

Tumor-LN-oC

Tumor and Lymph Node on Chip for
cancer studies



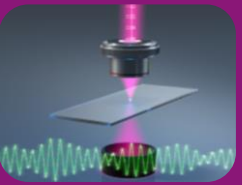
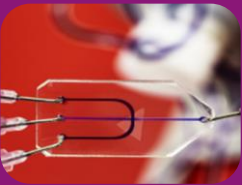
This project has received funding from the European Union's Horizon 2020
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The Project

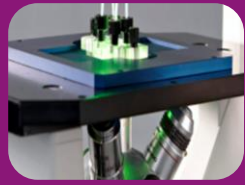


Tumor and Lymph Node on Chip for cancer studies

Individual platforms



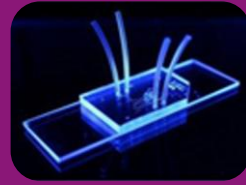
System integration



Preclinical validation



Exploitation



Project's Goal:

Tumor-LN-oC proposes the development and validation of **tumor-lymph node-on-chip platform** that will connect primary surgically removed human tumors and lymph node tissue from the same cancer patient.

Technologies involved:

- 🌀 Cancer biology
- 🌀 Molecular analysis
- 🌀 Microfluidics
- 🌀 Mid-IR photothermal spectroscopic sensors
- 🌀 Realtime imaging sensors
- 🌀 ML deep learning algorithms
- 🌀 Laser bioprinting



Funded by the Horizon 2020 Framework Programme of the EU
H2020-NMBP-TR-IND-2018-20
Lump Sum, GA no: 953234
Starting date: 01.05.2021 (48M)
Budget: 5,7 M€

The consortium

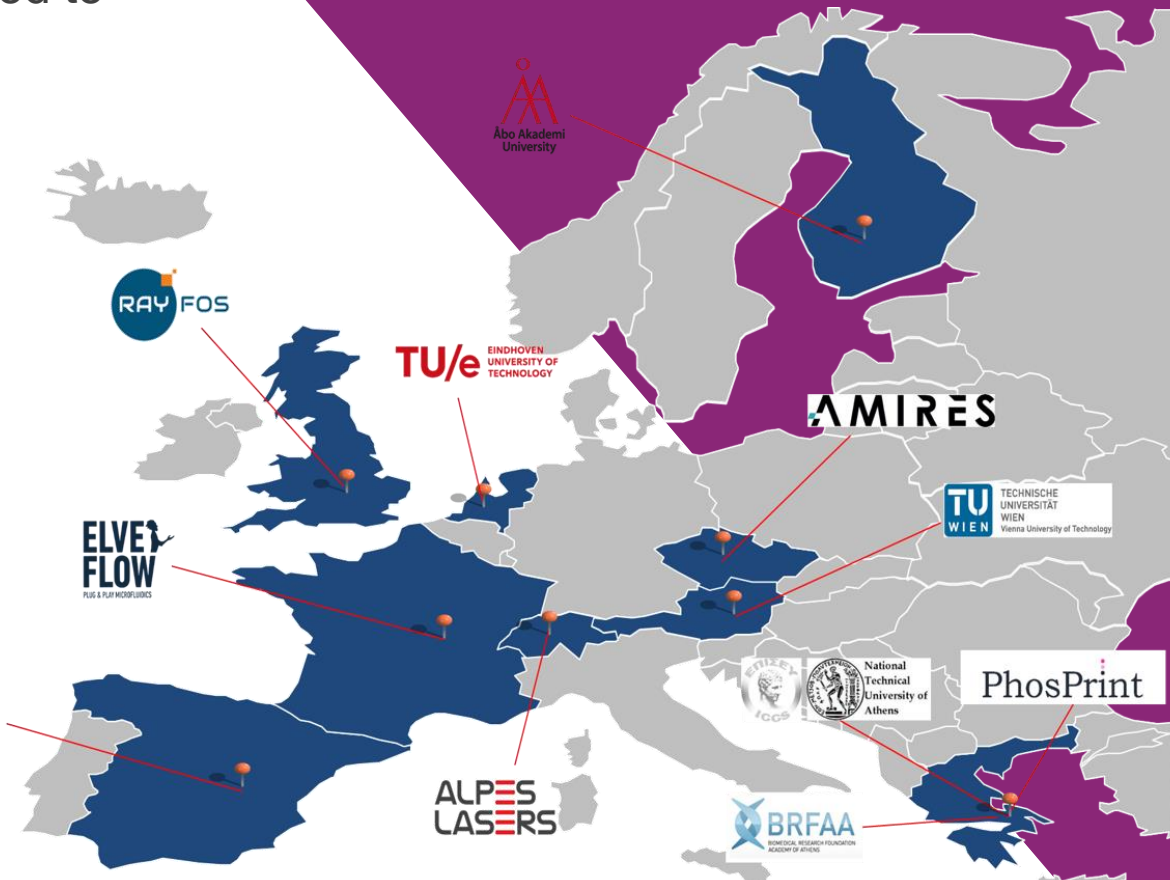
The consortium encompasses key – industrial partners and experts in the relevant interdisciplinary fields and is expected to have substantial impact in EU's economy and healthcare.

