CATRIN

Czech Advanced Technology and Research Institute

Chemistry

Agriculture

Translational Medicine

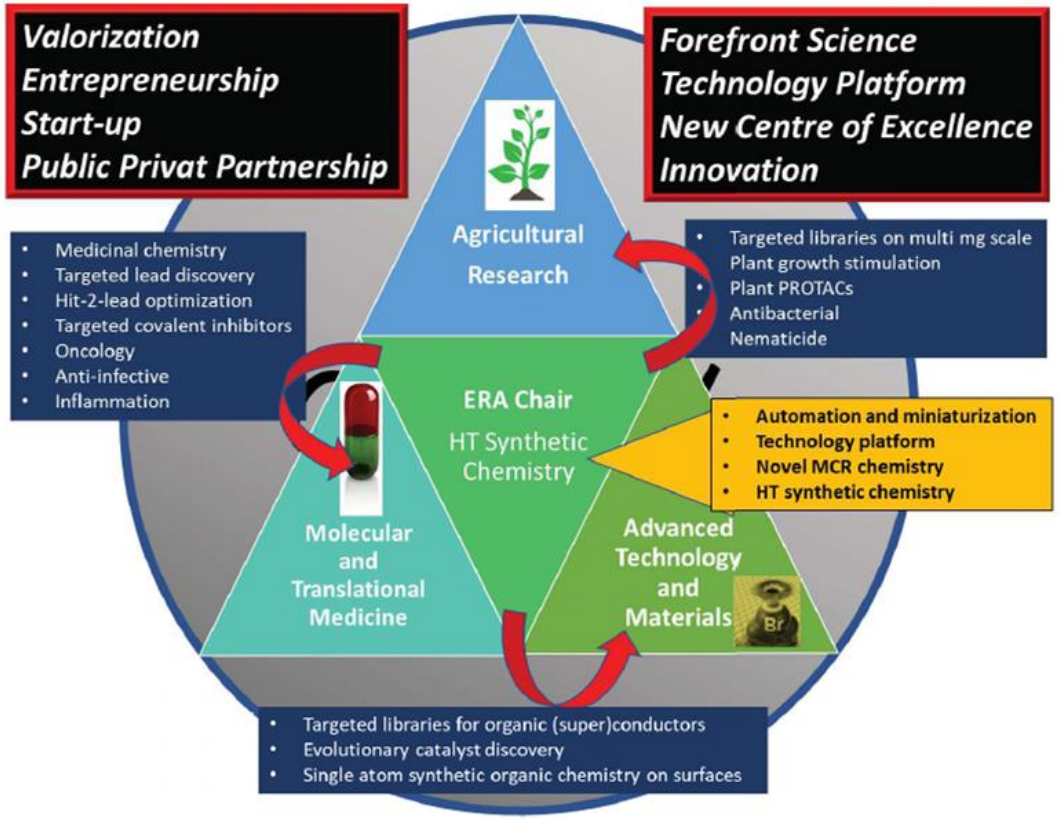
Renewable Energy

Innovative Materials

Nanotechnologies

ERA Chair
ACCELERATOR
Group of Innovative Chemistry
ERA Chair holder: Alex Dömling

Automation + Miniaturization = Acceleration: Revolutionizing Synthetic Chemistry for a Sustainable Future



The convergence of **automation** and **miniaturization** presents a compelling opportunity to significantly reduce costs, energy consumption, and waste generation, thereby minimizing the economic and environmental footprint associated with chemical research.

With this vision in mind, the **ACCELERATOR project** aims to propel automation and miniaturization in synthetic chemistry beyond its current state-of-the-art.

By synergizing these cutting-edge methodologies with **nanotechnology research**, **plant research**, and **biomedical studies** conducted at CATRIN and Palacký University, we endeavor to create a transformative platform for interdisciplinary collaboration.

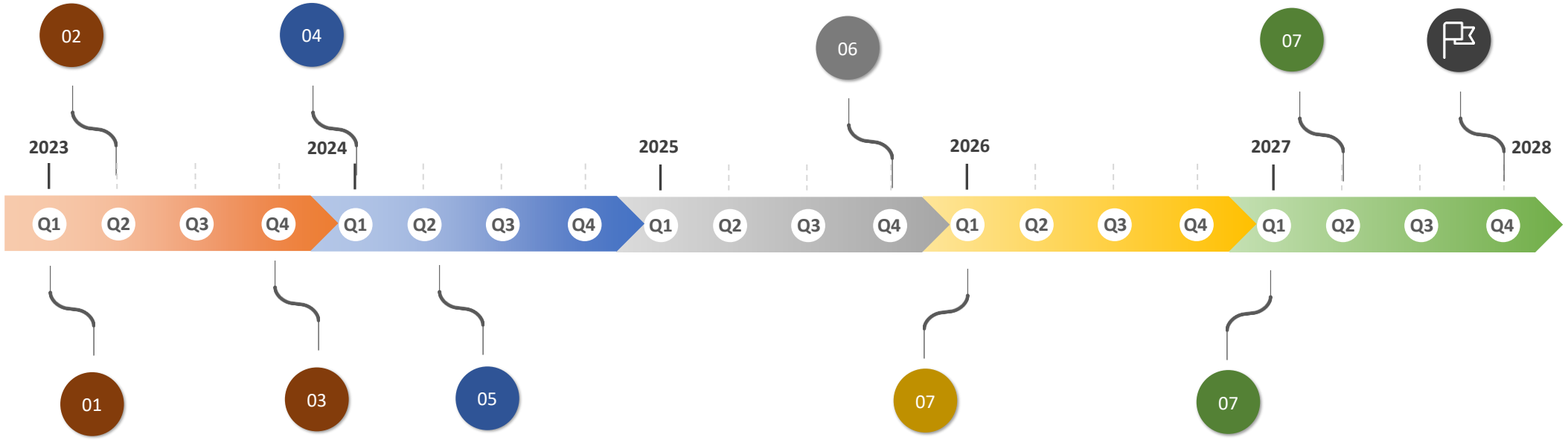
Deliverables
D2.7, D6.1, D6.2, D6.3
Milestone 2

