



INSTITUT UNIVERSITAIRE
DU CANCER DE TOULOUSE
Oncopole

**ACTIVITY
REPORT**
2021

**COLLECTIVE
EXPERTISE
TO FIGHT
CANCER**





CONTENTS

- 06 EDITORIAL AND KEY FIGURES
- 10 HIGHLIGHTS OF 2021

COMBINED STRENGTHS FOR INNOVATION

- 16 EXPERTISE IN EARLY CLINICAL RESEARCH
- 18 MULTIPLE MYELOMA
- 20 ACUTE MYELOID LEUKEMIA
- 22 BREAST CANCER
- 24 RADIOTHERAPY
- 25 ONCO-DERMATOLOGY
- 26 PANCREATIC CANCER
- 27 ACUTE LYMPHOBLASTIC LEUKEMIA

TARGETED ACTIONS FOR CARE

- 30 STILL MOBILIZED, STILL INNOVATIVE
- 32 SPORT & CANCER
- 33 PERSONALIZED CARE PATHWAYS
- 34 PREVENTING RECURRENCE
- 35 HANDICAP & CANCER

TOGETHER TO FIGHT CANCER

- 38 GENEROSITY & CHARITY
- 40 TEACHING AND TRAINING
- 41 PARTNERSHIPS & FUNDING
- 42 DISTINCTIONS

A UNIQUE SITE

- 46 THE IUCT-ONCOPOLE
- 48 THE TOULOUSE CANCER RESEARCH CENTER
- 50 CUTTING-EDGE TECHNOLOGIES
- 52 AT THE HEART OF THE "SANTÉ DU FUTUR" CAMPUS
- 53 COMPLEMENTARY ON-SITE EXPERTISE

EDITORIAL

“The Oncopole”, as patients and the general public know it, brings together on a single site more than 2,000 professionals committed to the fight against Cancer, divided between the Toulouse-Oncopole University Cancer Institute (IUCT-Oncopole) and the Toulouse Cancer Research Center (CRCT).

The Institut Claudius Regaud (Comprehensive Cancer Center) and several oncology services of the Toulouse University Hospital join forces, sharing their expertise and excellence in missions of care, research, and teaching.

The strength of this model — a pioneer in France— is based on this mutualization of competences by care and research teams, continuously collaborating in patients’ interests to offer a full range of state-of-the-art care.

Most of the fundamental and translational research teams benefit from dual leadership —both medical and scientific expertise—, a driving force of innovation in the care-research continuum.

Since its opening in 2014, original research projects have been rewarded and published in prestigious scientific journals, patient care has been revolutionized to face the challenges of cancerology,

and recent discoveries have opened up new therapeutic perspectives to prevent and cure cancers in an ever more personalized manner. The year 2021 has highlighted several of these achievements that we are pleased to share with you in this activity report.

Pr Jean-Pierre Delord
General Manager of the Institut Claudius Regaud and Administrator of GCS IUCT-Oncopole

Jean-François Lefebvre
General Manager of the Toulouse University Hospital and President of the General Assembly of the GCS IUCT-Oncopole

Pr Gilles Favre
Director of the CRCT

Impact & achievements

Key Figures 2021

6



Research

MONTHS MAXIMUM

for a discovery by the CRCT to be translated into a clinical trial at the IUCT-Oncopole

691

PUBLICATIONS

53

PUBLICATIONS

with an impact factor > 20

+15% compared to 2020
+76% in 4 years



18

RESEARCH TEAMS

113

**ENGINEERS, TECHNICIANS,
AND ADMINISTRATIVE PERSONNEL**

4

RESEARCH THEMES

- Oncogenic pathways of cancer: from modeling to targeted therapy
- RNA and cancer
- Tumor microenvironment and metabolism
- Onco-immunology

164

RESEARCHERS

9

**TECHNICAL RESEARCH
platforms**



Clinical trials

X2

CLINICAL TRIALS

In 8 years, the number of clinical trials has doubled at the IUCT-Oncopole

336

CLINICAL TRIALS

opened for inclusions in 2021

50%

EARLY PHASE TRIALS

1,744

NEW PATIENTS

included in 2021
(+8% compared with 2020)

INCLUSIONS

39%

**SPONSORED
BY THE IUCT-ONCOPOLE**

37%

**SPONSORED
BY ACADEMIA**

24%

**SPONSORED
BY INDUSTRY**



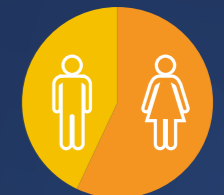
2,052 on-site staff



Cancer care activities

58,442
RADIOTHERAPY SESSIONS

120,250
CHEMOTHERAPY SOLUTIONS PREPARED



43% men
57% women

3,359
patients treated
WITH ORAL THERAPIES

199
TRANSPLANTS
of which **115** autologous transplants
and **84** allogenic transplants

26
patients treated
WITH CAR-T CELLS

171
patients treated
BY BRACHYTHERAPY

534
patients treated
BY SELECTIVE INTERNAL
RADIATION THERAPY

7,868
OPERATIONS
of which **2,197** to place an implantable
venous port or CVC (central venous
catheter) and **700** ablations

82%
OUTPATIENTS
in hospital departments

2,961 LBP (labile blood products)
transfusion sessions

4,791 anesthesia procedures
(except local)

64 total body irradiation sessions

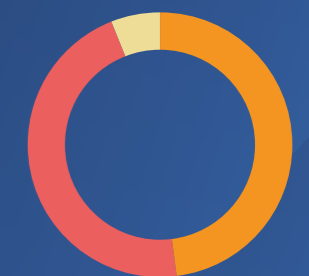
6.42 jours days mean length
of stay for full hospitalization

2,200 examens tests performed
by the Oncogenetics laboratory



AGE GROUPS:

0-14 years: **0,5%**
15-25 years: **3,7%**
26-74 years: **76,8%**
75 years and more: **19%**



GEOGRAPHICAL ORIGIN:

Haute-Garonne: **48%**
Occitanie-Pyrénées (outside
the Haute-Garonne): **46%**
France and international: **6%**



Teaching

225
INTERNS

67
DOCTORAL STUDENTS

132
PARTICIPANTS
in continuing
professional education



Patient care

732
CARE PROVIDERS

OF WHICH
183
PHYSICIANS

308
BEDS
of which **103** day-hospital beds

10,963
PATIENTS
(active hospitalization file)

36,880
PATIENTS TREATED
of whom **10,643** new patients

11,631 ↗
HOSPITAL STAYS
(+6,08% compared with 2020)

Highlights 2021



INNOVATION

Individualized vaccine against cancer: a first in Europe

The first patient with a head and neck cancer to benefit from the TG4050* vaccine in Europe is being treated in a phase I clinical trial at the IUCT-Oncopole. The principle consists of performing a tumor biopsy to sequence the cancerous cells and analyzing the data to identify the neo-antigens found specifically on the surface of these cells to produce an individualized vaccine —in only three months. A technological feat.

The vaccine aims to induce a long-lasting immune response complementary to treatments and to avoid recurrence. Prof. Jean-Pierre Delord, for non-virus-induced head and neck cancers, and Prof. Alejandra Martinez, for ovarian cancers, are the principal investigators of this study.

The IUCT-Oncopole is one of only two French healthcare facilities able to carry out such a clinical trial thanks to its combination, on a single site, of expertise and accreditations: most notably, recognized surgical teams, an immuno-monitoring service associated with a research team (T2i), the CLIP2 certification, a pharmacy with a clinical research unit and IMT (innovative medical treatments) authorization, an Office of clinical trials experience in early-phase studies.