11 partners

9 countries

5 academic and research partners

6 industrial partners / SMEs



Project summary

- Tumor-LN-oC is developing a **TRL 5 tumor-lymph node on-chip platform** which will mimic the tumor microenvironment and its connection to the lymphatic system.
- Using surgically removed human primary tumors and LN tissue from the same lung cancer patient, the multidisciplinary microfluidic platform will serve as a “**biological twin**” of the patient.
- This makes Tumor-LN-oC a **breakthrough innovation in metastasis diagnosis and drug testing**, potentially offering personalized treatment relying on molecular characterization of lymph node metastasizing cells.
- The platform will make it possible to:



study the interaction of primary tumors with LNs



monitor the lymph node metastasis process in real time



characterise signalling cues facilitating such metastasis,



identify spectral + molecular signatures in metastasizing cells

Project objectives

The project will significantly advance the fields of **microfluidics, cell biology, cancer biology, physics, and computer programming and software development**, by pursuing the following objectives:

To develop **robust, automated microfluidic chips** optimized for tumor cell and LN culture enabling the study of their crosstalk,



To integrate **Quantum Cascade Laser based mid- IR spectroscopy** for specific chemical signatures,



To **molecularly characterize** both migrating tumor-derived cells attracted to the LN and the soluble signals driving migration,



To demonstrate an **advanced image analysis and signal processing platform** using a micro-optics module and deep learning algorithms to monitor cells,



To **integrate all Tumor-LN-oC technologies in an automated platform** prototype compatible with existing laboratory equipment,



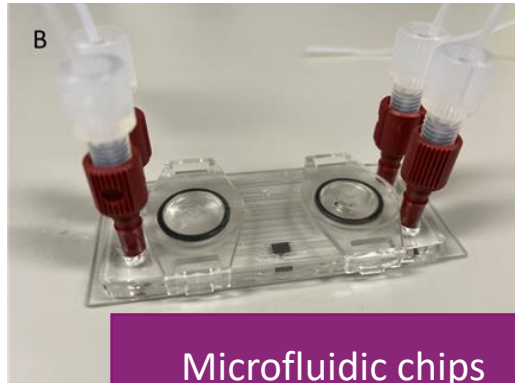
To demonstrate the **Tumor-LN-oC TRL5 platform** and validate it with real patient samples,



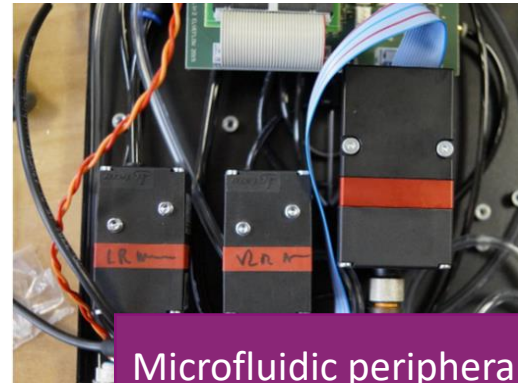
To establish regulatory pathways and assure **regulatory compliance** to facilitate exploitation and early market entry.