Deliverable
D6.4

Deliverables
D2.3, D2.4, D4.1, D4.2, D5.1, D5.2, D6.5, D6.6, D6.7
Milestone 7

Deliverable
D6.9

Deliverables
D2.5, D2.6, D3.1, D3.2, D3.3, D3.4, D4.3, D4.4, D5.3, D5.4, D6.1
Milestones 8, 9, 10
Review 3



Deliverable
D1.1
Milestone 1

Deliverables
D2.1, D2.2
Milestones 3

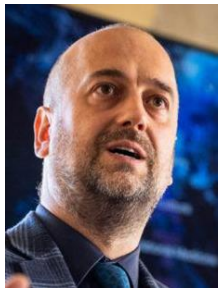
Milestones 4,5
Review 1

Milestone 6
Review 2

Deliverable
D6.8

ACCELERATOR – our team

Prof. Alexander Dömling
ERA Chair holder



Assoc. Prof. Pavel Banáš
Coordinator

Dr. Pravin Patil
Senior researcher

Monika Klimparová
Financial Manager/Project Manager

Dominika Knappová
Project Manager

Dr. Andryi Lubskyy
Postdoc

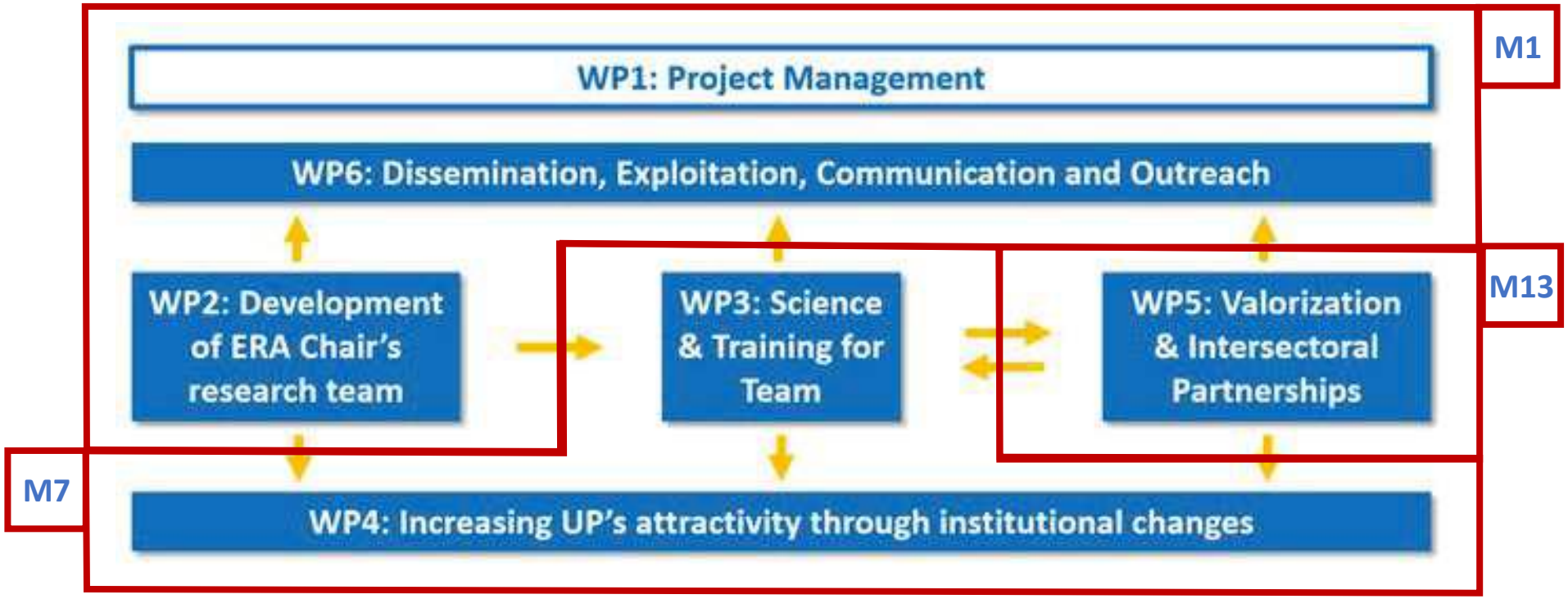
Dr. Thimmalapura Marulappa Vishwanatha
Postdoc

