneurs, and to promote the culture of collaborative learning that facilitates sharing of the best practices and ideas. All the programmes witnessed huge participation of the students and scholars from across the country, which speaks volumes of the relevance of the theme and quality of resource persons invited from prestigious institutions of the world.

Continuing with the institutional ethos of quality higher education through pedagogical innovations, the Department of Biotechnology of the University is organizing a course titled "Metabolic Engineering" from November 25-29, 2019 under the MHRD scheme of Global Initiative of Academic Networks (GIAN).

It is enlightening to note that the course will cover the specific topics of relevance including metabolic engineering and genomic engineering using CRISPR, genomic engineering using CRISPR, metabolic pathways overview, material balance and data consistency, regulation of metabolic pathways, control of enzyme levels, and methods for measuring metabolic fluxes using isotopes labeling, and metabolic control analysis. The course contents will enrich the knowledge of the participants about the latest trends in in metabolic engineering.

Given the quality of the expert leading the course, I have no doubt about the success of the course. I hope that the students and faculty of different universities shall take the fullest advantage of the course.

I would like to extend my compliments to the Department of Biotechnology for carrying forward the agenda of the University to adopt innovative pedagogies for dissemination of knowledge.

I wish the Course Coordinator and his team very best of luck for the organization of this course.

**Prof. R. C. Kuhad**

## Foreign Faculty



**Professor Mattheos Koffas**, received his B.S degree in Chemical Engineering from the National Technical University in Athens, Greece in 1994. He then joined the graduate program of the Department of Chemical Engineering at MIT where he worked on improving amino acid biosynthesis from *Corynebacterium glutamicum*. After completing his PhD in 2000, he joined DuPont's Central Research and Development as a research scientist where he worked on engineering the carotenoid biosynthesis of an obligate methanotroph. In August of 2002 he joined the faculty of the Department of Chemical and Biological Engineering at SUNY Buffalo as a tenure-track Assistant Professor and was promoted

to Associate Professor with tenure in the summer of 2008. In January of 2011 Prof. Koffas moved to his current position at RPI. In his research career, Prof. Koffas has worked with a variety of microorganisms and natural products including amino acids, polyphenols, fatty acids and terpenoids. He has published more than 70 peer-reviewed publications, more than 10 book chapters and holds 8 patents. He is a member of the Editorials Boards of various Journals in the area of Bioengineering.

## Host Faculty



Dr. Kashyap Kumar Dubey is working as Associate Professor in the Department of Biotechnology, Central University of Haryana. He has a background in research which combines engineering technologies with biochemical research. His focus has been to develop technologies that are significant for industry. His interest has been to develop industrially significant process for production of colchicine derivative (3-DMC) using microbial system (*Bacillus megaterium* ACBT3). He has developed an industrially significant process for production of colchicine derivative i.e., 3-demethylated colchicine (3-DMC) using microbial system mode. The products from the above process has proven track record and

is consumed as an anti-cancer drug with fewer side effects when compared to other available drugs. The molecule i.e. 3-DMC, developed by him is more potent than native molecule (i.e., colchicine) through an efficient microbial system via biocatalysts mechanism which has been considerably contributed by him. The experiments have been successful and well-documented by him in journals of repute. His effort has been to develop low cost technology which would lead to lesser cost. Dr. Dubey has published 45 research articles and five book chapters. He has completed two research projects and four are on going. He has successfully supervised six PhD. students and presently six students are pursuing their research under his supervision.

## About The University

The Central University of Haryana (established vide Central Universities Act 2009) is the only Central University in the state of Haryana to be funded and regulated by University Grants Commission and Ministry of Human Resource Development (MHRD), Government of India. Central University of Haryana is located at Jant-Pali villages of district Mahendergarh in South Haryana. Mahendergarh is now a part of the extended National Capital Region (NCR) and is 125 kilometers away from Delhi. It is well connected to Delhi through railways and road. At present, the University has 33 Departments of Study, organised under 11 Schools of Study, The University is one of the foremost universities in the country to implement Choice Based Credit System (CBCS) at the Post Graduate level. Department of Biotechnology was established under the aegis of School of Interdisciplinary and Applied Life Sciences in the academic year 2015-16. The Department is currently offering M.Sc. and Ph.D. programmes. More details about the University and the Department can be found at: <http://cuh.ac.in>.

### Course Coordinator

**Kashyap Kumar Dubey**  
Associate Professor  
Department of Biotechnology  
Central University of Haryana  
Mahendergarh-123031  
Mob: 9996122280  
E-mail: [kashyapdubey@cuh.ac.in](mailto:kashyapdubey@cuh.ac.in)

### Local Coordinator

**Prof. Satish Kumar**  
Professor & Head  
Department of Biotechnology  
Central University of Haryana  
Mahendergarh-123031  
Mob: 9052456653  
E-mail: [satishk@cuh.ac.in](mailto:satishk@cuh.ac.in)

### How to participate:

1. Register yourself on GIAN portal of IIT Kharagpur (<http://www.gian.iitkgp.ac.in/>)
2. Choose the course " Metabolic Engineering " by drop down menu
3. Fill the registration form and pay the course fee by DD/Cheque/RTGS
4. Scan filled registration form and send to Course Coordinator by E-mail.



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**REGISTRATION FORM**

**PERSONAL DETAILS**

Name of the Applicant : \_\_\_\_\_  
 GIAN Application ID : \_\_\_\_\_  
 Date of Birth : \_\_\_\_\_  
 Occupation : \_\_\_\_\_  
 Institution Address : \_\_\_\_\_  
 E-mail : \_\_\_\_\_  
 Mobile Number : \_\_\_\_\_

Paste recent  
 passport size  
 coloured  
 photograph

**REGISTRATION FEE DETAILS**

**By Cheque**

Amount (INR) : \_\_\_\_\_  
 Account Number : \_\_\_\_\_  
 Account Holder's Name : \_\_\_\_\_  
 Cheque No. & Date : \_\_\_\_\_

**By NEFT**

Amount (INR) : \_\_\_\_\_  
 Account Number : \_\_\_\_\_  
 Account Holder's Name : \_\_\_\_\_  
 Transaction ID & Date : \_\_\_\_\_

**By Demand Draft**

Amount: \_\_\_\_\_ DD No. \_\_\_\_\_  
 Bank: \_\_\_\_\_ Date \_\_\_\_\_

**Note:**

- Registration should be made in favour of **GIAN, Central University of Haryana A/c** via **cheque/online transfer mode** only. (Bank Name & Address: Punjab National Bank, Jant-Pali, Mahendergarh, Pin-123031; Account no. 7824000100009605; MICR 123024106; IFSC PUNB0782400)
- Proof of Registration fee payment should be sent to Dr. Kashyap Kumar Dubey, Department of Biotechnology, Central University of Haryana, Mahendergarh - 123031
- The scanned copy of filled Registration form duly signed by the applicant along with the proof of fee submission should also be sent by E-mail to Dr. Kashyap Kumar Dubey (kashyapdubey@cuh.ac.in)
- In case the candidate requires an accommodation a separate E-mail regarding this should be sent to kashyapdubey@cuh.ac.in **before October 25, 2019**

**Signature**

**Contact:**

**Dr. Kashyap Kumar Dubey** Course Coordinator; Email: kashyapdubey@cuh.ac.in ; Mob: 9996122280