TRANS
PHARM

Transforming into a sustainable European pharmaceutical sector

Espoo, Finland

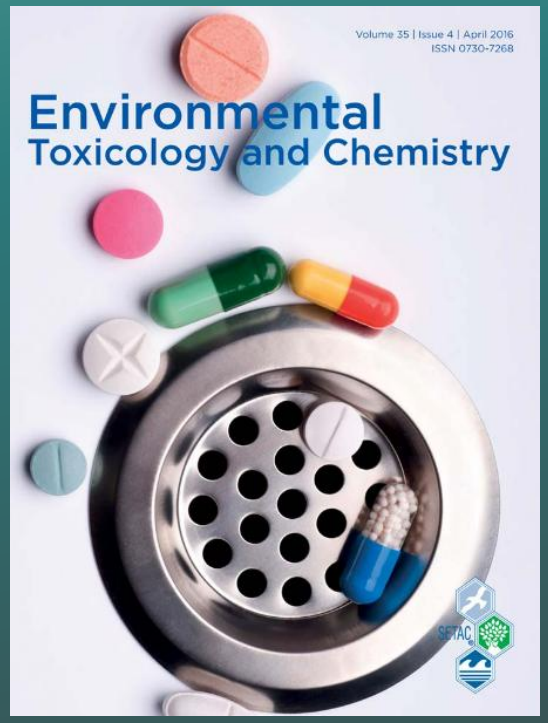
11-09-2026

Funded by
the European Union

This project has received funding from the European Union's Horizon Europe research and innovation program under grant agreement N° 101057816.

Christian Stevens; Project Coordinator; UGent

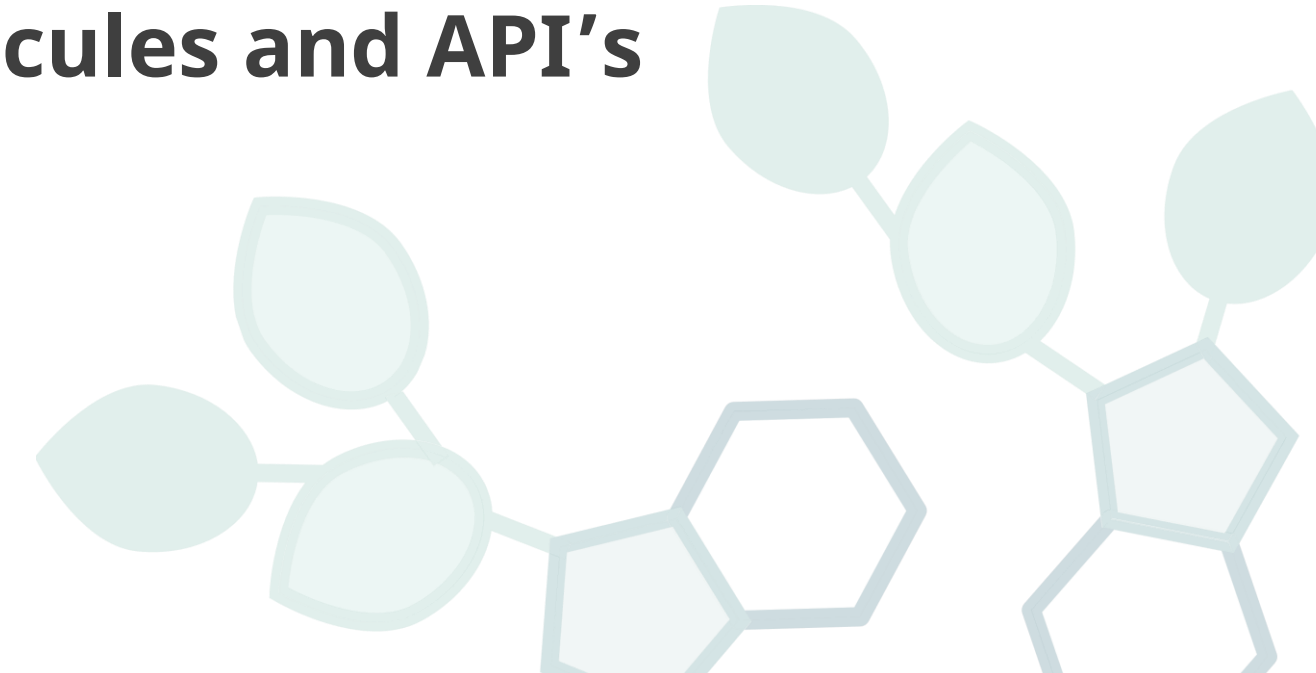
PROJECT CHALLENGES



- Major pharmaceutical production steps are shifted to lower income countries leading to:
  - Unstability of production
  - Unreliability of supply
  - Lack of global environmental protection
- APIs are ubiquitous in the environment
- Green Deal and European intention to pharmaceutical transition toward sustainability and security of supply