Kaoud Salama
PhD student

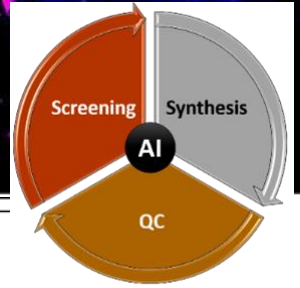
Riccardo Fusco
PhD student

Dr. Atilio Reyes Romero
Postdoc

ACCELERATOR – Work Packages



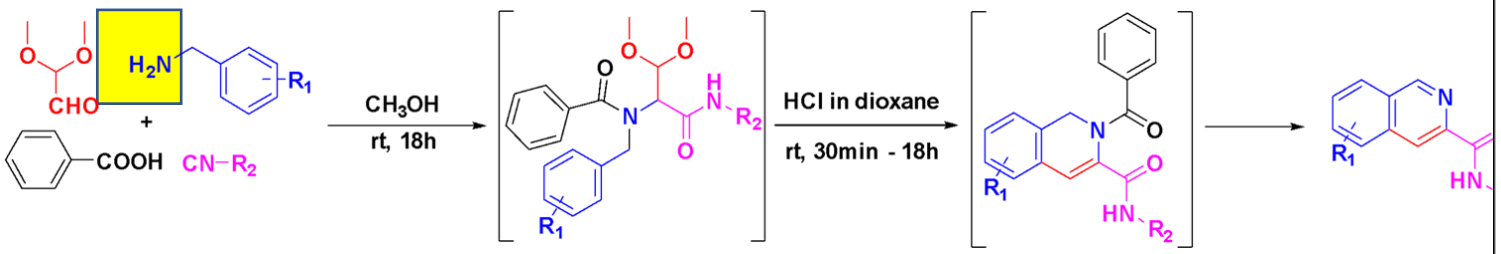
Example of high-throughput innovative chemistry