*Developed by the Transgene biotech company.



HAPPY ANNIVERSARY

TEN YEARS TO BECOME A REFERENCE IN CANCER RESEARCH

In September, the CRCT celebrated its 10th anniversary —ten years of growing importance for the Toulouse fundamental and translational research center. In 2014, it moved into its new premises at the Oncopole. Between 2016 and 2020, five new French and foreign teams set up there. In 2018, a CRCT-IUCT Oncopole team proposed a new approach to treating melanoma associating immunotherapy and anti-TNF drugs; six months later the first clinical trials began at the IUCT-Oncopole —a first achievement for the research-treatment continuum. Two years later, Dr. Salvatore Valitutti was awarded a European Research Council (ERC) Synergy Grant. For Prof. Gilles Favre, director of the center, “the objective of the CRCT in the coming years is to meet the challenge of the convergence of biology and medicine towards mathematics, computer science and physics to offer new therapeutic solutions”.

See you in ten years.





WEB SERIES

**PINK OCTOBER
EMILY'S PATH ("LE CHEMIN D'EMILIE"), THE WEB SERIES
THAT DARES TO SPEAK OF LIFE AFTER BREAST CANCER**

Fear of recurrence, contrast between the relief of one's entourage and one's own anxieties, persistence of disturbing residual side effects...

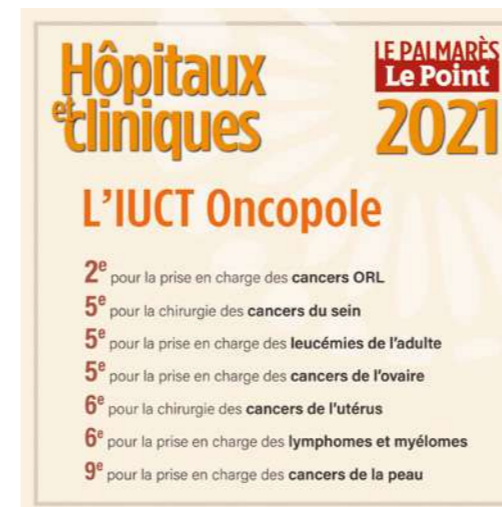
Life after breast cancer is a "forgotten" stage of the disease and a particularly difficult subject to broach. For Pink October 2021, the IUCT-Onco-pole launched an original web series, Emily's path. Its four episodes are, at once, pedagogical, informative, and committed, placing women and the healthcare team at the heart of a difficult subject with a touch of gentle, benevolent humor.

Winner of several awards, "Emily's path" won the jury's favorite prize from COM-ENT, the largest French organization of professionals in communication.



Emily's path provided the opportunity to announce the launch of the personalized after-cancer program (PPAC). Set up on the initiative of the breast cancer committee, this individualized program provides follow-up and accompaniment by healthcare professionals for patients close to home who sometimes find themselves at a loss once active treatments are finished and life after cancer has begun (see page 31).

"Le chemin d'Émilie" has been produced by **Pinkanova** and sponsored by **Maguelone Pontier**, general manager of the MIN de Toulouse (Toulouse Market of National Interest).



LEADERSHIP

HONOR ROLL – LE POINT

In its 2021 ranking of French hospitals, the weekly news magazine Le Point once again scored the IUCT-Onco-pole among the best French health-care facilities for the pathologies treated. **Congratulations to the teams.**



EVENT

ASCO 2021 – A SIGNIFICANT, HIGH-LEVEL PARTICIPATION OF THE IUCT-ONCOPOLE

The American Society of Clinical Oncology (ASCO) is one of the biggest annual innovation and clinical research conferences in oncology. The IUCT-Onco-pole distinguished itself with a total of 44 presentations, including two clinical symposia, three oral presentations, eight poster-discussions, 27 posters and four publications. Among those first-author presentations by Oncopole experts: the results of early-phase clinical trials relating to colorectal (Dr Carlos Gomez-Roca) and to urothelial (Dr Jonathan Khalifa) cancers, as well as research on breast cancer (Dr Anne-Lise Farcy).