AMBITION AND VISION

Improve the EU readiness for sustainable production of small molecules and API’s



AMBITION AND VISION

Improve the EU readiness for sustainable production of small molecules and API’s

- Benign by Design principles
- Greener Pharmaceutical production (solvents and continuous flow)
- Better biodegradability
- Assessing the sustainability
- Transfer of knowledge and ambition to the stakeholders

PARTNERS

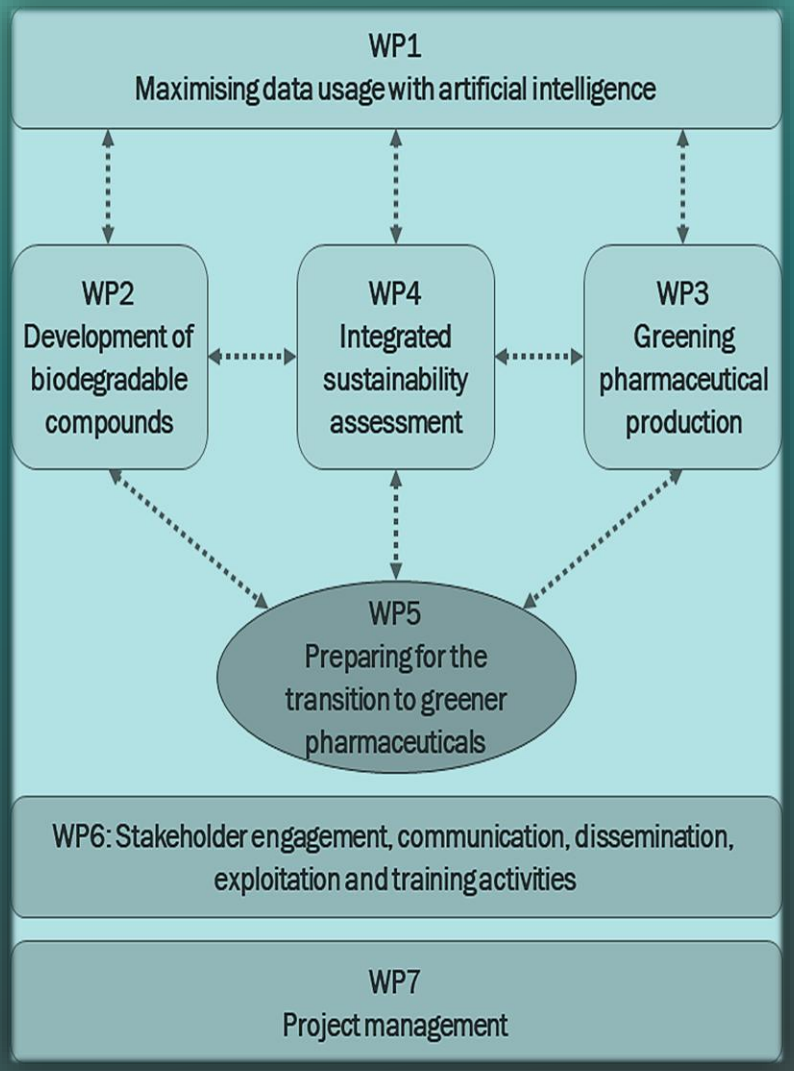
N°	Legal name	Short name	Country
1	UNIVERSITEIT GENT	UGent	Belgium
2	HELSINGIN YLIOPISTO	UH	Finland
3	CIRCA GROUP AS	Circa	Norway
4	STICHTING RADBOUD UNIVERSITEIT	RU	The Netherlands
5	LEUPHANA UNIVERSITAT LUNEBURG	LEU	Germany
6	KELADA PHARMACHEM LIMITED	KelAda	Ireland
7	ORION OYJ	Orion	Finland
8	RIJKSINSTITUUT VOOR VOLKSGEZONDHEID EN MILIEU	RIVM	The Netherlands
9	ECOLOGIC INSTITUT GEMEINNUTZIGE GMBH	Ecologic	Germany
10	BENKEI	Benkei	France
11	UNIVERSITY OF YORK	UoY	UK
12	LATVIJAS ORGANISKAS SINTEZES INSTITUTS	LIOS	Latvia

ADVISORY BOARD

PROJECT OVERVIEW

TransPharm

PROJECT WPs



WP	Title	Leader
1	Maximising data usage with artificial intelligence	UGent
2	Development of biodegradable compounds	LEU
3	Greening pharmaceutical production	UGent
4	Integrated sustainability assessment	RU
5	Preparing for the transition to greener pharmaceuticals	RIVM
6	Stakeholder engagement, communication, dissemination, exploitation and training activities	Ecologic
7	Project Management	UGent

Main objectives – WP 1

Molecular Property Prediction

- Open-source property prediction tool
- Biodegradability prediction
- Prediction of solvation-, safety-, and ecotoxicity-related properties