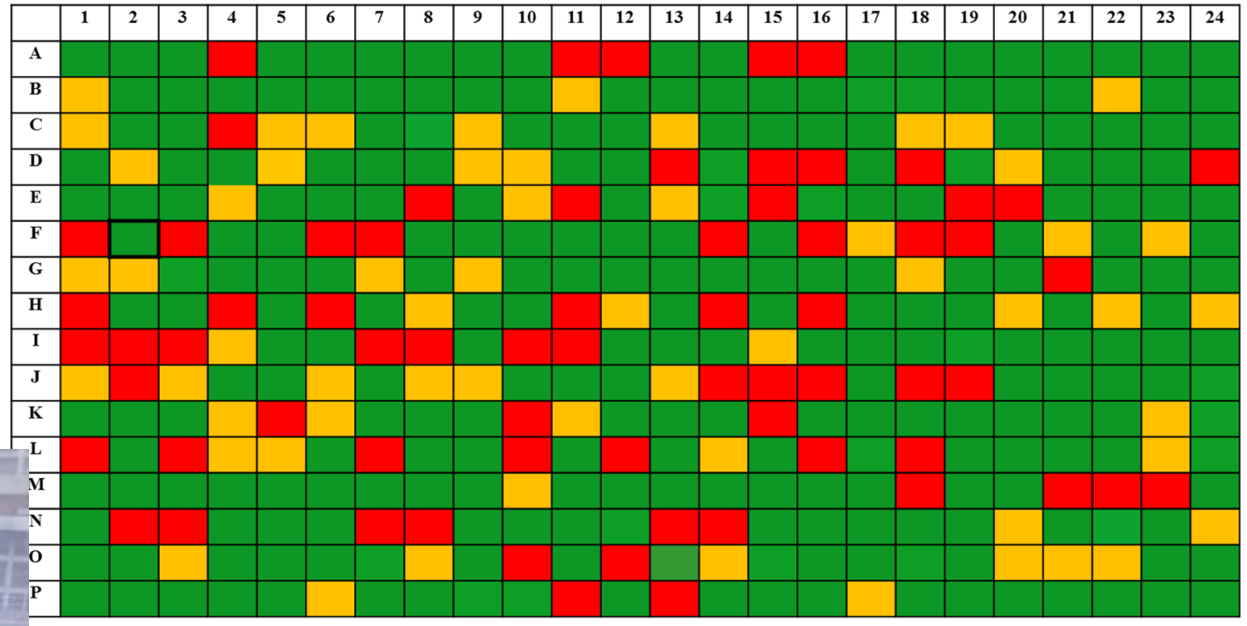


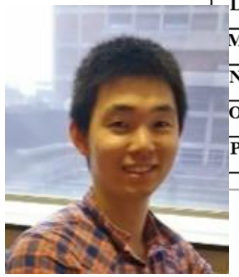
Isoquinoline

Glyoxal-mono acetal

Pomeranz–Fritsch type

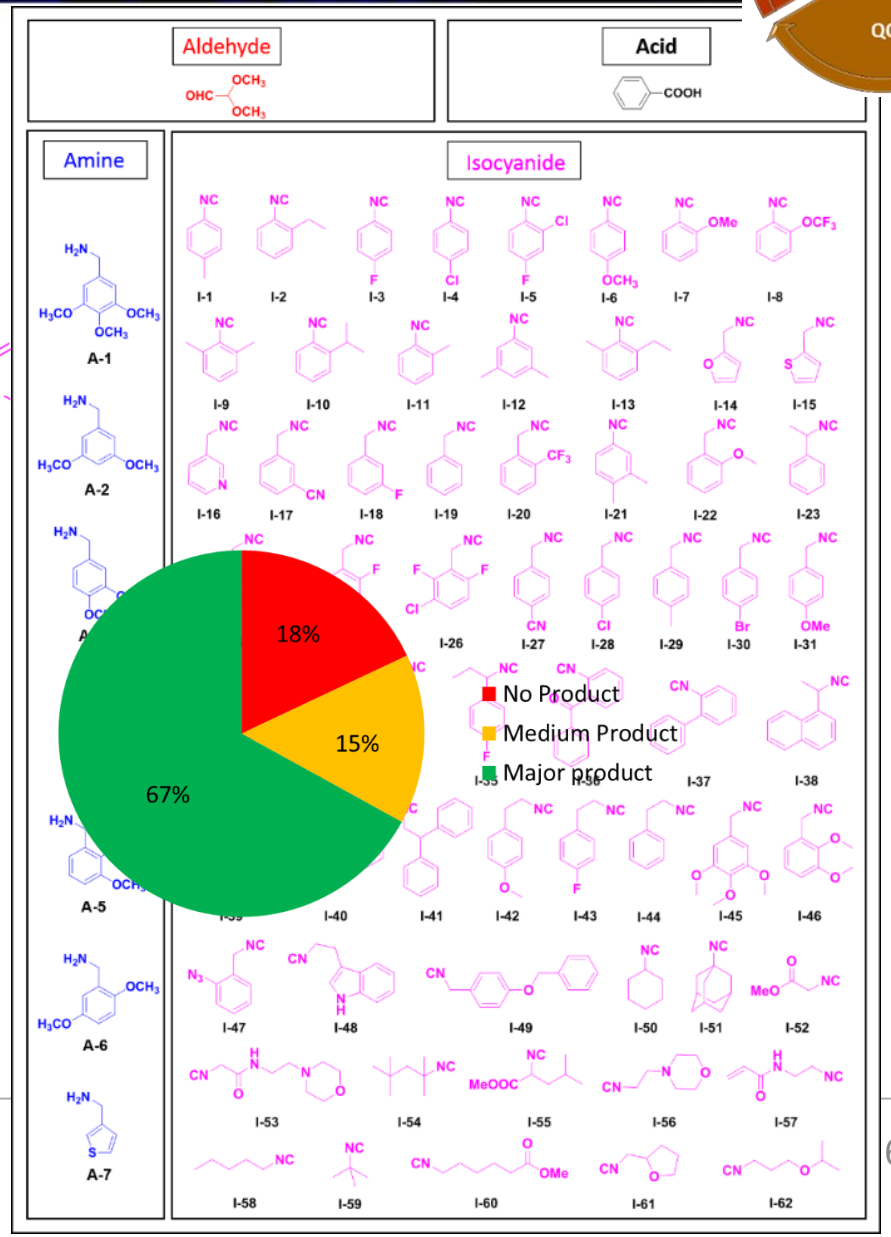




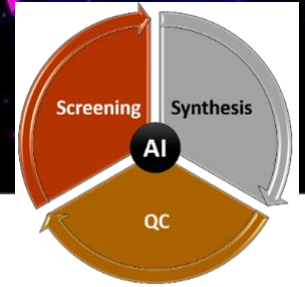


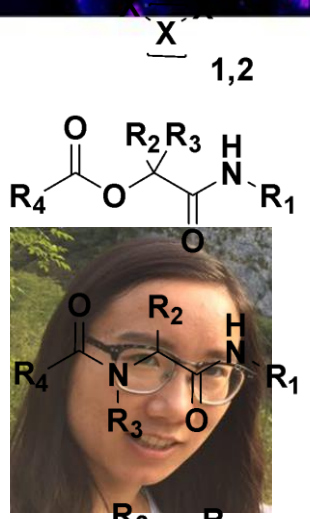
Yanze

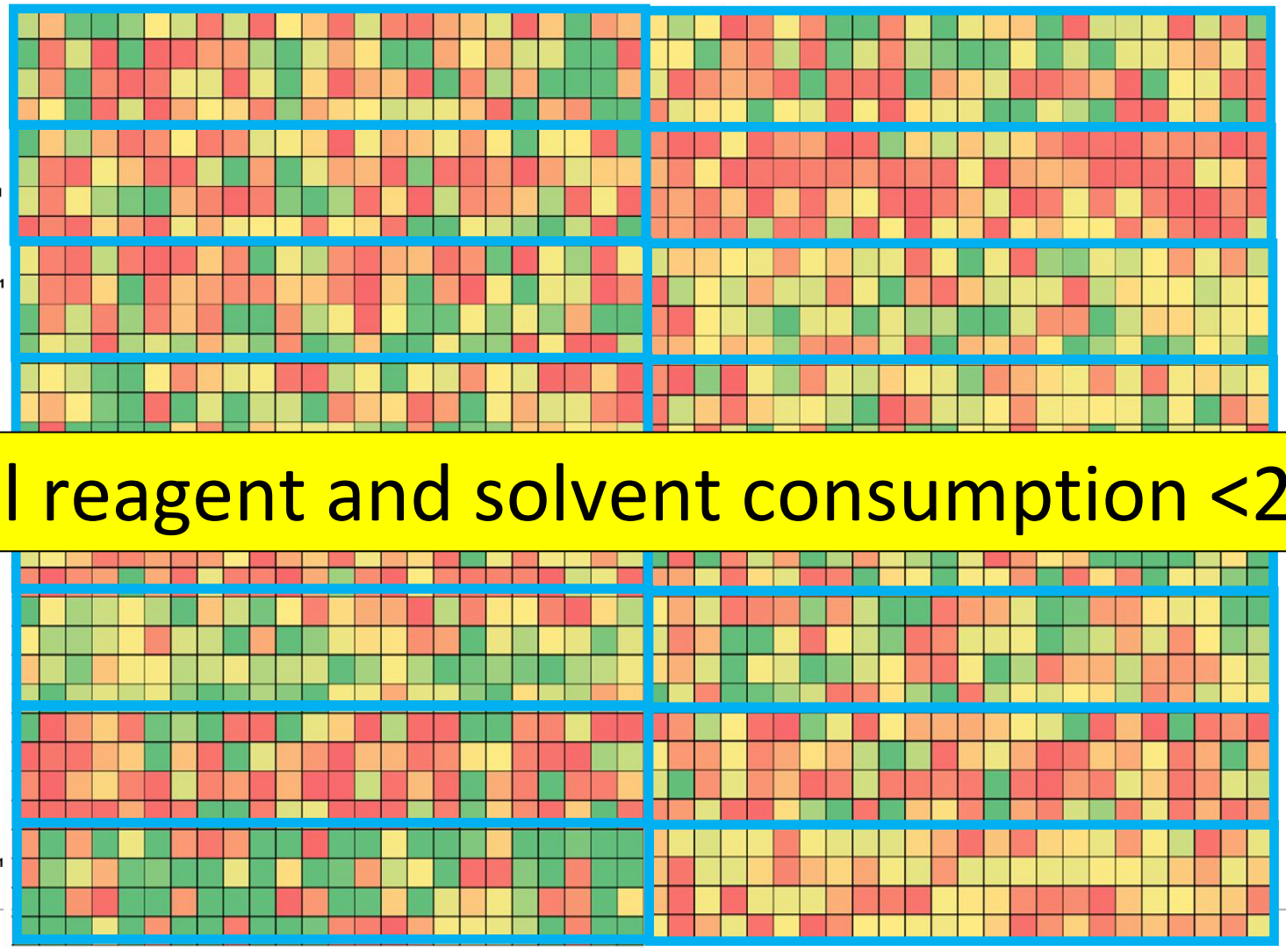
ACS Cent. Sci., 2019, 5 (3), pp 451–457

