BIDT 2027 "Building the Inflammation Digital Twin"

24 mai 2027 à 4 juin 2027

Institut Pascal

Programme Scientifique

WORKSHOP PROGRAMME

OVERALL APPROACH

The work is built in two layers:
1. Base layer: a generalisable module of innate immunity and inflammation.
2. Second layer: pathology-specific adaptations of that module.

The groups will model inflammation in different pathological settings, such as sepsis, autoimmunity, cancer and vaccine responses, guided by experts in each field.

TYPICAL DAY (from Week 1 Tuesday)

09:00 Coffee and croissants
09:30 Quick briefing on the previous day's activities and today's agenda
10:00 Keynote or talk
11:00 Break
11:15 Discussion with the speaker and participants
12:15 Lunch break
Afternoon: working groups, presentations or talks (see each day)

WEEK 1 – PATHOLOGIES AND INFLAMMATION

MONDAY – Introduction
09:00 Coffee
09:30 Introduction to the workshop by the organisers – Anna Niarakis, Philippe Moingeon, Gary An
10:00 Overview of the previous edition: achievements and new perspectives – Anna Niarakis
11:00 Presentation of the Institut Pascal
Coffee break
11:30 How the workshop works: breakout sessions, working groups and shared resources (Git repository, Zenodo, Figshare)
12:15 Buffet lunch
14:00 Task pitches: each task manager presents their task (5 × 10 minutes, plus questions)
15:00 Flash talks: participants introduce themselves, their expertise and what they can bring to the tasks; poster presenters can advertise their poster (2 minutes each)
16:40 Poster session 1 with coffee
17:30 Team sign-up: arranging the working groups
18:00 End

TUESDAY – Sepsis and Inflammation
09:00 Coffee and croissants
09:30 Briefing and agenda
10:00 Opening keynote: Modelling sepsis – [Keynote Speaker 1], [Affiliation]
11:00 Discussion: advances and challenges in building predictive models for sepsis
12:15 Lunch break
14:00 Planning the working groups: a senior scientist is assigned to each group to provide guidance or give a focused 30-minute talk
15:30 Working groups – Tasks 1 and 2 (2 subgroups)
18:00 End
18:00 Happy hour: cheese, fruit, wine and beer (until 20:00)

WEDNESDAY – Cancer and Inflammation
09:00 Coffee and croissants
09:30 Briefing and agenda
10:00 Keynote: Implementing digital twins in oncology – [Keynote Speaker 2], [Affiliation]
11:00 Break
11:15 Discussion: inflammation-mediated cancer mechanisms

12:15 Lunch break – group photo
13:30 Introduction to Tasks 3 and 4
Working groups – Tasks 1–4 (4 subgroups)
18:00 End

THURSDAY – Autoimmunity and Inflammation
09:00 Coffee and croissants
09:30 Briefing and agenda
10:00 Opening keynote – [Keynote Speaker 3], [Affiliation]
11:00 Break
11:15 Discussion: inflammation timescales in acute and chronic illness
12:15 Lunch break
13:30 Working groups – Tasks 1–4 (4 subgroups)
18:00 End
19:00 Social event: dinner at a restaurant (until 23:00)

FRIDAY – Vaccines
09:00 Coffee and croissants
09:30 Briefing and agenda
10:00 Opening keynote: Vaccines – [Keynote Speaker 4], [Affiliation]
11:00 Break
11:15 Discussion with the keynote speaker and participants
12:15 Lunch break
14:00 Mid-workshop presentations from the four subgroups, with open discussion and contributions from all participants
Introduction to Task 5
18:00 End

WEEK 2 – FROM MODELS TO APPLICATIONS

MONDAY – Scaling
09:00 Coffee and croissants
09:30 Briefing and agenda
10:00 Keynote: Scaling – [Keynote Speaker 5]
11:00 Break
11:15 Round-table discussion with the keynote speaker and participants
12:15 Buffet lunch
14:00 Poster session 2 with coffee
15:30 Working groups – Tasks 1–5 (5 subgroups)
18:00 End