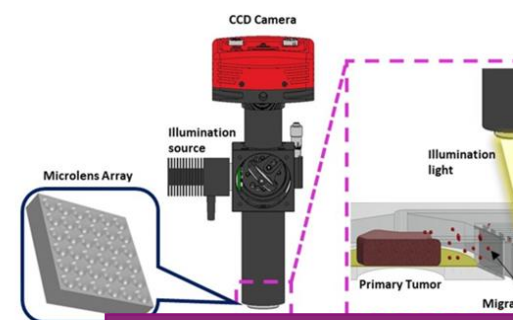
6 technological modules



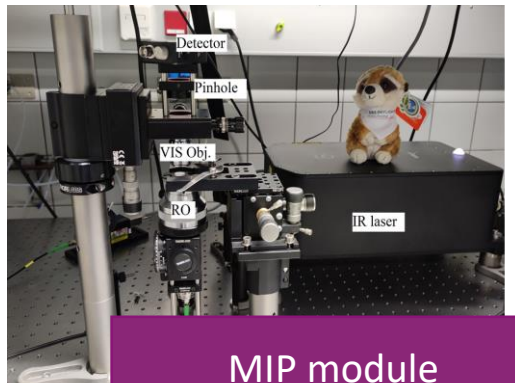
Microfluidic chips



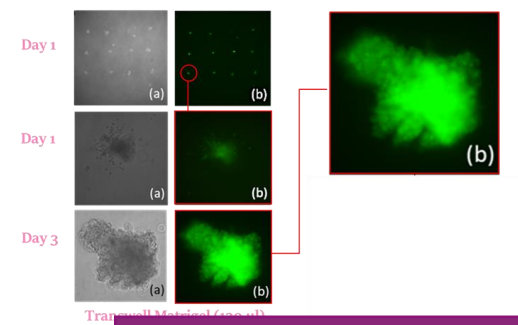
Microfluidic peripherals



Micro-optics module



MIP module



Laser bioprinting

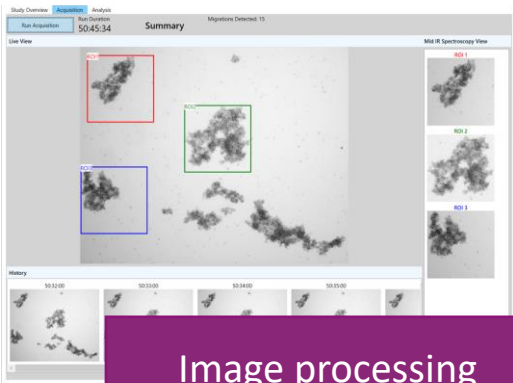
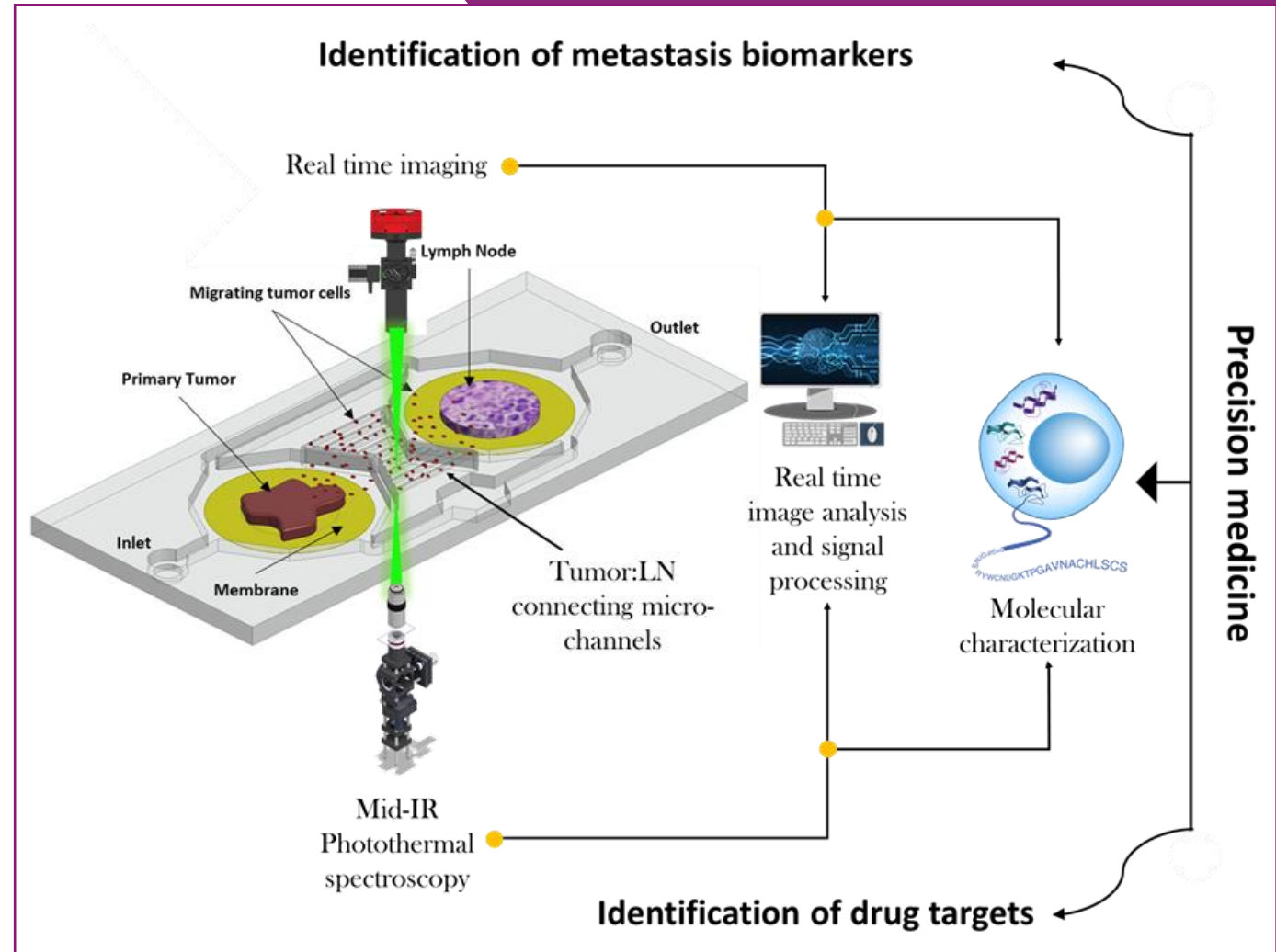