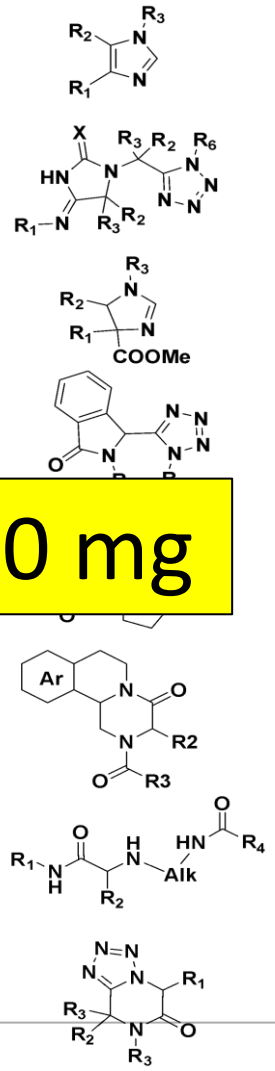


Example of high-throughput innovative chemistry







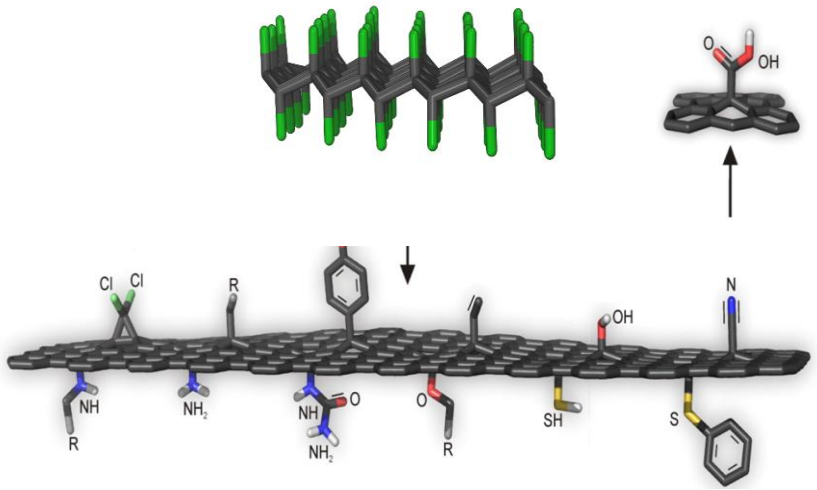


➢ Total reagent and solvent consumption <20 mg

Gao et al. ***Green Chem.***, 2023, Advance Article

Application of innovative chemistry in material research

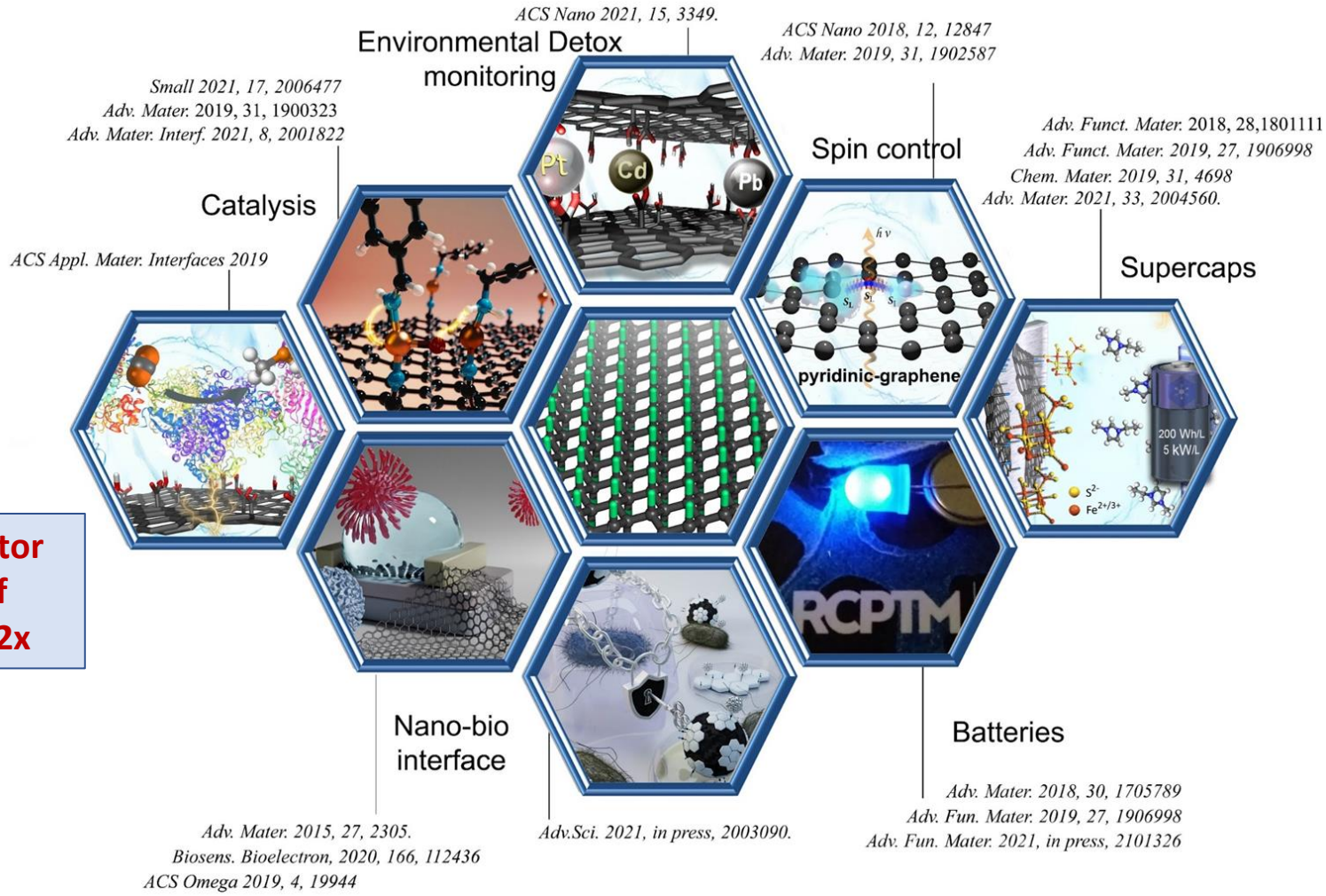
Graphene chemistry



erc