Synthesis Planning in Continuous Flow

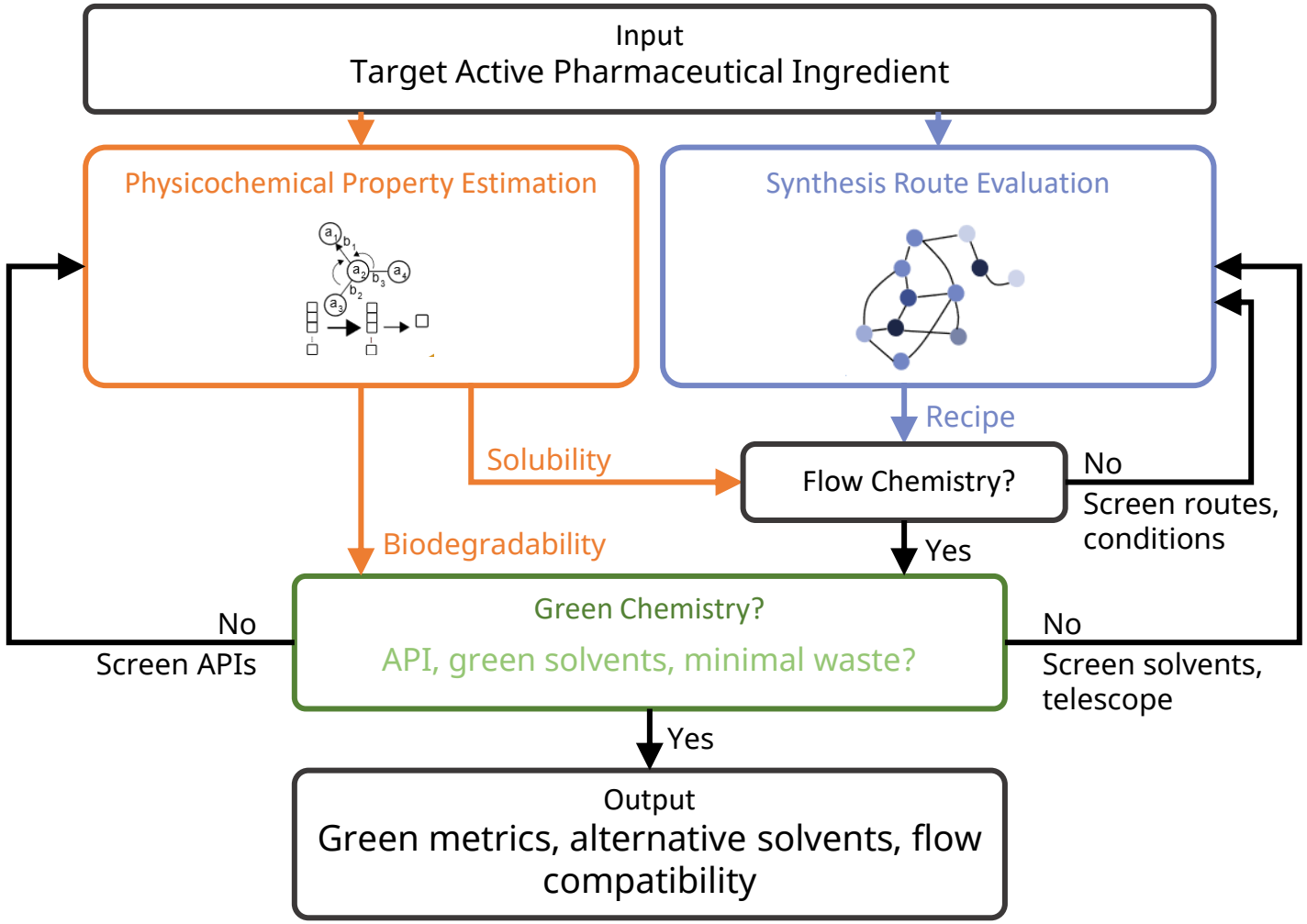
- Reaction condition suggestion
- Reaction planning
- Creation of a matching tool for multistep syntheses

Solvent Design and Scoring

- Sequel to CHEM21 solvent selection guide
- Automating solvent selection
- Design and experimental validation of new green solvent

WP1 - Maximising data usage with AI

Goal of WP1



M.R. Dobbelaere, I. Lengyel, C.V. Stevens, K.M. Van Geem, Journal of Cheminformatics, 16, (2024). https://doi.org/10.1186/s13321-024-00834-z
Rxn-INSIGHT; fast chemical reaction analysis using bond-electron matrices

Main objectives – WP2

Main objective 1 (T2.1)

- Optimization of biodegradation model for publication

Main objective 2 (T2.2, T2.4)

- Evaluation of environmental degradation and ecotoxicity of new molecules

Main objective 3 (T2.3)