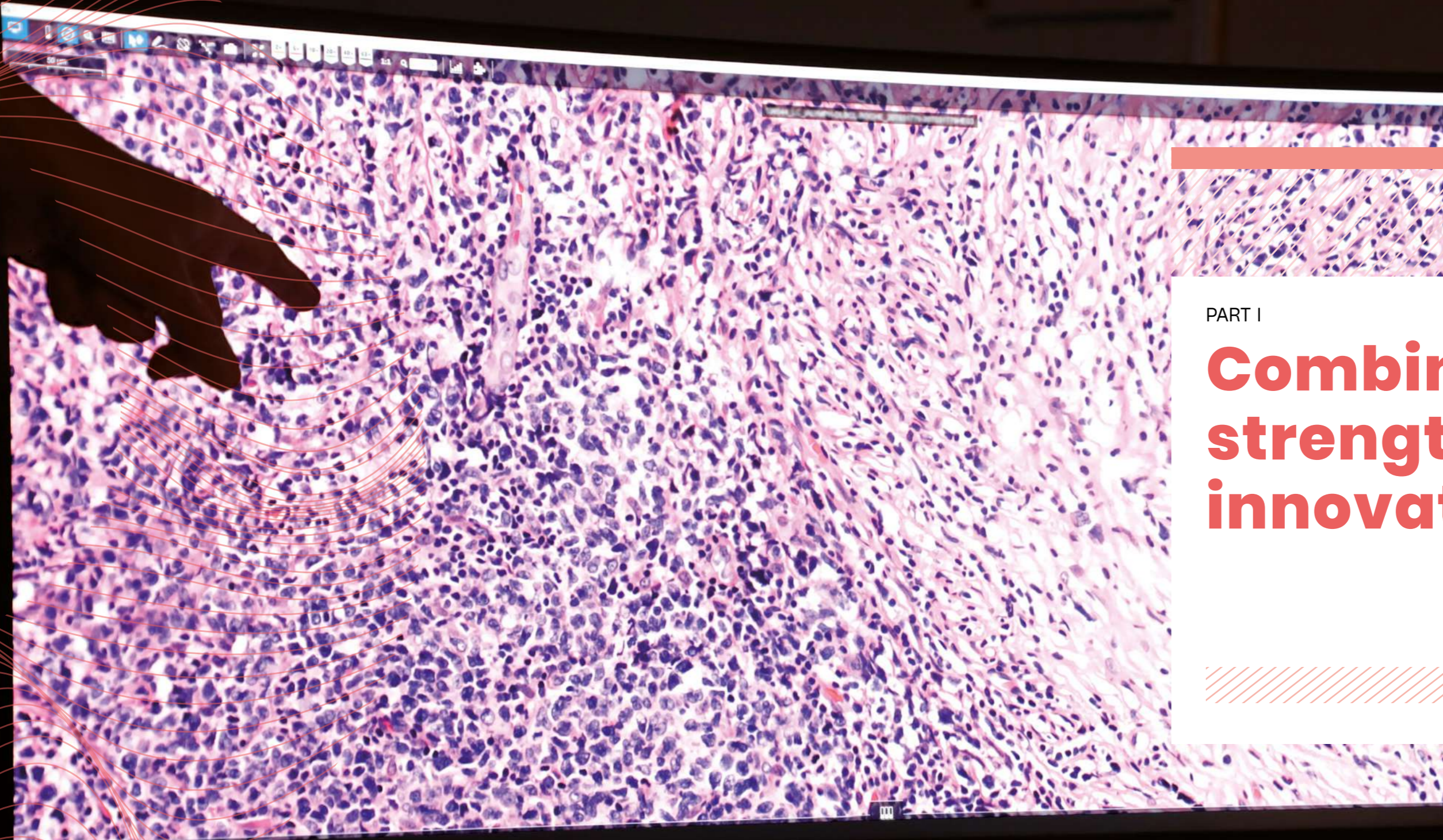
IN THE SPOTLIGHT

41ST CONGRESS OF THE FRENCH HEMATOLOGY SOCIETY – DATAML CHANGES PRACTICES IN CARING FOR ACUTE MYELOID LEUKEMIA

Among the highlights of this congress was the presentation of the **DATAML registry compiling data from 4,900 acute myeloid leukemia patients treated in Bordeaux and Toulouse over a period of 12 years.** These data mean improving care for patients with this cancer. A further highlight, 53 presentations were given by the hematology teams, most notably talks on chronic myeloid leukemia (Dr Françoise Huguet) and multiple myeloma (Dr Aurore Perrot).



Pr Christian Recher, head of the hematology department and founder of the DATAML registry



PART I

Combined strengths for innovation

Expertise in early clinical research

Developing new treatments, perfecting innovative strategies to improve response to existing therapies, profiling, and diagnoses... The IUCT-Oncopole's ambition is to encourage early clinical research. Since its creation, it has continued to acquire cutting-edge technologies, to learn from emerging expertise, and to open out to academic and industrial collaboration. It has been certified as an INCa Early Phase Center (CLIP2).

ONE TRIAL OUT OF TWO AT THE IUCT-ONCOPOLE IS EARLY PHASE

AN INDICATOR THAT IS EXPLAINED BY:

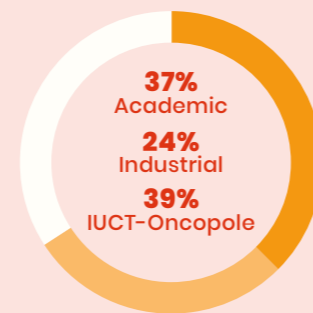
- The care-research continuum, veritable backbone of the IUCT-Oncopole, from its architectural conception to the integration of physicians in the 18 CRCT teams
- High-level platforms such as **immuno-monitoring** (Prof. Maha Ayyoub), and the **pharmacology** laboratory (Prof. Etienne Chatelut).
- A **clinical research unit within the hospital pharmacy** (Dr Anaïs Grand) and an IMT (Innovative medical treatments) authorization.
- Laboratories renowned for their expertise:
 - **Onco-medical biology** (Prof. Gilles Favre)
 - **Onco-hematology** (Prof. Véronique De Mas)
 - **Pathology** (Prof. Pierre Brousset)

- A **pre-clinical phase platform** – CREFRE-US006 (director Massimiliano Bardotti).
- A **biopathology support clinical trials support unit** – SBEC (Dr Philippe Rochaix).

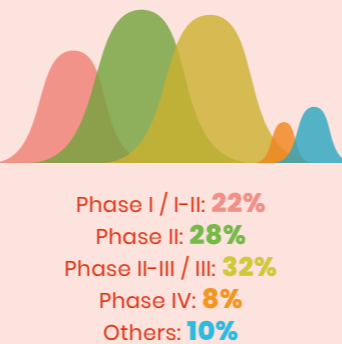
AND ALSO:

- **ICR Research and innovation management** (Muriel Poulblanc) certified ISO 9001:2015. Since November 2021, a Biostatistics & Health Data Science unit has been included (Thomas Filleron).
- **Toulouse University Hospital Research and innovation management** (Olivier Lairez) certified ISO 9001:2015.
- A day-hospital for clinical research, traditional hospitalization for clinical research, an immunotherapy unit.
- A **Cancer BioBank** with more than 33 collections stored.

PERCENTAGE OF INCLUSIONS BY TYPE OF SPONSOR



PERCENTAGE BY TRIAL PHASE INCLUDED IN 2021



168

EARLY-PHASE TRIALS opened for inclusions in 2021 of which **75** phase I/I-II trials and **93** phase II trials



Early phase clinical trials include phase I, phase I-II, and phase II levels. Their aim is to evaluate the efficacy and tolerance of a new drug or a combination of drugs, following conclusive academic and industrial research.

TOLERANCE

A SELECTIVE INHIBITOR OF THE MAP KINASES PATHWAY TO TREAT PATIENTS WITH MELANOMA



The MAPK (mitogen-activated protein kinases) pathway is a signaling pathway involved in cell migration, proliferation, differentiation, and death. Mutations causing constitutive activation of MEK1 and MEK2, two kinase proteins making up the MAPK pathway, are involved in many cancers and are thus interesting therapeutic targets. Indeed, primasertib proves to be a specific inhibitor of these kinases and is very well tolerated by patients with solid cancers or melanomas, as has been shown in the phase I clinical trial carried out by Prof. Céleste Lebbé, dermatologist at the AP-HP, and supervised by Prof. Jean-Pierre Delord, medical oncologist and early-phase specialist.

EFFICACY

A PROMISING THERAPEUTIC COCKTAIL



A new therapy based on a high dose of chemotherapy makes it possible to increase patients' complete response when suffering from malignant germinal tumors. This has been shown by a phase II clinical trial led by Dr Christine Chevreau, principal investigator, and Prof. Etienne Chatelut, head of the pharmacology laboratory. Treatment consists of two cycles combining paclitaxel and ifosfamide, and three cycles of high-dose carboplatin combined with etoposide over three days. Individual dosing of these drugs results in significant efficacy and satisfactory tolerance.

1. Lebbé et al. Target Oncol 2021
2. Chevreau et al. Cancer Med 2021

Multiple Myeloma

Precision medicine and appropriate therapeutic strategy

Multiple myeloma is a tumor caused by the accumulation of clonal plasma cells and represents 13% of all malignant hemopathies. Although cancer care for this disease has considerably improved over the last decades, adjusting therapeutic strategies to patients' age and comorbidities, adaptation to individual risk is only beginning. High-risk patients still have a poor prognosis, and it remains difficult to accurately identify and treat them.

AN ESSENTIAL FACTOR IN DIAGNOSING HIGH-RISK PATIENTS



We have developed innovative immunotherapy strategies that reduce the risk of recurrence and improve the quality of life of Multiple Myeloma patients."

Dr Aurore Perrot,
hematologist and member of the GENIM team

The CRCT GENIM Oncogenomics and the Myeloma immunology team ¹ have shown that deletion of the short arm of chromosome 17 (del(17p)) is a factor of poor prognosis, even more so when associated with a biallelic inactivation of TP53. Prof. Jill Corre and her colleagues have underscored the fundamental importance of identifying 17p deletion as the key factor in diagnosing and identifying high-risk patients to prescribe the most effective treatment.

Among these treatments, anti-CD38 monoclonal antibodies such as daratumumab have shown significant effectiveness in treating multiple myeloma and fighting recurrence ². Moreover, daratumumab combined with lenalidomid as a first-line treatment considerably improves patients' quality of life, decreasing pain ³.