European Research Council
Established by the European Commission

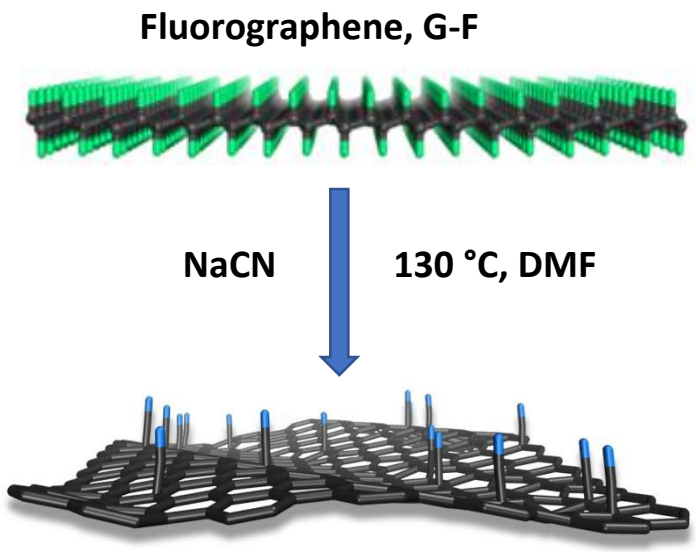
Consolidator Proof of Concept 2x

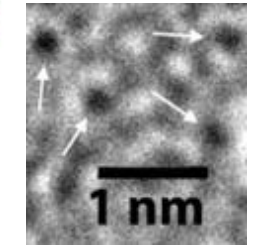
European Innovation Council
European Innovation Council (EIC) established by the European Commission, under the Horizon Europe programme (2021-27)



Application of innovative chemistry in material research