Image processing

Project Concept

- The **microfluidic chip** has 2 separate chambers for Tumor and LN tissue, connected via microfluidic channels which will facilitate cell migration
- **Microfluidic peripherals** provide the flow mimicking the tumor microenvironment and lymphatic system
- Advanced **laser bioprinting** technology allows precise placement of tumor cells and organoids in the chip
- The **micro-optics module** makes it possible to visually monitor migrating cells in the channel in real time
- **Mid-IR Photothermal spectroscopy** facilitates molecular characterisation of migrating cells
- **Automatic image analysis and signal processing** aid in the interpretation of results



Project impact

- The identification of novel biomarkers characterizing metastatic can be exploited therapeutically and enable the use of existing drugs, or the development of new ones that could inhibit tumor growth and dissemination
- The spectral “fingerprint” of migrating/metastasizing cells can be used for diagnostic purposes in tumor and lymph node biopsies
- The platform will serve as a preclinical setting for parallel testing of drugs for individual cancer lung cancer patients.
- The proposed technologies will provide added value to the EU cancer diagnostics and pharmaceutical industries
- The project will lower the barriers associated with the application of OoC technology in disease diagnosis and therapy.



The Tumor-LN-oC platform will enable the **development of novel metastasis-related diagnostics tools and novel therapies** in a more **targeted and personalized manner**.

Expected results

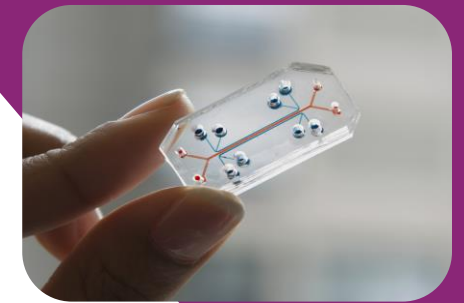
Development of novel diagnostic tools and therapeutic approaches

Added value to the EU cancer diagnostics and pharmaceutical industries



Lower barriers associated with the application of OoC technology in disease diagnosis and therapy

Verifiable progress in the application of Organ-on-Chip technologies for in-vitro research