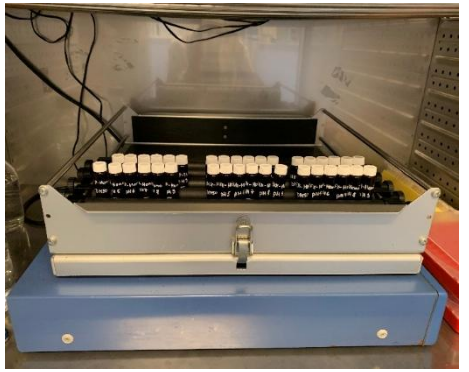
- Optimization of test conditions for MiniCBT
- Lab demonstration of stage 1 and 2 prototype

Main objective 4 (T2.4)

- Ecotoxicity assessment of OFX-Hemi series in *D. magna*

WP2 Development of more environmentally benign fluoroquinolones

- 15 new FQs were synthesized and their environmental and antimicrobial properties were investigated
  - Comparable antibiotic activity against several pathogenic microorganisms (MIC_{90} < 10 µM)
  - None of the new FQs were readily biodegradable
  - Very sensitive to photolysis with less ecotoxic products (e.g., CIP-Hemi)
  - Acid-catalyzed hydrolysis to less active and partially biodegradable products (e.g., CIP-Hemi)
- Investigation of quinolones indicate the importance of hydroxylation at 2 and 6 or 8 for complete mineralization



WP2 Development of a miniaturized biodegradation test system

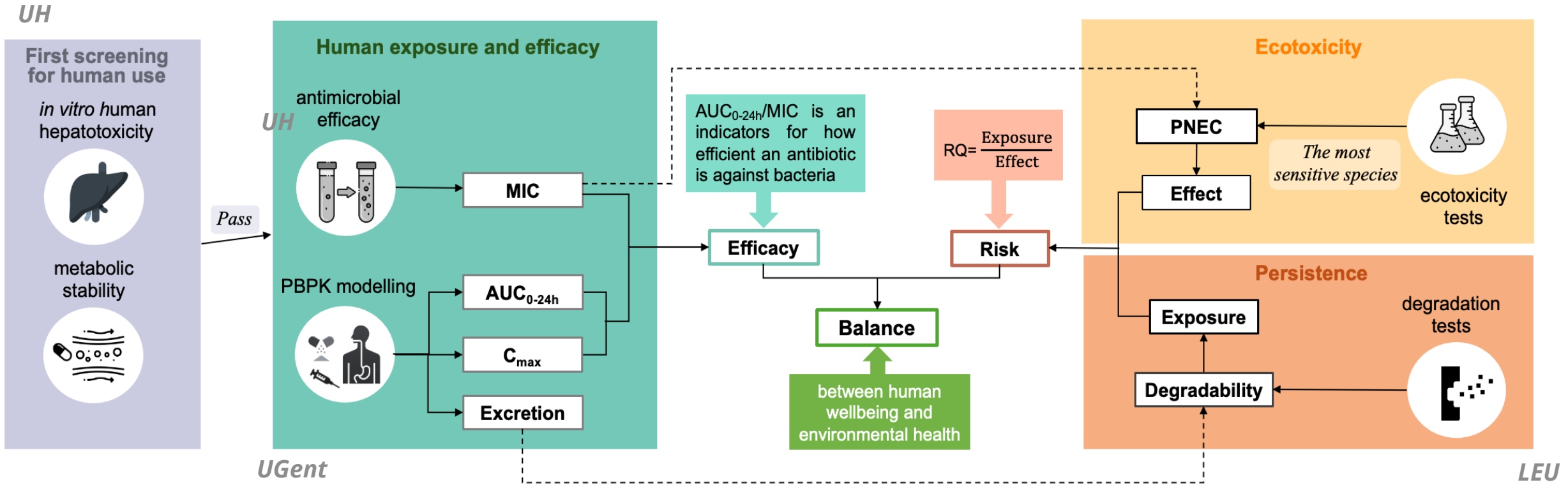
- Miniaturization of the Closed Bottle Test (OECD 301D) from approx. 270 mL to 20 mL and automatization of O_2 measurements including automatic sampling were achieved
  - Validation showed similar results at both volumes

- **Hands-on time:** 0 h (during 28-day period)
- **User-defined O_2 measurement frequency:** incl. O_2-based triggers for interval change during experiment to better capture the degradation kinetics (when change occurs)
- **Flexible:** From 100 mL → down to at least 1 mL
- **Scalable:** Compatible with other endpoints (e.g., CO_2, pH) by changing the sensor type (consumable) and the meter unit (low cost)

WP 2: Integrated risk-benefit assessment method

- Despite its **higher degradability**, the novel analogue CIP-hemi generally shows a **higher environmental risk** than CIP to aquatic ecosystems, due to higher daily doses needed for comparable therapeutic efficiency.

