

Rapportage projectinformatie PPS-en Landbouw, water, voedsel

Datum versie: 7 december 2020

1. Projectinformatie

1.1 Organisatie/financiering (keuze maken)	TKI A&F/TKI T&U/WR-PPS/overig
1.2 Projectnummer	AF-15503
1.3 Project titel	Evolutionary Trade-offs in dairy fermentation
1.4 Projectleider (naam en emailadres)	Herwig Backmann
1.5 Startdatum (dd-mm-jjjj)	01-10-2016
1.6 Einddatum (dd-mm-jjjj)	22-12-2021
1.7 MMIP primair (nummer en naam van het MMIP, zie overzicht bijlage 1)	
1.8 MMIP secundair (deze alleen invullen als er een 2 ^e MMIP is waar het project aan bijdraagt)	

2. Projectomschrijving

2.1 Samenvatting Geef een korte samenvatting van wat het project inhoudt en beoogt. Het gaat om een publiek beschikbare samenvatting (doel, bijdrage aan de missie, op te leveren resultaten in termen van kennis voor doelgroep x en de partners in het project).
<p>In engineering and economics trade-offs are well known. Similarly, evolutionary trade-offs in microbial cells are defined as the optimization of one trait at the cost of another. For instance, if a cell puts lots of energy into the production of costly molecules like exo-polysaccharides little energy is available for cell growth.</p> <p>This project focuses on the influence of trade-offs on industrial fermentations. We will investigate the role for key enzymes in dairy fermentations including enzymes involved in growth, (post-) acidification, flavor- and texture formation. Industrially relevant parameters will be investigated including temperature, salt, starvation and pH stress. These conditions change rapidly throughout cheese manufacturing and we will investigate how these changes influence functionality of the starter culture in the fermented dairy product.</p>
2.2 Doel van het project Wat gaat het project bijdragen aan de doelen van de KIA, de missies en de MMIP's?
<p>The goal of this project is to generate knowledge that allows to improve industrially relevant topics in dairy fermentation such as the development of new starter cultures, shorten lag-phases, increase flavor formation, shorten cheese ripening times and improve the robustness of the fermentation process.</p>
2.3 Motivatie Licht toe waarom dit project passend en nodig is binnen het MMIP
<p>In the Netherland roughly 750 million kg of cheese are produced annually. Improving the production processes contributes to economic competitiveness, health and sustainability.</p>
2.4 Resultaat Zo SMART mogelijke beschrijving van de beoogde resultaten van het project. Het gaat om zowel de inhoudelijke resultaten (in relatie tot vraag 2.2) als resultaten zoals bijeenkomsten en rapporten. Geef zoveel mogelijk ook de planning per jaar.
<p>The steering possibilities during the dairy manufacturing processes will be investigated for identified cellular trade-offs e.g. growth rate, lag-times and flavour formation. This should lead to industrially relevant process optimizations. The results will be reported in scientific publications and should result PhD thesis. The contracts of several PhD students were to finish at the end of 2020 but for three of the students a 3 months prolongation could be financed with contributions from TKI, Universities and</p>

project budget. The focus in 2020 was on the finalization of the experiments and preparations of peer reviewed scientific publications.

Jaarrapportage (svp ook laatste jaar invullen)

3. Status project

3.1 Status project (keuze maken)	project loopt op schema/project loopt achter/project loopt voor/project is niet gestart/project is voortijdig afgesloten/project is afgerond
3.2 Toelichting incl. voorziene wijzigingen t.o.v. het oorspronkelijke werkplan	The project runs for a big part according to plan. However, due to Covid19 and serious restrictions to laboratory access and working with bachelor and master students some parts of the project (mainly in the area of experimental evolution) were abandoned.

4. Behaalde resultaten

4.1 Korte beschrijving van de inhoudelijke resultaten en hun bijdrage aan het MMIP (zoals beschreven in 2.2)
The majority of the deliverables defined in the project plan were achieved this year. This includes new methodology to for instance determine proteomes of bacterial cells when grown in a dairy environment, detailed metabolic models, data on microbial growth after rapid environmental transitions and extensive datasets on industrially relevant trade-offs in defined media and after microbial growth in cheese. Currently this data is being analyzed and written into manuscripts for publication in scientific journals. Three papers were published in 2020 and 2 are currently under review.
4.2 Deliverables (bijeenvkomsten en andere output, die niet benoemd wordt in 4.3 en 4.4)
<ul style="list-style-type: none"> ▪ Proteome turnover in <i>L. lactis</i> under industrial relevant conditions ▪ Enzymatic activity decay data on flavor and growth related enzymes at industrially relevant conditions ▪ Impact of environmental transitions on heterogeneity, outgrowth and fermentation times in milk ▪ Modulation of the catalytic capacity of a starter culture ▪ Extended metabolic model to identify trade-offs based on data generated in the deliverables above ▪ Alteration of starter functionalities (in whey, milk and cheese) by exploiting trade-offs
4.3 Communicatie (lijsten)
4.3.1 Wetenschappelijke artikelen en hun doi (Digital Object Identifiers)
https://academic.oup.com/femsre/article/44/6/804/5912834 https://www.frontiersin.org/articles/10.3389/fbioe.2020.580090/full https://www.sciencedirect.com/science/article/pii/S2214799320301387 https://www.biorxiv.org/content/10.1101/2020.10.15.340554v1 (under review)
4.3.2 Rapporten/artikelen in vakbladen
4.3.3 Overige communicatie-uitingen (inleidingen/posters/radio-tv/social media/workshops/beurzen)
Several posts on social media eg. Linkedin and Twitter concerning the published articles (reaching 1000 of people in the field)
4.4 Overige resultaten: technieken, apparaten, methodes
New methods developed pertain to long term measurements of microbial activity (10.3389/fbioe.2020.580090), proteome measurements of bacteria growing in milk (manuscript in preparation) and a method for continuous monitoring of microbial growth in cleared milk (manuscript under review)

4.5 Projectwebsite: geef het adres van de projectwebsite (indien beschikbaar)

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