1. Corre et al. Blood, 2021
2. Avet-Loiseau et al. JCO, 2021
3. Perrot et al. JCO, 2021

€4M

FUNDING
by the Riney Foundation

1

PROJECT
led by Prof. Avet-Loiseau

**THE TEAM HAS
THE LARGEST MYELOMA TUMOR
BANK IN THE WORLD**



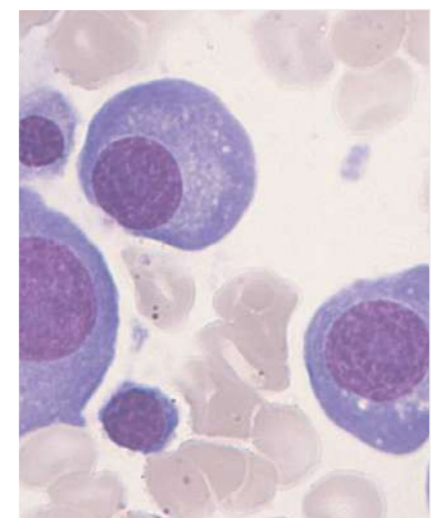
SEQUENCING THE COMPLETE GENOME OF CANCEROUS CELLS

Further to the primary alterations leading to tumor initiation, a succession of mutations and genomic rearrangements appear that result in heterogeneity within the cancerous cells. It is hypothesized that certain high-risk sub-clones, undetectable with classic methods, are then selected. These sub-clones are involved in disease progression as well as resistance to treatment.



The project thus consists of sequencing the complete genome of unique cells to detect and characterize these small high-risk sub-clones as soon as the disease is diagnosed. It also seeks to follow the evolution of these sub-clones through a few treatment cycles to define their evolutionary profile.

PRECISE MOLECULAR DIAGNOSIS FOR APPROPRIATE AND MORE EFFECTIVE TREATMENT: THE AMBITION OF THIS PROJECT FUNDED BY THE RINEY FOUNDATION.



Acute Myeloid Leukemia (AML)

Fighting resistance to treatment in three steps

Cancer care and treatment of acute myeloid leukemia (AML) have greatly improved over the last few years, but resistance to different treatments remains a major clinical challenge. Our strategy is based on three steps: identifying patients at risk by transcriptomic analysis and biomarkers; understanding the resistance mechanisms to identify new therapeutic targets; optimizing treatments.



In time, the idea would be to use this score to improve patient follow-up and to propose personalized therapies, administering a bi-therapy, associated or not with the mitochondrial activity inhibitor, to those patients likely to benefit from it.

Dr Jean-Emmanuel Sarry,
Head of the METAML team

TRANSCRIPTOMIC ANALYSIS, A FIRST STEP IN UNDERSTANDING RESISTANCE TO TREATMENTS

Taking a closer interest in the most frequently found alteration in acute myeloid leukemia, the NPM1 mutation, Morgane Gourvest¹ under the direction of Marina Bousquet of the CRCT team R'n Blood team, and in collaboration with the Pathology department, pointed out the oncogenic role of a new long non-coding RNA (lncRNA), baptized LONA. The overexpression of this transcript in acute myeloid leukemia induces resistance to treatments and may thus represent an interesting therapeutic target to fight the latter.

DOES THE MITOCHONDRIA CONTROL RESISTANCE TO CHEMOTHERAPY?

The mitochondria, veritable energy supply to cells might play a preponderant role in response to chemotherapy in acute myeloid leukemia. Claudia Bosc (the METAML team, directed by Jean-Emmanuel Sarry) published results of a mitoscore implementation to better define the level of resistance of cancerous cells: the higher the level of mitochondrial activity, the greater the resistance to treatments. By inhibiting this activity, Claudie Bosc and Lucille Stuani succeeded in suppressing this resistance to conventional chemotherapies² or to the therapy targeting the IDH mutation³.

330

PATIENTS
included in the LAM-SA 2007 study

€330,000

OF CHARITABLE FUNDING
for Dr Jean-Emmanuel Sarry's
METAML team

1

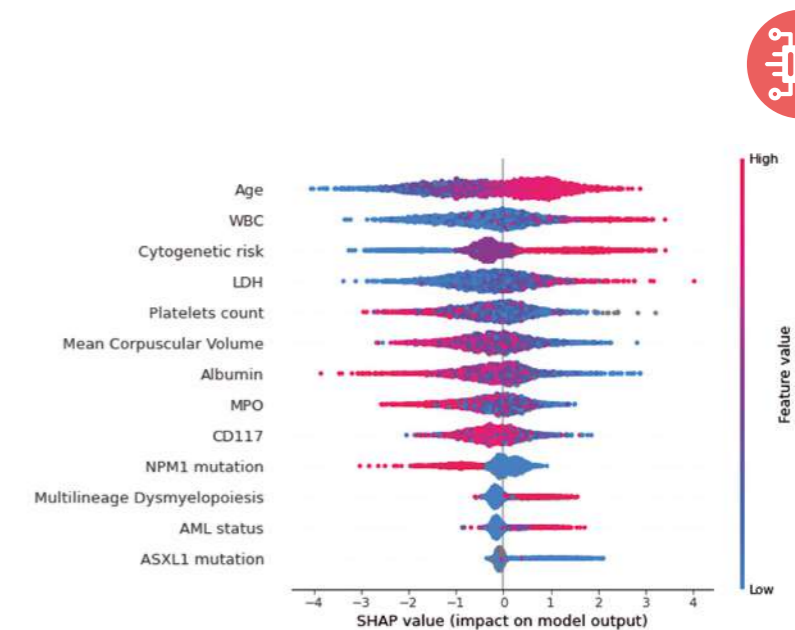
CELL
is enough to identify resistance
to treatment

A PRECISE CLASSIFICATION OF PATIENTS BY SUB-GROUPS TO ACHIEVE OPTIMAL TREATMENT

Bypassing factors of resistance to treatments is one of the major keys in cancer care for patients with acute myeloid leukemia. Laetitia Largeaud⁴, from the CRCT team IGAALD (directed by Prof. Eric Delabesse), in collaboration with the Hematology department, reported that adding lomustine to conventional chemotherapy increases response rate to the treatment, while considerably reducing the risk of recurrence. This study also made it possible to analyze patients' molecular profiles, to classify them and to identify the type of profile most inclined to successfully benefit from this treatment.

INNOVATION FOR MODELING TREATMENT RESPONSE

Ibrahim Didi, a student at the Ecole Polytechnique and winner of the prize for the best research internship in 2021, developed models using Deep Learning to predict post-treatment survival of AML patients and the best treatment choice at the time of diagnosis. He was supervised by Dr Sarah Bertoli (IUCT-Onco-pole), David Simoncini of the Toulouse Institute for Computer Research (IRIT) and Jean-Marc Alliot, head of IA/Big Data at the Toulouse University Hospital. Artificial intelligence will make it possible to improve treatment choice to optimize its efficacy for each patient.



Predictive factors of survival for patients treated by intensive chemotherapy for AML.