Full results:

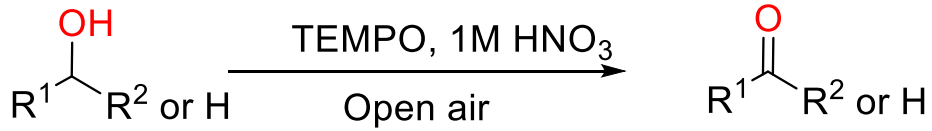


WP3: Greening Pharmaceutical Production
Metal-free, aerobic oxidation of alcohols

The oxidation of alcohols to aldehydes and ketones is a key transformation.

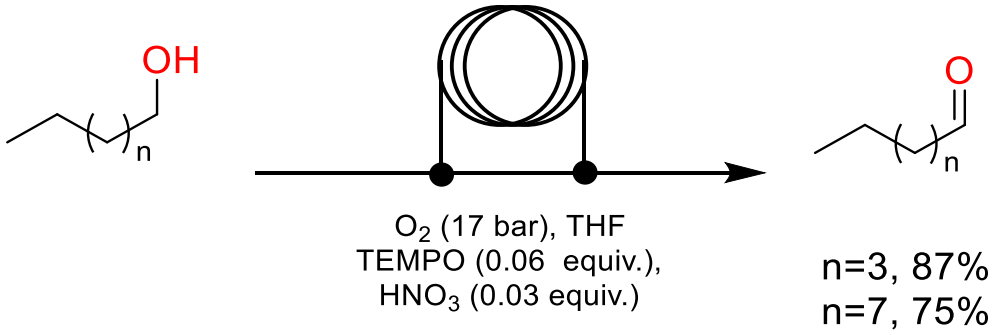
Air as an oxidant is crucial for the safe and sustainable synthesis.

A thermally *pre-activated* HNO_3/TEMPO –system



Time scale
Primary alcohols: 15 min
Secondary alcohols: 60-90 min

TEMPO (0.01 equiv.)
HNO_3 (0.25 equiv.)

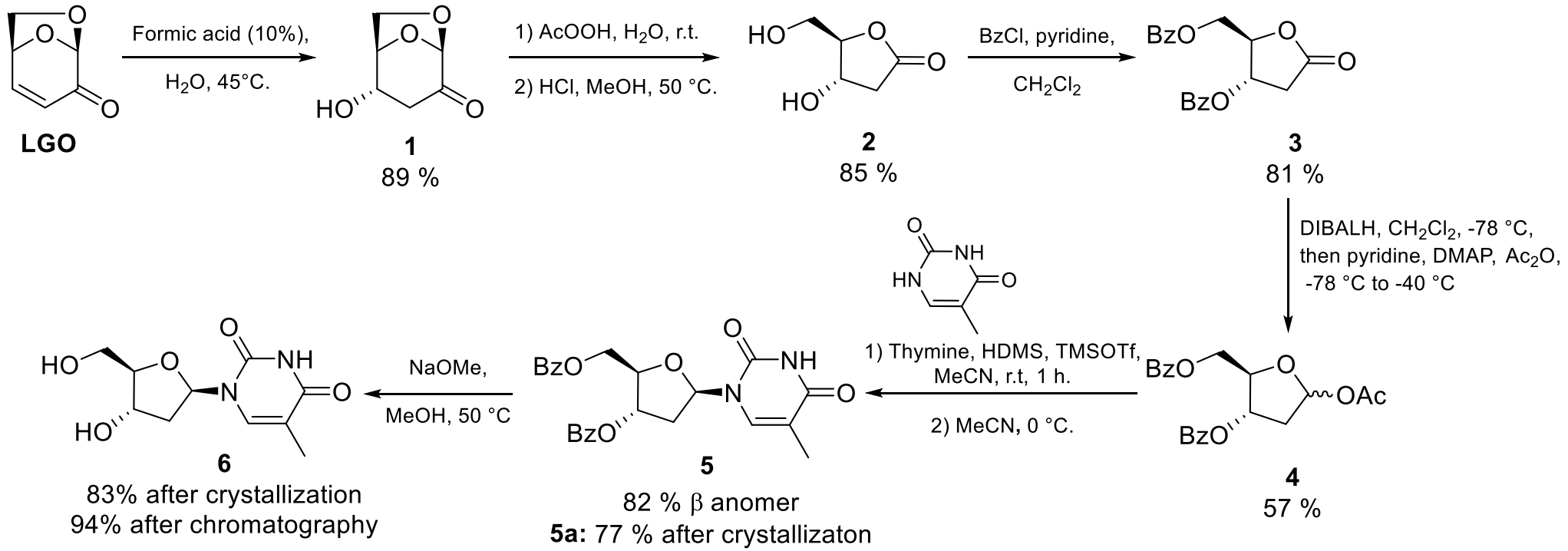


n=3, 87%
n=7, 75%

The method is transferable to continuous flow, => enhanced process safety, sustainability, and better scalability, making the oxidation method highly appealing.

