

ADVANCED COURSE

Cellular Agriculture - Precision fermentation and cultured meat

12 - 14 November 2024

Marcel Ottens
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AIM OF THE COURSE

In Cellular Agriculture, biotechnological methods are used to produce traditionally animal derived products. In this rapidly developing field there are two main approaches: either components are produced via precision fermentation using genetically modified micro-organisms, or cellular products such as meat are grown in bioreactors. This technology can play a role in the protein transition by diversifying our protein sources. We are on the verge of introducing cellular agriculture products to the market, whilst at the same time tackling technological and societal challenges.

The aim of the course is to familiarize participants with potential CellAg products and the key considerations and disciplines needed to design production processes. The multidisciplinary nature is reflected in the program, where teachers from universities and companies join forces to offer a selection of theory and practice. In this way, the course will provide an intensive overview of the state of the art and the necessary link between the various disciplines. All teachers of this course are experts in their topic and have been selected for their outstanding teaching qualities. The participants are invited to engage in active discussions with the teachers. This very

personal approach is underlined by the fact that the maximum number of participants is set to 35. After the course the participants will be well educated on the critical disciplines that encompass CellAg. Additionally, the participants will have made acquaintances with experts in the fields and among each other.



BioTechDelft
POSTGRADUATE EDUCATION

CELLULAIRE
AGRICULTUUR
NEDERLAND

TUDelft

COURSE DESCRIPTION

This course is intensive and has a multidisciplinary approach. To ensure active participation by those attending, a combination of theoretical (lectures) and practical (small group case design) work is offered. Some online preparatory materials will be provided to ensure all have the same basic knowledge.

LECTURES

The lectures are planned such that we start with building our understanding of the final Cellular Agriculture product that can be consumed. Then we will cover the specifics of the cells and establishing production strains (microbial) / cell lines (animal). The second day of the course will focus on the main aspects of designing and controlling effective production processes, and quantifying economical and environmental benefits over traditional production methods. The final course day will revolve around legal and societal aspects of introducing a novel food. A number of industry cases will be discussed to allow reflection of the shared theory versus “real life” experiences.

EXERCISES

To actively incorporate the offered theory, a small-group exercise will be provided that runs through the three course days. It will end with presentations and a panel discussion on the final course afternoon. The course will be given in English.

WHO SHOULD ATTEND?

This Advanced Course is aimed at professionals (MSc, PhD, or equivalent experience) in biotechnology, food production, or biochemical process engineering with a basic working knowledge of the other disciplines. The course is aimed at those active in academia and industry who seek to update their knowledge on Cellular Agriculture. Both technical and societal topics will be covered in the course. In addition, this Advanced Course is an elective in the two-year postgraduate programs of Delft University of Technology.

COURSE BOARD

Marcel Ottens
Bioprocess Engineering
Department of Biotechnology
Delft University of Technology
Delft, the Netherlands

René Wijffels
Bioprocess Engineering
Wageningen University & Research
Wageningen, the Netherlands

Lorenzo Moroni
Biofabrication for Regenerative Medicine
MERLN Institute for Technology-Inspired
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Maastricht University
Maastricht, the Netherlands

TU DELFT

Joshua Flack
Jean Marc Daran
Marcel Vieira Lara
Cees Haringa
Marieke Klijn
John Posada

COURSE COORDINATION

Yvonne van Gameren
Jenifer Baptiste
BioTech Delft, Delft University of Technology
Department of Biotechnology
Delft, the Netherlands

LECTURERS

Julia Keppler
Wageningen University and Research
Wageningen, the Netherlands

Annabelle Cassiman
Those Vegan Cowboys
Gent, Belgium

Joao Marques Garcia
Wageningen University and Research
Wageningen, the Netherlands

Wouter van Winden
dsm-firmenich
Delft, the Netherlands

Dirk Martens
Wageningen University and Research
Wageningen, the Netherlands

Matt Baker
Maastricht University,
Maastricht, the Netherlands

Francesco Montanari
Wageningen University and Research
Wageningen, the Netherlands