Artificial Intelligence-Based Predictive Models for Acute Myeloid Leukemia

Ibrahim Didi, Poster, ASH Annual Meeting and exposition 2021

IN COLLABORATION WITH

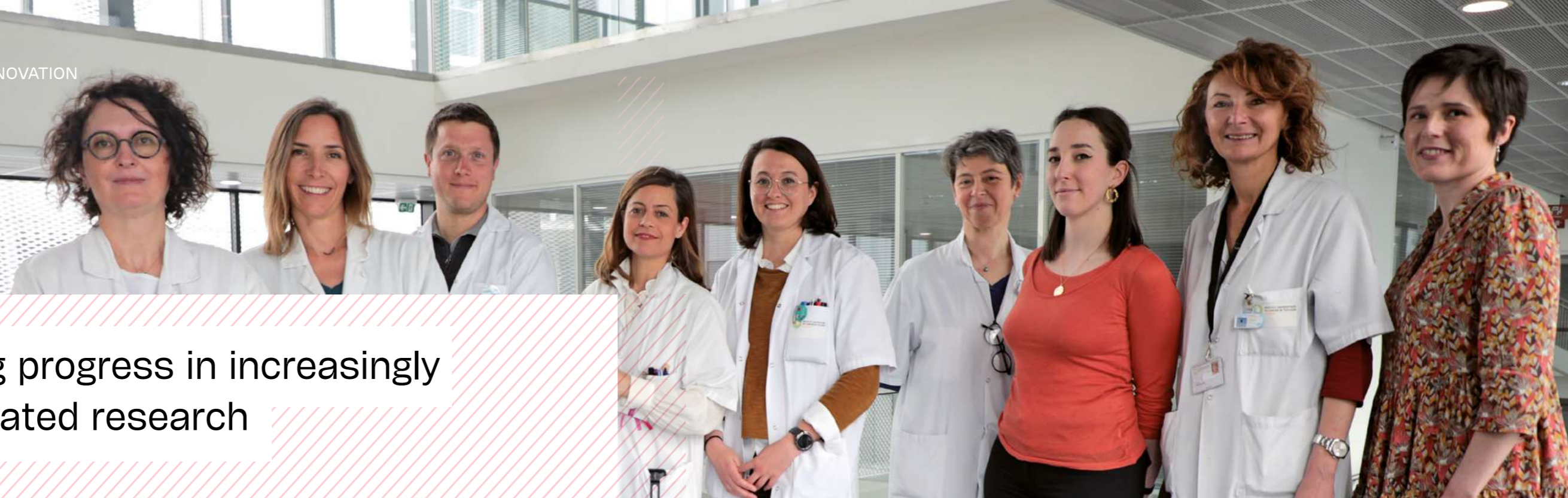


Institut de Recherche en Informatique de Toulouse
CNRS-UMR-118-1171-1172



1. Gourvest M et al. Leukemia 2021
2. Bosc C et al. Nature cancer 2021
3. Stuani L et al. J Exp Med 2021
4. Largeaud L et al. Leukemia 2021

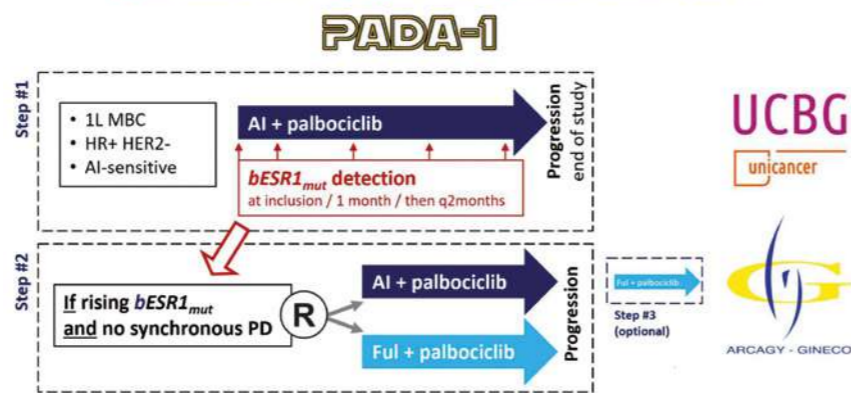
Breast Cancer



We are making progress in increasingly complex integrated research

It is becoming indispensable to study interactions between cancer cells, the microenvironment, and treatment to improve patient care. To this end, the Pathology, Medical oncology and Biostatistics departments have studied the impact of neoadjuvant chemotherapy on the immune microenvironment, highlighting the changes in protein expression in immune checkpoints associated with different prognoses. Implementing this integrated research underscores the complexity of the systems involved.

Palbociclib and ctDNA for *ESR1* mutation detection



Dr. Anne Pradines and the CRCT SGNATHER team, along with Prof. Florence Dalenc, co-director of the breast cancer committee, participated in the PADA-1 study sponsored by Unicancer. For the first time, the effectiveness was shown of changing hormone therapy after detecting by liquid biopsy a mutation of the *ESR1* gene in circulating DNA.

In breast cancer patients, *ESR1* gene mutations (coding for the estrogen receptor) may explain cancer cells' acquired resistance to aromatase

inhibitors. Changing hormone therapy in favor of fulvestrant early in non-progressive disease –as soon as an *ESR1* mutation in circulating tumor DNA is detected– can significantly delay the onset of cancer resistance to standard therapy. The PADA-1 study was presented at the San Antonio Breast Cancer Symposium (SABCS) in 2021.

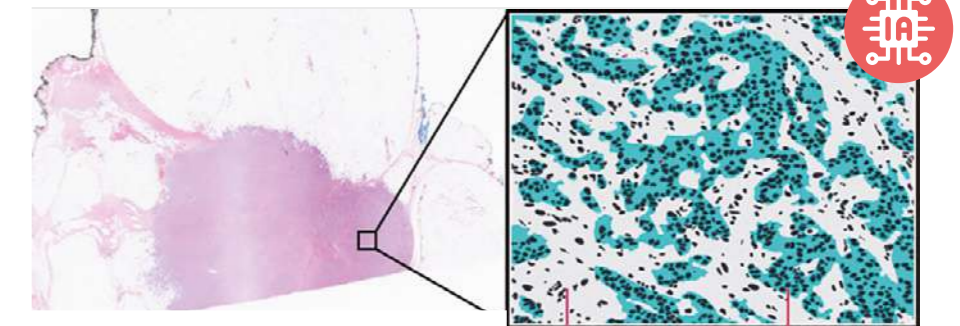
Etude PADA-1 (UNICANCER) GS3-05. Fulvestrant-palbociclib vs continuing aromatase inhibitor-palbociclib upon detection of circulating *ESR1* mutation in HR+ HER2- metastatic breast cancer patients: Results of PADA-1, a UCBG-GINECO randomized phase 3 trial

One of the stakes in breast cancer research is our capacity to analyze a great number of parameters from tumor cells, but also from the microenvironment. Our response is developing solutions based on emerging technologies such as artificial intelligence.



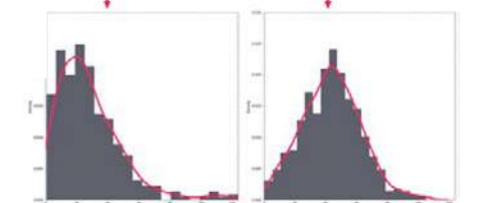
The aim is to use artificial intelligence to better understand the morphological complexity of tumors all the while developing a common language between pathologists and algorithms. This is the key to making progress in understanding cellular interactions and their impact in terms of prognosis and response to treatment."

Dr Camille Franchet, pathologist on the breast cancer committee



AI IN THE FIGHT AGAINST BREAST CANCER

Through the APRIORICS project, supported by the Health Data Hub and BPIFrance, the Pathology department is building a large collection of microscopic breast cancer images, richly glossed thanks to the development of an automatic annotation technique for immunohistochemistry-stained images. The significant number of these images and stainings will enable us to train algorithms, thereby allowing pathologists to increase their capacity for analyzing tumors, gaining both accuracy and time.