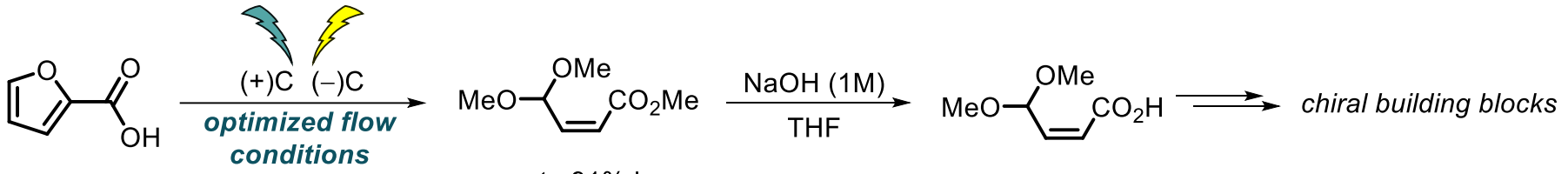
Uddin J., Heshmatnia F., Dejaegere A., Eronen A., Stevens CV., Repo, T. ***2026****, Manuscript.*

WP3: Greening Pharmaceutical Production
Synthesis of Telbivudine



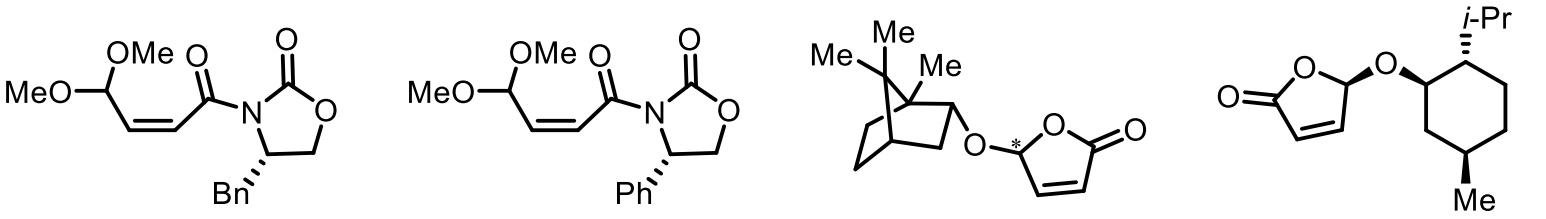
- "A Synthetic Route to Telbivudine from Levoglucosenone: Exploiting a Renewable Chiral Platform", chronic hepatitis B infections, anti-viral

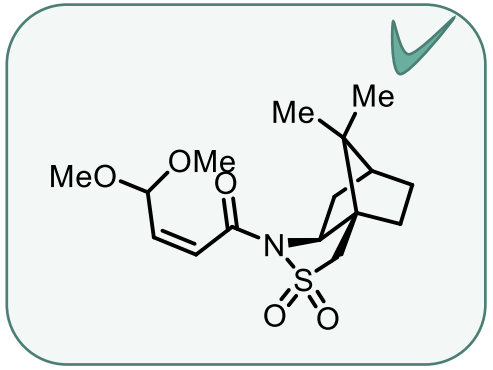
WP 3: Electrochemical derivatization of platform molecules to access building blocks for API manufacturing (LIOS) - Riga



optimized conditions: NH_4BF_4 (1.2 equiv.); MeOH:MeCN (9:1), n = 5 F/mol, **single-pass flow**