TUESDAY – Digital Twins and AI in Clinics and Drug Design
09:00 Coffee and croissants
09:30 Briefing and agenda
10:00 Keynote: Regulatory aspects – [Keynote Speaker 6]
11:00 Break
11:15 Discussion: access to real-world data
12:15 Lunch break
14:00 Talk of special interest: AI in health and drug design – Philippe Moingeon, University of Paris-Saclay
15:00 Coffee break
15:30 Working groups – Tasks 1–5 (5 subgroups)
18:00 End
18:00 Happy hour: cheese, fruit, wine and beer (until 20:00)

WEDNESDAY – Hackathon and Presentations
09:00 Coffee and croissants
09:30 Briefing and agenda
10:00 Hackathon-style hands-on session: stitching the pieces together, adaptation and testing – all groups
11:00 Break
11:15 Hackathon-style hands-on session (continued) – all groups
12:15 Lunch break

14:00 Presentations from the five subgroups
18:00 End

THURSDAY – Industry and Integration
09:00 Coffee and croissants
09:30 Briefing and agenda
10:00 Industry talk – [Industry Speaker]
11:00 Break
11:15 Discussion: national and international opportunities for collaboration
12:15 Lunch break
14:00 Assembling the IDT – all groups: collective review and feedback
15:00 Coffee break
15:15 Assembling the IDT (continued) – all groups: collective review, feedback and draft writing
18:00 End
19:00 Social event: dinner at a restaurant (until 23:00)

FRIDAY – Summary and Report
09:30 Coffee
10:00 Organising notes and produced material; assembling the draft report
10:45 Coffee break
11:00 Organising notes and produced material; assembling the draft report (continued)
12:00 Lunch break
13:00 Collective review and feedback
14:45 Coffee break
15:15 Collective review and feedback (continued)
16:00 End

Working-Group Taks

WORKING-GROUP TASKS

Task 1: Aggregating existing knowledge to create a general knowledge map of inflammation
We will use both established and original data sources, knowledge-extraction and integration tools, and AI large language models (LLMs) to bring together existing information on the genes, pathways, cells, tissues and organs needed to describe the full range of inflammatory mechanisms. The result will be a collection of diagrams built with appropriate ontologies and annotations.

Task 2: Building and implementing executable inflammation models of different granularity
We will identify tools, libraries and pipelines for building executable versions of the different inflammation processes, and existing inflammation models that can be generalised and adapted to different scales. We will search public repositories for inflammation models at the pathway, cell and tissue levels and create complementary modules of inflammatory mechanisms. The models will be annotated and validated against published inflammation data, to ensure they reproduce fundamental input/output behaviours and complex in vitro experimental outcomes.

Task 3: Leveraging interpretable deep learning and hybrid models to enhance model robustness and generalisability
We will develop interpretable IDT models that reveal how they reach their decisions, so that users can understand the rationale behind prognostic predictions. We will develop hybrid models that combine data-driven and mechanistic approaches to model multi-scale processes more effectively. Alternatively, we will enhance deep-learning models with mechanistic knowledge of intracellular molecular wiring to improve their predictive accuracy and reliability.

Task 4: Evaluating disease-related responses
It may not be possible to link inflammation models at every scale to the full-body human virtual simulator. We will start by connecting the scales with the smallest biological gap between them, recognising that this may require abstractions at different scales.

Task 5 (perspective): Generating virtual patient cohorts
To develop a methodology for representing disease pathophysiology across patient heterogeneity, we will sample clinically valid parameter spaces to generate virtual patients for selected immune disorders, correcting for population and gender imbalances. We will also adapt

data-augmentation techniques and generative models for use with clinical data, and assess the robustness and generalisability of the resulting virtual patient cohorts.

Poster sessions

POSTER SESSIONS

Poster session 1: Week 1 Monday, 16:40–17:30, with coffee
Poster session 2: Week 2 Monday, 14:00–15:30, with coffee
Posters from each session stay up for the whole week so participants can keep discussing them during breaks.

SOCIAL PROGRAMME

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Every Monday Buffet lunch (12:15)
Every Tuesday Happy hour with cheese, fruit, wine and beer (18:00–20:00)
Every Thursday Social dinner at a restaurant (19:00–23:00)

SHARING MATERIAL

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Materials, drafts, reports and models produced during the workshop will be shared through a Git repository, Zenodo and Figshare.