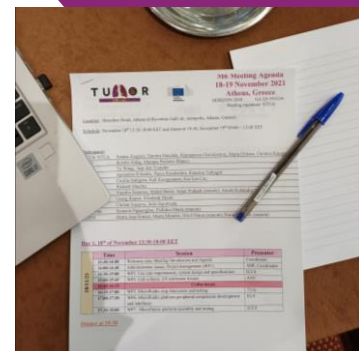
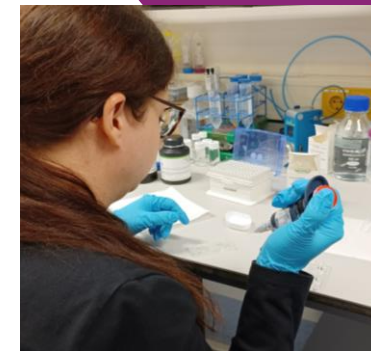
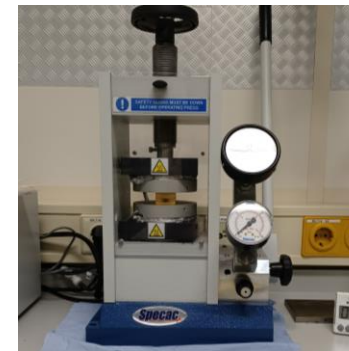
Reduction of the need for animal and clinical testing

Increased awareness and knowledge about medical regulatory policies and requirements, especially by academics and SMEs



Project progress

- Specifications of the Tumor-LN-oC platform completed
- First iteration of the microfluidic chips fabricated
- Tests of microfluidic chip ongoing (co-culturing in static and flow conditions), continuous improvements
- Prototype for low-leak pressure controller developed
- Mechanical design of MIR laser source completed
- Initial setup of micro optics module completed
- Image analysis and signal processing platform established
- Machine learning algorithms
- Experimental Setup of MIR spectroscopy ongoing
- Successful bioprinting process on various membranes
- Regulatory roadmap finalised
- Dissemination strategy and initial commercialisation plan prepared, implementation ongoing



Get in touch!



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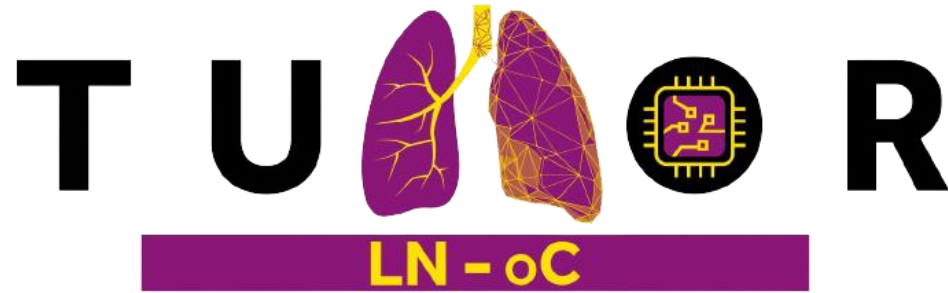


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Visit us at <https://tumor-ln-oc.eu/>

The screenshot shows the homepage of the Tumor-LN-OC website. At the top, there is a navigation bar with the logo 'TUMOR LN-OC' and links for 'ABOUT TUMOR-LN-OC', 'PROJECT TEAM', 'NEWS & EVENTS', 'DISSEMINATION MATERIALS', and 'CONTACTS'. Below the navigation bar, a main heading states: 'Tumor-LN-OC proposes the development and validation of tumor-lymph node-on-chip platform that will connect primary surgically removed human tumors and lymph node tissue from the same cancer patient'. A 'READ MORE' button is located below this text. The central part of the page features a grid of four columns, each representing a project phase: 'Individual platforms', 'System Integration', 'Preclinical Validation', and 'Exploitation'. Each column contains three small images illustrating the work. Below the grid, there are two sections: 'OVERVIEW' and 'OBJECTIVES'. The 'OVERVIEW' section describes the development and validation of a TRL 5 tumor-lymph node-on-chip platform. The 'OBJECTIVES' section outlines the general objective of generating a Tumor-LN-OC platform for monitoring LN metastasis. Both sections have 'READ MORE' buttons at the bottom.



Thank you!

Any questions?

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