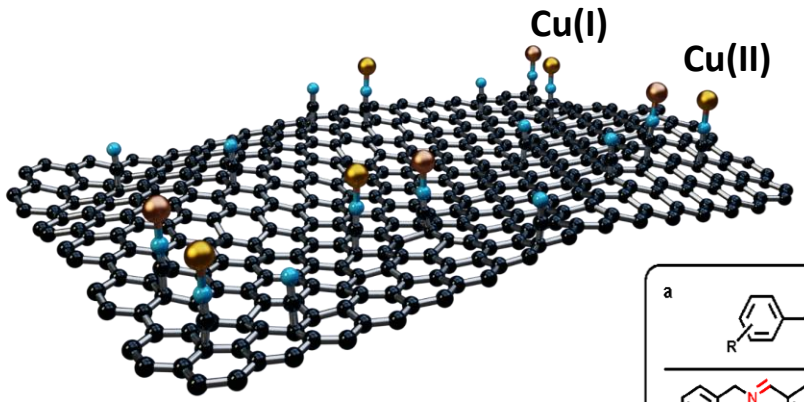
Single Atom Engineering = Beyond Nanotechnologies = Alex Contribution in Organometallic Chemistry onto Surfaces

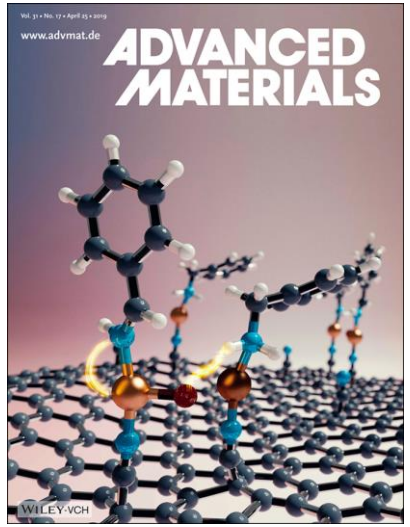




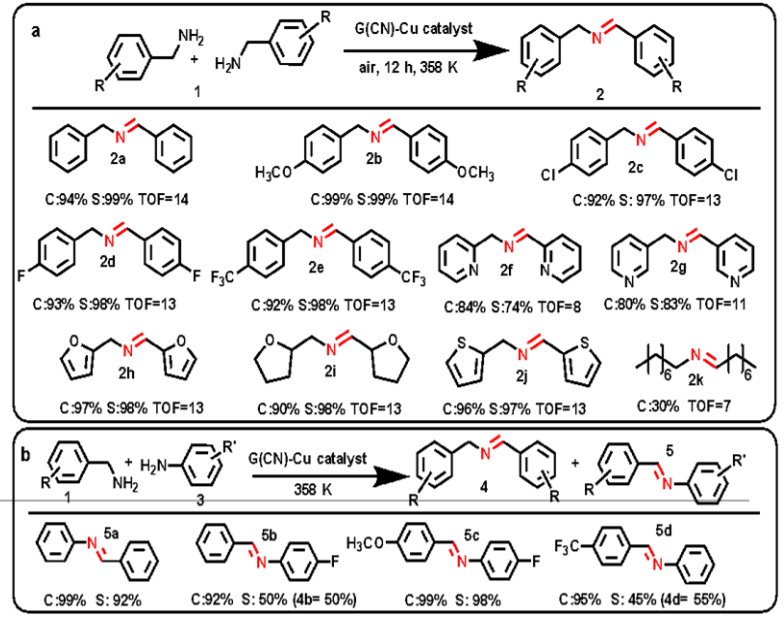
$CuCl_2$

G-CN acts as 2D Trap for RT Single Atoms Dative Bonding





Adv. Mater. 2019, 31, 1900323.