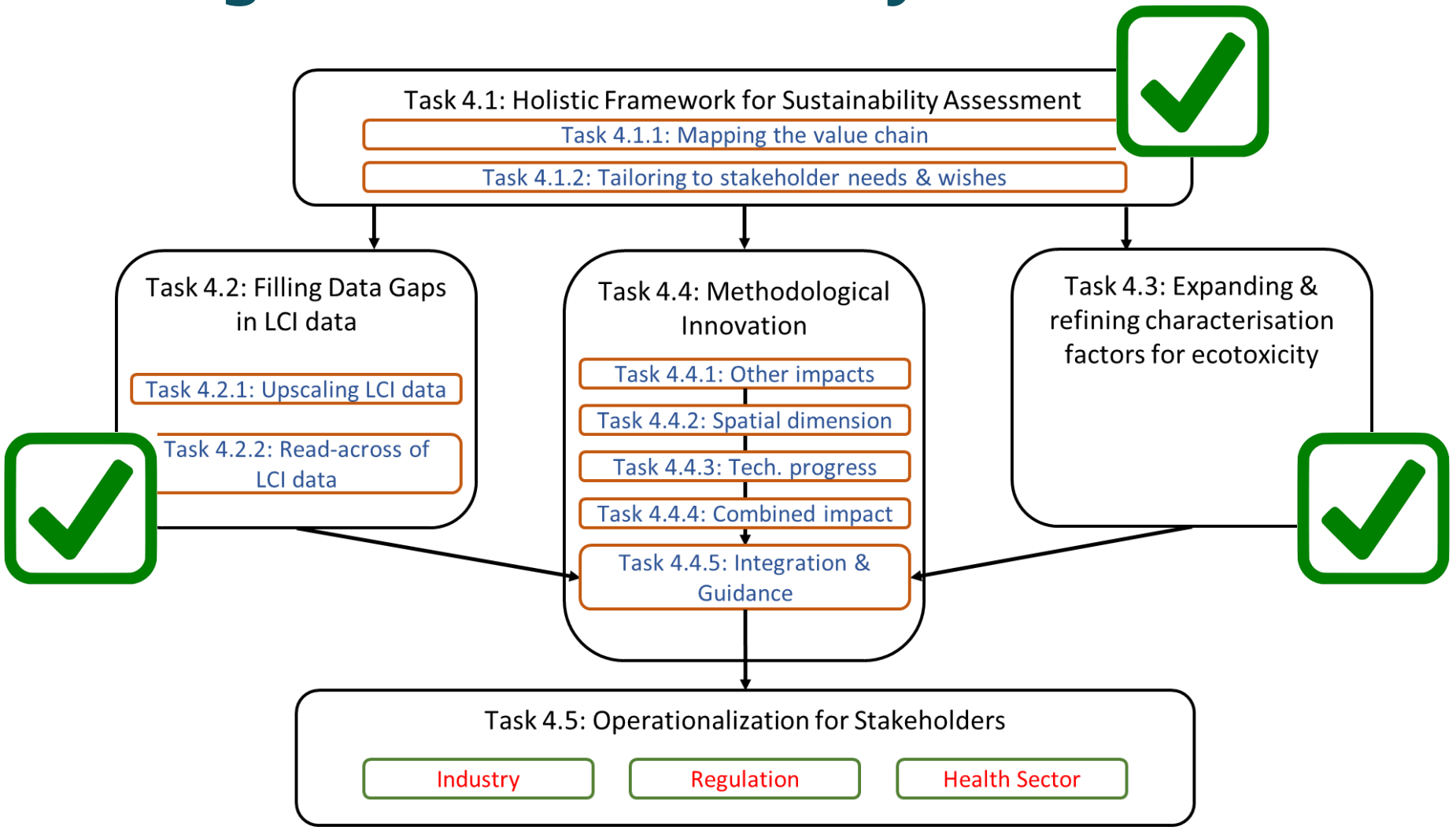
chiral building blocks





Derivatization successful

WP4: Integrated Sustainability Assessment



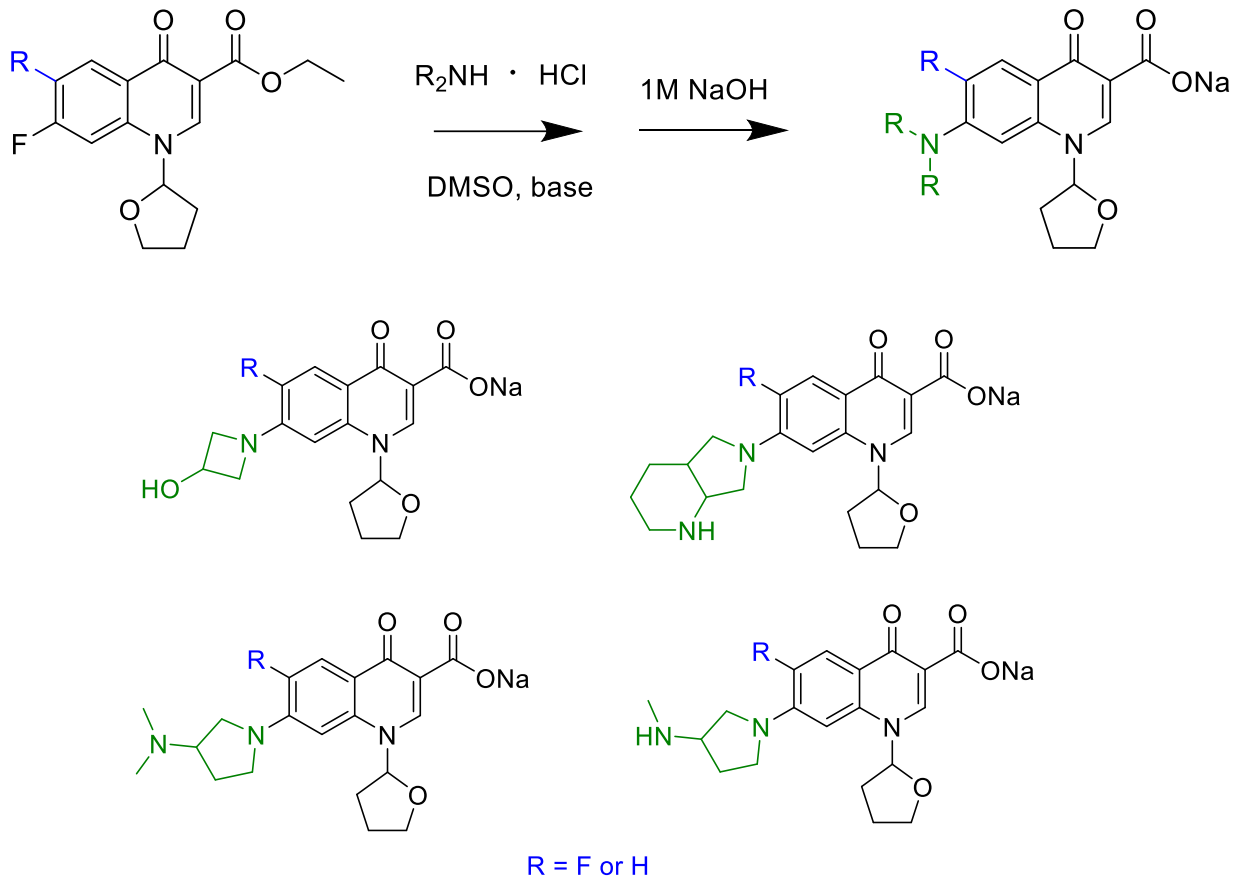
WP5: Preparing for the Transistion to greener Pharmaceuticals