Radiotherapy

Projects to improve the accuracy and efficacy of treatments

The Radiotherapy department completed its facilities with Hyper Arc technology, thanks to collaboration between the Radiotherapy and Medical physics departments. Hyper Arc enables radiotherapists to treat multiple cerebral metastases in a single session lasting about 20 minutes, compared with other techniques.



In a further project, and for the first time in the region, IUCT-Oncopole radiotherapy treated a patient suffering from refractory ventricular tachycardia with stereotaxic cardiac irradiation. Since neither anti-arrhythmia medications nor invasive intra-cardiac ablation proved effective, cardiologists from the Toulouse University Hospital (Rangueil), radiotherapists and medical physicists pooled their expertise to treat this patient with a strong, targeted irradiation, thereby reducing the number of tachycardia attacks. Three patients were thus treated in 2021, and several others thus far in 2022.

EFFECTIVELY COMBINING CHEMOTHERAPY AND RADIO THERAPY

To improve care for patients with IDH-mutant anaplastic astrocytomas, Dr Vincent Esteyrie of the Radiotherapy department, in collaboration with the Pathology department, carried out a study under Prof. Elisabeth Moyal's supervision using the national POLA cohort to determine the best choice of chemotherapy following radiotherapy. This research made it possible, for the first time, to demonstrate the clinical benefits of giving priority to PCV (procarbazine, lomustine and vincristine) chemotherapy following radiotherapy.

Pr Elisabeth Moyal,
Head of the Radiotherapy department

Esteyrie et al. Oncologist 2021

Onco-Dermatology

73

INTERNATIONAL EXPERTS

21

EUROPEAN COUNTRIES AND THE UNITED STATES

FOR BETTER MANAGEMENT OF TREATMENT-RELATED TOXICITIES

Coordinate international experts to control side effects



For the first time in Europe, a Task Force has been created exclusively dedicated to managing undesirable side effects associated with anticancer treatments. Coordinated by Dr Vincent Sibaud, it includes 73 dermatologists in 18 European (and three non-European) countries. Their aim is to establish protocols for managing undesirable side effects in dermatology to improve patients' quality of life. They will also study new toxicities linked to treatments, notably those induced by immunotherapy¹.

Pr Nicolas Meyer,
Head of the oncodermatology committee and **Dr Vincent Sibaud,** oncodermatologist

Moreover, results of the clinical study carried out by the oncodermatology committee led by Prof. Nicolas Meyer and the CRCT MELASPHINX² team suggest that by adding antibodies targeting the TNF cytokine to immune checkpoint inhibitors, side effects are reduced, and the therapeutic cocktail is well tolerated by patients with advanced melanoma.

1. Apalla et al. J Eur Acad Dermatol Venereol 2021,
2. Montfort et al. Clin Cancer Res 2021

Pancreatic Cancer

Rapidly detecting cancer and its metastases to guarantee the best chances for patients

The discovery of new biomarkers and the development of new technologies have the potential to detect cancers more rapidly and with greater precision. Both accuracy and time-to-response are major assets in effectively fighting such cancer.



Through a multidisciplinary approach, bringing together physics and biology, we are developing new technologies to help diagnose and follow-up patients treated for pancreatic cancer, gaining new insights into the biology of these tumors."

Dr Pierre Cordelier,
Head of the ImPact team

1. Tijunelyte I et al. Biosens Bioelectron 2021
2. Thibault B et al. EMBO Mol Med 2021

Micro-RNAs (miRNAs) are short non-coding RNAs that play a key role in regulating gene expression in physiology and in cancer. miRNA levels are greatly altered in cancer patients, both in tissues and in blood, so detecting them in plasma can help diagnose or follow-up patients with cancer. The CRCT ImPact team headed by Dr Pierre Cordelier has demonstrated that miR-21 miRNA levels are upregulated in pancreatic tumors, but also in patients' saliva and plasma. The team collaborated with physicists from the LAAS-CNRS to devise novel nanodevices for liquid biopsies based on the μ LAS microfluidic chip technology to accurately detect and measure miR-21 levels in less than one minute¹.

DETECTING METASTATIC EVOLUTION TO ACT IN THE EARLY STAGE OF CANCER

In more than half of solid cancers, the PI3K signaling pathway is altered. Moreover, Benoit Thibault from the SigDyn team directed by Julie Guillermet-Guibert, has been able to demonstrate that PI3Ks signaling pathway activation was necessary in the transition from a micro-metastatic state towards visible macro-metastatic development, responsible for unfavorable evolution of the cancer². PI3K inhibitors are effective in fighting this metastatic evolution and are thus therapeutically promising.

LESS THAN 1

MINUTE to detect non-invasive biomarkers of pancreatic cancer



A PARTNERSHIP unique to Toulouse

€553,000

INVESTED in the PI3K project, of which €50,000 come from the LabEx TOUCAN and €483,000 from Europe

Acute Lymphoblastic Leukemia

Identifying and targeting molecular alterations: a promising avenue

Acute Lymphoblastic Leukemia (ALL) is a bone marrow cancer associated with a blockage of blood cell production and an anarchic proliferation of these immature cells. They result from successive mutations that reprogram the hematopoietic progenitors towards a pre-leukemic state before beginning the actual leukemic transformation. In exceptional cases, the initial mutation is inherited, as shown by the CRCT team "Impact of Genetic Alterations on the Development of Acute Leukemia" (IGAALD), led by Prof. Eric Delabesse. Identifying these molecular alterations is essential in following-up these cancers, treating the early phases of the disease and developing therapeutic agents.

NEW MUTATIONS HAVE BEEN IDENTIFIED TO BETTER UNDERSTAND THE MOLECULAR MECHANISM OF ACUTE LYMPHOBLASTIC LEUKEMIA LEADING TO BETTER CARE FOR PATIENTS



Reading the genome of two brothers and a sister with ALL, Laura Jamrog, a doctoral student in the CRCT IGAALD team, in collaboration with Dr Nicolas Duployez of the Lille University Hospital Hematology department, identified a germinal mutation of the PAX5 gene. This mutation might be the initiating event of the leukemia in this family. This translational research provides a better understanding of the molecular mechanisms involved in exceptional cases of familial leukemia.

Duployez*, Jamrog* et al. Blood 2021
*Co-1st Author



PART II

TARGETED ACTIONS FOR CARE



TARGETED ACTIONS FOR CARE

Still mobilized, still innovative

The Covid-19 health crisis continued through 2021, mobilizing all the healthcare teams to maintain safe patient care. Physicians and other healthcare professionals adapted to this unprecedented situation, in some cases, reinventing themselves. An overview of the initiatives and projects to improve care pathways and patients' quality of life.

HOME-NURSING OR CLINICAL TRIALS AT HOME

The Covid-19 pandemic posed severe constraints on the conduct of clinical trials. Starting with a high risk of exposure to SARS-COV-2 for patients –already fragile– having to come to the hospital to receive experimental treatment, aside from services being saturated and thus likely to disrupt the smooth running of a trial.

Initiated by MSD laboratories, the project of administering experimental treatments at patients' homes –a first in France for cancerology– was able to come to fruition through Prof. Nicolas Meyer's collaboration with healthcare teams and the clinical research unit of the hospital pharmacy, along with Myriam Estrabaut and Sarah Delbos of the Office of clinical trials. The patient care pathway was rethought, and the

procedure for inclusion was readjusted. Finally, the pharmacy teams knew how to reorganize to prepare experimental treatments, once validated by the medical investigator, and send them to patients' homes.