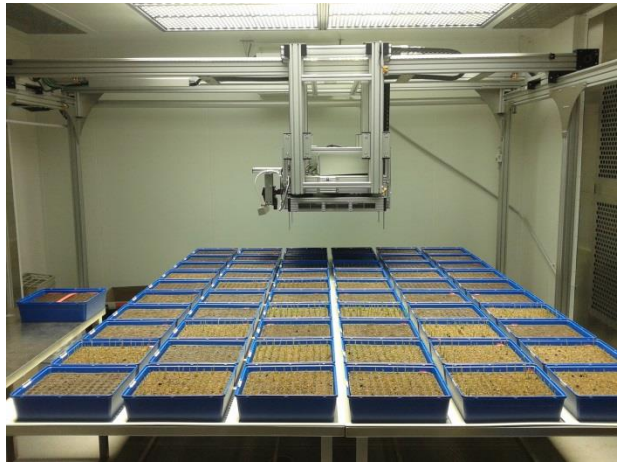


G-CN-CuI/CuII – SAC for Oxidative Coupling of Aromatic Amines

Challenge: Control/Tuning the coordination and electronic properties of SAs = ERA CHAIR

Application of innovative chemistry in plant research

OloPhen - Automated bioassaying and phenotyping pipe-line



Source
- genotypes
- compounds
- extracts
- microbes
- VCs
- collections
- libraries
- batches
- series
- …

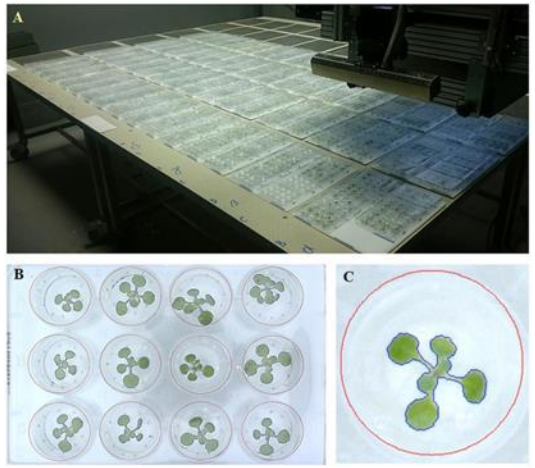
Application
- seed treatment
- foliar
- drenching

Assay
- *in vitro* bioassays
- *in planta* assays
- Hormonal response
- Emergence
- Seed germination
- Early development
- Shoot growth response
- Growth and physiology

Conditions
- normal
- abiotic stress
- biotic stress

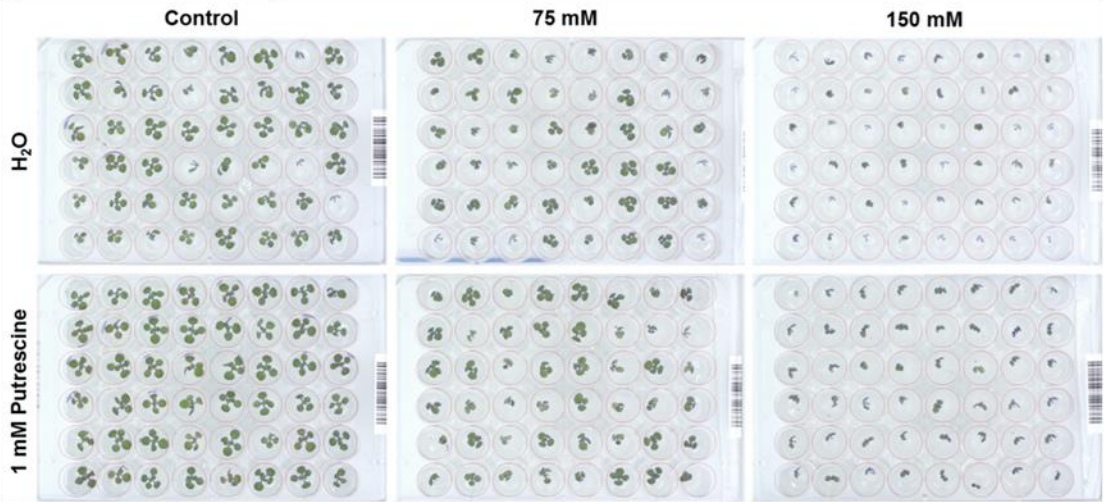
Application of innovative chemistry in plant research

6-, 12-, 24-well plates



De Diego et al., 2017

48-well plates



Ugena et al., 2018

Challenge: High-throughput synthesis of biostimulants library for high-throughput phenotyping

Type of well plate	No. plants	Replicates	Platform capacity	Total plants	No. variants	Assay duration
6-Well Plates	6	3		2880	160	14 days
12-Well Plates	12	2	480 Plates	5760	240	9 days
24-Well plates	24	1		11520	480	9 days
48-well plates				23040 plants		7 days

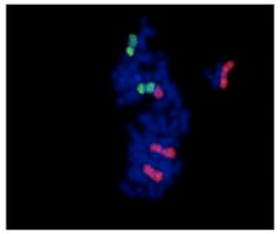
Application of innovative chemistry in biomedicie

IMTM

Major determinants of therapeutic outcome

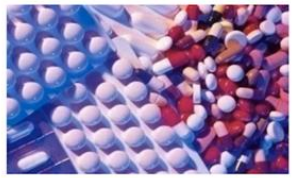
ANATOMIC STAGE OF DISEASE (DIAGNOSTICS - IMAGING)

BIOLOGY (BIOMARKERS & MOLECULAR TARGETS)



THERAPEUTIC OUTCOME
PERSONALIZED MEDICNE

THERAPIES (SMALL MOLECULES, BIOLOGICS, ATMPs)



Challenge: High-throughput chemical synthesis and in-vitro testing of new therapeutics