Is there a business case for greener pharmaceuticals?

- White paper with barriers and incentives sent to EMA
  - non-regulatory (technological, business, consumer attitude,…)
  - Regulatory (perceived and effective)

Synthesis of biodegradable fluoroquinolone derivatives

- Continuation of synthesis of Cip-hemi derivatives



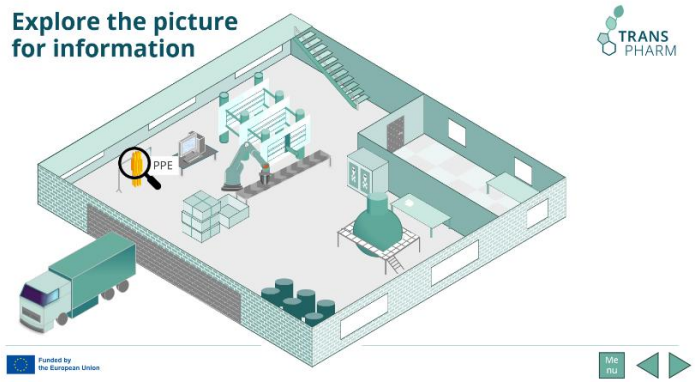
WP6 – Stakeholder engagement, communication, dissemination, exploitation and training activities

Professional training

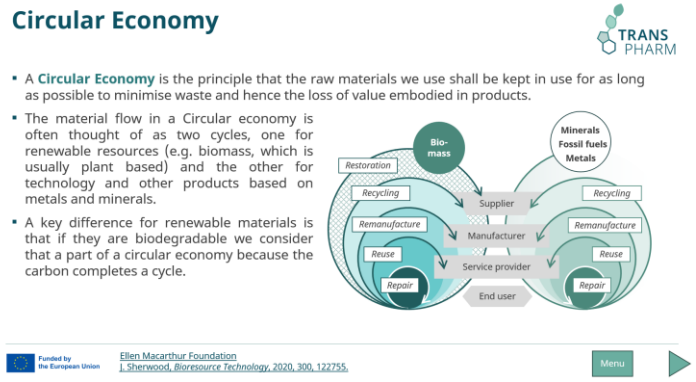
- The three modules (now accessible via CESPE website).

Planetary Boundaries

Sustainable healthcare



Environmental policy



WP7 – Project Management

MANAGEMENT

- Risks and KPI
- QAP
- Dashboard

COMMUNICATION

- Project meetings
- SharePoint platform
- Mailing lists

COORDINATION

- Interim reports
- Extension Amendment
- Final GA & Event

Project Information

TransPharm

Grant agreement ID: 101057816

DOI

10.3030/101057816

Start date

1 June 2022

End date

31 May 2026

Funded under

Health

Total cost

€ 7 610 515

EU contribution

€ 7 573 014

Coordinated by

UNIVERSITEIT GENT

Belgium

https://cordis.europa.eu/project/id/101057816

Funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation program under grant agreement N° 101057816.

TRANS PHARM

Thank you all for the excellent collaboration and all the interactions

TRANS PHARM

Thank you

TRANS PHARM

Contact/Questions?

Prof. Christian Stevens, Department of Green Chemistry and Technology
Faculty of Bioscience Engineering
UGent, Belgium

Chris.Stevens@UGent.be

+32 (0)9 264 59 57