This home-nursing organization made it possible for patients to avoid loss of chance, all the while improving their quality of life by limiting transport. This orientation may well be reinforced in clinical research in the coming years.



COVID-19: AN UNWAVERING COMMITMENT

Critical points to check daily, flexible organization, coordination among services, notably with critical and intensive care units... The IUCT-Oncopole professionals were ready to get down to work to guarantee the continuity of care and patient safety.



PERSONALIZED CARE PROGRAM FOR AFTER-CANCER (PPAC)

Announced in our last Pink October campaign, the personalized care program for after-cancer (PPAC) has since been deployed for patients treated for localized breast cancer. The PPAC takes over from the personalized care program, when active treatments are finished, to clearly identify a new period called "after cancer", or "post-treatment". The program is given to the patient following consultation with a physician and then with a specialized nurse. The aim is to plan post-therapeutic follow-up and global accompaniment for all patients in an individualized manner, particularly for supportive care close to home, in partnership with community healthcare professionals. The PPAC can be revised over time.

This organization was set up by the breast cancer committee (Prof. Florence Dalenc, Prof. Charlotte Vaysse, Dr. Eva Jouve) in collaboration with the Direction of nursing.

VIRTUAL REALITY UNDER STUDY

A pilot approach was launched in several services (operating suite, surgery, oncology, radiology, consultations) to evaluate the use of virtual reality headsets and the benefits for patients. "A decrease of pain and anxiety, proven by several studies", claims anesthesiologist Dr Geneviève Salvignol, project pilot, "for procedures performed under local anesthesia (endoscopy, placing an implantable venous port, dental care) or for delicate or complex care such as dressings. It can be used to help patients relax before an imaging examination (ultrasound biopsy), a radiotherapy and chemotherapy session. Finally, it generates interest in pain management." The mobile palliative care team led by Dr Valérie Mauriès and the Committee for the Fight Against Pain (CLUD) are associated with the project to implement a best practice guide in integrating virtual reality into care pathways.

THE DEF'IT OR HOW TO FIGHT AGAINST TASK INTERRUPTIONS

With a frequency of 6.7 times per hour and per healthcare professional, the Haute Autorité de la Santé (HAS) has considered task interruption, since 2016, a problem in its own right. The IUCT-Oncopole Safety culture committee has created a working group on the subject, with a first initiative entitled "DEF'IT". The principle? Invite healthcare teams to identify a situation where tasks are interrupted so as to analyze and propose corrective action via the video support. Eleven services have thus far met the challenge, with a first prize awarded to the imaging team.

Moreover, "DEF'IT" has also convinced five other cancer centers who have, in turn, taken up the challenge, as well as UNICANCER, who awarded a "DEF'IT Prize" at its national convention in November 2021.

5

PROJECTS
for patient reception
and comfort

These five projects from different services were chosen by a jury composed of IUCT-Oncopole healthcare professionals, patients' representatives, and patients. They were funded by the 2021 IFAQ* program.

- Create a space for children whose parents are receiving cancer care (oncopsychology)
- Limit patients' claustrophobia (nuclear imaging)
- "Better communicate with and entertain patients" (oncologie 3B)
- Improve patient comfort (admissions office)
- Limit symptoms of discomfort by aromatherapy (supportive care)

* Financial incentive to improve quality (IFAQ) provided by the HAS.



TARGETED ACTIONS FOR CARE

Sport & Cancer

Develop and evaluate adapted physical activity

The IUCT-Oncopole extends its Sport and Cancer program to Adolescent and Young Adult patients (AYA) and to patients treated by CAR-T Cells.

The Sport and Cancer Center, run with CAMI Sport & Cancer since 2017, has grown with the extension of the program to Adolescents and Young Adults (AYA) in September 2021.

Patients aged 15 to 24 years of age from Hematology, HSC Transplants, and the oncology ward 2A can take part in two individual sessions of sports therapy for 15 to 45 minutes a week during their hospitalization.

The Sport and Cancer Center is run by Dr Nathalie Caunes-Hilary along with AYA specialist physicians Dr Christine Chevreau for oncology and Dr Françoise Huguet for hematology. Sports therapy, provided by a CAMI profes-

sional, follows up from a checkup and physical tests. Physical and psychological supervision is assured by the healthcare team.

The IUCT-Oncopole, one of the precursors in France for using the so-called CAR-T Cells, was chosen to host the CAMI pilot program dedicated to patients receiving this state-of-the-art therapeutic innovation. The project consists of programming 21 sessions of sports therapy before, during and after hospitalization for patients treated by CAR-T Cells. Eight patients undertook the program in 2021, for a final objective of 60 inclusions. An evaluation of the benefits (fewer side effects, better quality of life) will be carried out at the end of the experimental period with the aim of nationally implementing the program.



Extend the activities of the Sport and Cancer Center to an AYA population and to patients receiving innovative treatments reinforces our clinical expertise on the benefits of appropriate physical activity."

Dr Nathalie Caunes-Hilary, Head of the Supportive Care department

165

PATIENTS followed the Sport and Cancer program in 2021

+ 1,000

SESSIONS of sports therapy carried out



PARTNERS



TARGETED ACTIONS FOR CARE

Personalized care pathways

A wider offer in therapeutic education and in after-cancer accompaniment

2021: the 5th therapeutic education program launched.

After breast cancer, oral treatments at home, transplants in hematology and internal medicine, the head and neck care pathway has developed a therapeutic education program.

Called "To make your mouth water", it targets patients following head and neck radiotherapy. Four group workshops are proposed to help patients share experiences and better manage their daily life: swallowing, avoiding the risk of "going down the wrong pipe", diet and oral comfort, inter-personal relations and managing

emotions. Twenty-two patients have taken part in the workshops since the program began in 2021. The "To make your mouth water" program was developed by the Supportive Care department and the transversal unit for therapeutic education (UTEPT) for cancer care in the Occitanie region (led by the IUCT-Oncopole).

The Interdisciplinary Department of Supportive Care (DISSPO) has given new impetus to the ACAMEOT program, a personalized care pathway offered to patients to help them remain at/return to work after breast or blood cancer. Two social workers from the DISSPO, Pauline Pascau and

Emilie Carayon, participate in this program involving several partners (IUCT-Oncopole, Toulouse University Hospital, AG2R, Marijul RH, Fondation Toulouse Cancer Santé). Six patients benefitted from individual accompaniment in 2021.

1

supplementary therapeutic EDUCATION PROGRAM

1

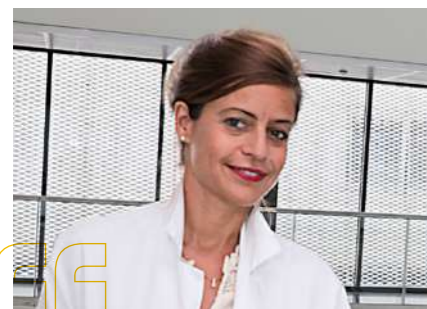
PERSONALIZED PROGRAM to remain at or to return to work

TARGETED ACTIONS FOR CARE

Preventing recurrence

A national project of personalized follow-up

The PRÉCIDIVE project aims to “prevent the recurrence of severe chronic disease by modifying diet and physical activity.”



PRÉCIDIVE was officially selected as a Project in healthcare innovation 2021 to be implemented in 2022.”

