

ADVANCED COURSE

# Cellular Agriculture - Precision fermentation and cultured meat

12 - 14 November 2024

Marcel Ottens  
René Wijffels  
Lorenzo Moroni

## 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

**TU**Delft

## 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  
Regenerative Medicine  
Maastricht University  
Maastricht, the Netherlands

## TU DELFT

Josh Flack  
Jean Marc Daran  
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

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*

**09:30** Overview of companies and commercial developments  
*Marcel Ottens*

Theme: Starting with the end in mind: food science

**10:20** From intermediate to food: product development  
*Julia Keppler*

**11:10** The ultimate stretch: microbial casein as industrial example  
*Annabelle Cassiman*

**12:00** Group picture & Lunch

Theme: Cell engineering to optimize production

**13:00** Microbial strain selection and engineering, use of bioinformatic tools  
*Jean Marc Daran*

**13:50** Key steps in animal cell line development: sampling, engineering, screening, cell banking  
*Josh Flack*

**15:10** From cells to structures: biofabrication possibilities  
*Matt Baker*

**16:00** 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*

**09:50** Scale-up aspects of animal cell culture processes  
*Dirk Martens*

**11:10** Group work on assigned design case

**12:10** Reactor design and dynamics  
*Cees Haringa*

**13:00** Lunch

**14:00** Analytical approaches for process and product  
*Marieke Klijn*

**14:50** Downstream processing of CellAg products  
*Marcel Ottens*

**16:10** 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** Regulatory framework for precision fermentation and cultured meat: The EU example  
*Francesco Montanari*

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

**11:15** 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*

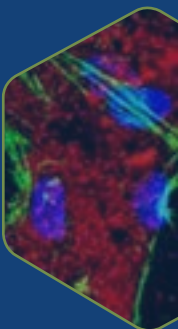
**14:15** The myriad of applications of Vivici's animal-free B-lactoglobulin  
*Marcel Wubbolts*

**15:30** Group work: Case presentations

**17:15** 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

€ 2.100 in case of registration before 21 October 2024 or  
€ 2.350 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.

The fee for SME companies is € 1.350 and for SME of BioTech Campus Delft is € 1.150.

To facilitate enrolment of young PhD-students from universities, a limited number of fellowships is available. The course fee with fellowship is € 1.150. 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

T +31 15 278 1922

E [biotechdelft@tudelft.nl](mailto:biotechdelft@tudelft.nl)

W [biotechdelft.com](http://biotechdelft.com)

Advanced  
Courses in  
**Biotechnology**

[biotechdelft.com](http://biotechdelft.com)

Department of Biotechnology, Delft University of Technology  
Van der Maasweg 9  
2629 HZ Delft, The Netherlands

T +31 (0)15 278 1922 E [biotechdelft@tudelft.nl](mailto:biotechdelft@tudelft.nl)