Marleen Onwezen
Wageningen University and Research
Wageningen, the Netherlands

Daan Luining
Meatable
Leiden, the Netherlands

Marcel Wubbolts
Vivici
Delft, the Netherlands



PROGRAM

TUESDAY 12 NOVEMBER 2024

Theme: Setting the scene

08:45 Registration

09:00 Introduction: Cellular Agriculture, course, and participants
René Wijffels

09:45 Overview of companies and commercial developments
Marcel Ottens

Theme: Starting with the end in mind: food science

10:30 From intermediate to food: product development
Julia Keppler

11:30 Formulation of casein to make cheese
Annabelle Cassiman

12:30 Group picture & Lunch

Theme: Cell engineering to optimize production

13:30 Microbial strain selection and engineering, use of bioinformatic tools
Jean Marc Daran

14:30 Key steps in animal cell line development: sampling, engineering, screening, cell banking
Joshua Flack and Joao Marques Garcia

15:45 From cells to structures: biofabrication possibilities
Matt Baker

16:45 Group work on assigned design case

18:00 Social drink

WEDNESDAY 13 NOVEMBER 2024

Theme: Production processes at commercial scale

09:00 Scale-up of CellAg processes
Wouter van Winden

10:00 Considerations for industrial scale cell growth
Dirk Martens

11:00 Group work on assigned design case

12:00 Reactor design and dynamics
Cees Haringa

13:00 Lunch

14:00 Analytical approaches for process and product
Marieke Klijn

15:00 Downstream processing of CellAg products
Marcel Ottens

16:00 Assessing impact: Life Cycle Analysis and Techno-Economic Assessments
John Posada

17:00 Group work on assigned design case

19:30 Course buffet and drinks

THURSDAY 14 NOVEMBER 2024

Theme: Legal and societal aspects

09:00 Registration process of novel food products: EFSA example
Francesco Montanari

10:00 What consumers want and need to adopt CellAg products
Marleen Onwezen

11:00 Group work on assigned design case

12:00 Lunch

Theme: Industry perspective

13:00 A general introduction on how to make meat from cells
Daan Luining

14:00 The myriad of applications of Vivici's animal-free B-lactoglobulin
Marcel Wubbolts

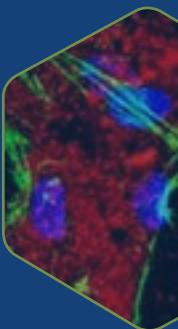
15:00 Group work: Case presentations

16:30 Panel discussion: what defines the road forward?

17:30 Social drink

LOCATION

The course will be held at the
Delft University of Technology
Department of Biotechnology
Van der Maasweg 9
2629 HZ Delft, The Netherlands
<http://bt.tudelft.nl>



COURSE REGISTRATION

Please register via the website to attend the course. Deadline for application is 22 October 2024. Applicants will be handled in order of the date of receipt.

COURSE FEE

€ 2.200 in case of registration before 3 September 2024 or € 2.450 in case of registration after this date. In the event of cancellation before 17 September 2024, a full refund will be granted. After this date, a 25% fee charge can be made.

To facilitate enrolment of young PhD-students from universities, a limited number of fellowships is available. The course fee with fellowship is € 1.250. To apply, please include a copy of your registration as a PhD-student from your university.

The fee includes course materials, lunches, the drinks on Tuesday and Thursday the course buffet on Wednesday. The fee does not cover other meals and lodging.

When the number of participants is too low to have a fruitful course, BioTech Delft will cancel the event no later than six weeks before the start of the course. The course fee will be reimbursed within three weeks after cancellation.

In case a speaker will not be able to present his/her lecture due to unforeseen circumstances, BioTech Delft will arrange an equivalent replacement.

Preparatory materials will be accessible a month before the start of the course, and after receipt of the course fee.

The complete course book will be supplied at the start of the course.



BioTech Delft organises biotechnology education at postgraduate level. BioTech Delft closely cooperates with the department of Biotechnology of Delft University of Technology. Since its foundation, in 1987, BioTech Delft has very successfully organised various types of postdoctoral education.

Currently BioTech Delft offers Advanced Courses given each year, covering the multidisciplinary spectrum of biotechnology. The courses have a long track-record dating back to 1988.

- *Microbial Physiology and Fermentation Technology (1988)*
- *Downstream Processing (1989)*
- *Biocatalysis and Protein Engineering (1999)*
- *Environmental Biotechnology (1993)*
- *Bioprocess Design (2014)*
- *Modelling and Computation for Microorganisms in Bioprocesses (2018)*
- *Integrated Multi-Omics approaches for Improvement of Industrial Microbes (2020)*
- *Cellular Agriculture (2024)*

FURTHER INFORMATION

Jenifer Baptiste, BA

Course coordination

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