Partner Search Form
Horizon Europe
Health

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CONTACT

Organisation	EPFL	**Department**	Institute of Chemical Sciences and Engineering
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Organisation type

Research organisation type	☒ Research Organisation ☒ University ☐ Company ☐ Other	**Is your company a Small and Medium Sized Enterprise (SME*)?** **Number of employees:**	☐ YES ☒ NO

Your enterprise is an SME if:
- it is engaged in **economic activity**
- it has **less than 250 employees**
- it has either an **annual turnover not exceeding €50M**, **or an balance sheet total not exceeding €43M**
- it is **autonomous**

For the definition of SMEs, look at: http://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition_en

Short introduction of key areas of institute's research:
EPFL/LCSB develops computational systems biology methods for mechanistic modelling of metabolism in health and biotechnology. Our work combines genome-scale reconstructions, stoichiometric, thermodynamic and kinetic constraints, dynamic ODE models, multi-omics integration, metabolic control analysis, uncertainty quantification, and AI-assisted parameterisation. We apply these methods to cell-level near-genome-scale dynamic models of cancer metabolism and to model-guided design of microbial cell factories for sustainable biomanufacturing.

Former participation in an FP European project?

Project title / Acronym:

Activities performed:

☒ YES ☐ NO

- EU Horizon 2021-2027, grant 101289831: ORIGIN - Optimized Routing and Industrial Generation of Ingredients from Nature (2026-2030)
  - AI-driven retrosynthesis/pathway/enzyme/strain design; predictive kinetic models for microbial hosts; generative-AI/kinetic-modelling workflows; open-source computational tools for biomanufacturing
- EU Horizon 2020 grant 814408: Shikifactory 100 - Modular cell factories for the production of 100 compounds from the shikimate pathway (2019-2023)
  - large-scale kinetic modelling, computational strain design, omics-data integration, model-guided metabolic engineering and experimental design support

Expertise / Commitment offered

Description of your expertise:

EPFL/LCSB offers expertise in constructing, parameterising and validating large-scale dynamic kinetic models for mechanistic, cell-level prediction in health and biotechnology. The same core technology can support two complementary Horizon Europe themes.

For cancer VHTs, we can construct and validate cell-level mechanistic modules of cancer

	metabolism. We have developed near-genome-scale kinetic models of human ovarian cancer metabolism integrating multi-omics and physicochemical constraints, including BRCA1 wild-type and BRCA1-deficient/mutant physiologies. These models reproduce hallmark cancer-metabolic phenotypes, predict metabolic vulnerabilities and drug targets, and simulate dynamic drug-response signatures. In a consortium, we can adapt this framework to FAIR longitudinal patient, cell-line or organoid datasets; generate patient- or cohort-specific model ensembles; and couple the cell-level metabolic twin to tissue, organ or clinical decision-support layers. For biotechnology and biomanufacturing, we contribute mechanistic and AI-enabled workflows for the design, optimisation and validation of microbial cell factories. Our NOMAD framework (NOnlinear dynamic Model-Assisted rational metabolic engineering Design) uses nonlinear kinetic model populations to scout enzyme/gene intervention spaces while preserving physiological constraints such as growth, metabolite levels and dynamic robustness. This supports Design-Build-Test-Learn cycles, metabolic engineering, biofoundry workflows, and prioritisation of strains for sustainable production of bio-based chemicals and materials. Our experience covers model-guided strain design in E. coli and S. cerevisiae, including experimentally implemented designs for aromatic compound production. We also contribute generative-AI pipelines for parameterising large kinetic models. REKINDLE, RENAISSANCE and latent-space exploration methods generate dynamically valid model ensembles, reduce the cost of uncertainty-aware simulations, and enable high-throughput exploration of strain, disease and treatment perturbations. Proposed tasks: FAIR data/model harmonisation; mechanistic model construction; generative-AI parameterisation; uncertainty quantification; perturbation and intervention simulations; biomarker/vulnerability or strain-design prioritisation; nonlinear validation; open-source workflows; and deposition of model/data assets in relevant European platforms. Representative publications: • Toumpe, I.; Masid, M.; Hatzimanikatis, V.; Miskovic, L. Multi-omics-driven kinetic modeling reveals metabolic vulnerabilities and differential drug-response dynamics in ovarian cancer. bioRxiv (2025). doi: 10.1101/2025.10.22.682756. • Choudhury, S. et al. Reconstructing Kinetic Models for Dynamical Studies of Metabolism using Generative Adversarial Networks. Nat. Mach. Intell. 4, 710-719 (2022). doi: 10.1038/s42256-022-00519-y. • Choudhury, S.; Narayanan, B.; Moret, M. et al. Generative machine learning produces kinetic models that accurately characterize intracellular metabolic states. Nat. Catal. 7, 1086-1098 (2024). doi: 10.1038/s41929-024-01220-6. • Choudhury, S.; Toumpe, I.; Gabouj, O. et al. Generative approaches to kinetic parameter inference in metabolic networks via latent-space exploration. Nat. Commun. (2026). doi: 10.1038/s41467-026-72184-3. • Narayanan, B. et al. Rational strain design with minimal phenotype perturbation. Nat. Commun. 15, 723 (2024). doi: 10.1038/s41467-024-44831-0. • Narayanan, B.; Jiang, W.; Wang, S. et al. Kinetic-model-guided engineering of multiple S. cerevisiae strains improves p-coumaric acid production. Metab. Eng. 91, 430-441 (2025). doi: 10.1016/j.ymben.2025.06.008.
Keywords specifying your expertise:	Virtual Human Twin; mechanistic modelling; dynamic kinetic models; cell-level VHT; cancer metabolism; ovarian cancer; BRCA1; multi-omics integration; thermodynamic constraints; ODE models; metabolic control analysis; drug-response simulation; metabolic vulnerabilities; generative AI; REKINDLE; RENAISSANCE; latent-space exploration; NOMAD; nonlinear dynamic model-assisted design; metabolic engineering; strain design; synthetic biology; biomanufacturing; bio-based chemicals and materials; microbial cell factories; E. coli; S. cerevisiae; Pseudomonas putida; biofoundry workflows; Design-Build-Test-Learn; FAIR/open-source model assets.
Commitment offered:	☒ Research ☒ Demonstration ☒ Training ☒ Technology ☒ Dissemination ☐ Other:

Interested in participation in project types:			
	☒ Research & Innovation Action	☐ Innovation Action	☐ EIC Pathfinder

Work Programme research areas: indicate your interest

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1) EU Mission on Cancer / Horizon Europe Mission Work Programme 2026: dynamic and multiscale Virtual Human Twins for cancer research; mechanistic cell-level VHTs; cancer onset/progression and personalised treatment modelling; AI-enabled analysis of FAIR multimodal data; validation with longitudinal patient/cell-line/organoid data; open-science model/data assets for UNCAN.eu and the Advanced VHT Platform.

2) Horizon Europe Cluster 6 - Circular economy and bioeconomy sectors: innovating for sustainable bio-based systems, biotechnology and the bioeconomy; AI-enabled metabolic engineering, biofoundry-compatible modelling, strain-design workflows and mechanistic biomanufacturing concepts for sustainable bio-based chemicals/materials. EPFL/LCSB can contribute the computational layer, preferably together with experimental, industrial, pilot-scale, sustainability and SSH partners.

Call topic(s):
• HORIZON-MISS-2026-02-CANCER-01: Virtual Human Twin (VHT) Models for Cancer Research.
• HORIZON-CL6-2026-01-CIRCBIO-07: Advancing the European bio-based innovation enabled by biotechnology and biomanufacturing concepts.

Do you have other partners for this topic (which partners/country)?

No confirmed consortium partners for these topics yet. EPFL/LCSB is seeking to join or help shape consortia.

Profile of partner sought

Role

☒ technology development	☒ research	☒ training
☒ dissemination	☒ demonstration	☒ other clinical/end-user validation; FAIR data/platform integration; pilot-scale and sustainability assessment

Country /region

☐ EU Member States and Horizon Europe Associated Countries. Priority: partners with complementary clinical, experimental, industrial biotechnology, data-platform, pilot-scale, sustainability and stakeholder-engagement capabilities.

Expertise required

For HORIZON-MISS-2026-02-CANCER-01: clinical or translational cancer teams with longitudinal patient, cell-line or organoid datasets, ideally including multi-omics, treatment perturbations and outcomes; ovarian/gynecological cancer expertise is particularly relevant but not mandatory. Tissue-, tumour-microenvironment-, organ- or organism-level VHT modellers to couple with the EPFL cell-level metabolic module. Data engineering and platform partners for EHDS-compatible metadata, FAIRification, UNCAN.eu and Advanced VHT Platform deposition. Healthcare professionals and patient/caregiver organisations for clinical relevance, usability, validation and participatory development. Optional: AR/VR or visualisation partners for model exploration.

For HORIZON-CL6-2026-01-CIRCBIO-07: partners developing synthetic/molecular biology, gene-editing, metabolic-engineering, microbiome or biofoundry approaches for non-health, non-biofuel bio-based applications. Experimental strain-engineering and fermentation partners are sought to validate model-predicted designs, preferably with use cases in sustainable bio-based chemicals, materials or natural products. SMEs/industrial biotechnology partners, pilot-scale facilities, IBISBA/ELIXIR-linked infrastructure partners, LCA/TEA and environmental-sustainability experts, policy/standardisation actors and SSH/civil-society partners would strengthen scale-up, FAIR data, DNSH compliance and societal acceptance.

I agree with the publication of my contact data: ☒ YES ☐ NO