Pr Charlotte Vaysse, surgeon and co-head of the breast cancer committee

More specifically, for the cancer component of the project, the goal is to set up a personalized recurrence-prevention program for all obese patients with non-metastatic breast cancer following (neo)adjuvant treatments (with the exception of hormone therapy).

The IUCT-Oncopole is a partner in this project sponsored by the Toulouse University Hospital, led by Profs. Charlotte Vaysse and Florence Dalenc for breast cancer.

This preventive program takes account of several considerations: the person’s profile, a group session devoted to individualized lifestyle changes, professional accompaniment by experts (dietitians/coaches in adapted physical activity/psychologists), and personalized guidance in function of results achieved. Collabora-

tion among professionals, patients, primary care physicians and specialists, as well as program and tele-evaluation coordination will be assured by ad hoc software.

The PRÉCIDIVE project falls within “Article 51 of the code of the social security or innovation in healthcare”, a national experimentation framework for new care pathways, more effective and less costly. The two other chronic diseases concerned are the emergence of permanent diabetes after gestational diabetes and the recurrence of exacerbated chronic obstructive pulmonary disease (COPD), led by Profs. Patrick Ritz, Hélène Hanaire and Alain Didier of the Toulouse University Hospital.

1
MILLION EUROS

5
YEARS

1
NATIONAL PROJECT
Art. 51 – Innovation in healthcare

35
PATIENTS
with disabilities included in 2021

50
INFORMATIONAL DOCUMENTS
easy-to-read and understand

1 PILOT PROJECT
supported by the Institut national du cancer (INCa)

TARGETED ACTIONS FOR CARE

Handicap & cancer

An unprecedented collaboration in favor of inclusiveness and personalized care

In terms of incidence and mortality, people with disabilities are affected by cancer to the same extent as the general population.

Nevertheless, addressing their needs and feelings in confronting this stressful, often poorly understood, situation means adapting their cancer care. This is the role of the Handicap and cancer project, led jointly by the IUCT-Oncopole and the Association for Protection of Invalid Children (ASEI), the leading player in the medico-educational domain.

Begun in February 2021, the Handicap and cancer program is based on a dedicated care pathway with a single telephone number for making appointments and a nurse coordinator to anticipate patients’ needs and adapt examinations and procedures ahead of time. Informational material on the care pathway and care management have been developed based on Augmentative and Alternative Communication (AAC). Reciprocal training of professionals in both establishments, the last component of the program, has made it possible to launch an ad hoc module open to French medical practitioners and educators.

The project was introduced to healthcare and medico-social professionals in a thematic event with the Onco-Occitanie network during a Pitch’Unicancer (run by the network of French Comprehensive Cancer Centers), and during summer sessions of the National Agency Supporting Performance (ANAP) in Oncology. It won the 11th Trophy for innovation awarded by the FEHAP (Federation of private, non-profit making hospitals and medico-social facilities) at its 2021 national congress.





PART III

Together to fight cancer

TOGETHER TO FIGHT CANCER

Generosity & charity

The commitment of private individuals, associations, companies, and benefactors at our side has allowed us to move ahead in developing innovative programs: research projects, patients' quality of life, acquiring high-tech material. All the Oncopole teams would like to express their deepest gratitude to all of our donors for their support and confidence.

In 2021 the IUCT-Oncopole received more than €725,618, of which €181,759 were bequests.



DISTRIBUTION

25%
OF BEQUESTS

75%
OF DONATIONS

SEVERAL FUNDRAISING CAMPAIGNS IN 2021



COMPANIES MOBILIZE



Isabelle Novaro
+33 (0)5 31 15 50 37 - dons@iuct-oncopole.fr

You can help us in several ways. By a secure online donation, by direct debit, by check. Visit our platform: don.iuct-oncopole.fr

Every donor receives a tax receipt.

The service for donations and bequests is at your disposal for further information.

Our thanks to associations for their ongoing support

EVEIL ET LOISIR - LAURE-MINERVOIS

LE 13 13 - MARATHON DE LAURIE

ATOUT CŒUR POUR L'ONCOPOLE

LES AMIS DE L'ONCOPOLE

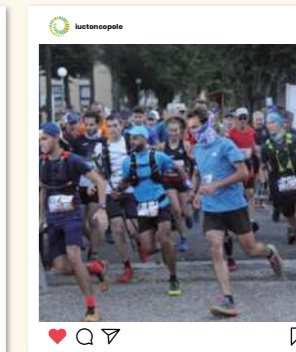
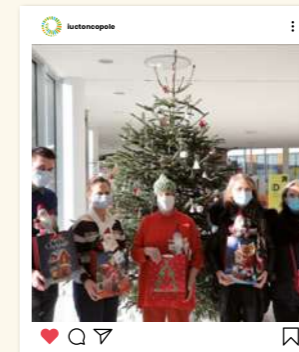
L'ASSOCIATION POUR LA RECHERCHE SUR LES TUMEURS CÉRÉBRALES - ARTC 31

BENOIT UN SOURIRE POUR LA VIE

PHIL'ANTHROPE

RANDO POUR UNE MAMAN

LES GROLLES-TROTTEURS DU MINERVOIS



Many thanks as well to...

Arts Et Poteries Giroussens - Entente Cordiale Gaillacoise - Rotary Club Lectoure Fleurance - Comminges Sans Frontières - A E S Association Entraide Solidarité - Asso Gymnastique Volontaire J'y Vais - Caregivers Trek 65 - Lions Club Carcassonne Liberté - Association Vivre Comme Avant - Association Pour Corentin - Association Bel Horizon - La Capulette Gym Volontaire - Association Vivre Avec - Association Tous Concernés Albias - Association Les Rubies



HUMANITARIAN ACTIVITY



Since 2013, the IUCT-Oncopole and the association "Des Ailes pour Saint-Louis" help the Saint-Louis Hospital, Senegal, through donations of material, on-site staff training and hosting trainee physicians at the Oncopole. In 2021, a fourth campaign was successfully carried out, collecting and sending material for the Senegalese hospital: an anesthesia ventilator, operating room image intensifiers and hospital furniture, for a total of 23 m³.

Bravo for this ongoing initiative.

Teaching & Training

A flight simulator for health-care professionals

“Is there a care provider in the cockpit?” is a training program « made in Oncopole », bringing together the fields of healthcare and that of aeronautics. Thanks to immersion in a flight simulator, healthcare professionals reinforce their non-technical competences (communication, stress management) and their teamwork. This program, available on the AVIASIM site, established itself in 2021 offering more than nine sessions in Toulouse and Lyon.



Oncostream

The surgical and operating room team, since 2014, relies on video, 3-D and web technologies to enrich its medical and scientific knowledge. In partnership with Oncostream, more than 37 webinars were broadcast in 2021. A special Turquoise September webinar brought together, live, more than 1,000 professionals and patients for more than three hours.

SPOC (Small private online course)

The “Care pathways for cancer patients” SPOC, developed for all health-care professionals added a module on hematology and integrated the catalogues of the Nurses’ training institutes in Midi-Pyrénées, Brittany, and the Universities of Paris.



225

INTERNS

67

DOCTORAL STUDENTS

62

PARTICIPANTS in continuing professional education

74

UNIVERSITY STAKEHOLDERS of whom **30** Full professors, **25** Associate professors, **10** University hospital assistants

Qualiopi certified process

CERTIFICATION obtained in November 2021

Partnerships & funding

Research activities at the Oncopole are undertaken as a partnership with international centers, industry, funding agencies, patients’ associations, and governmental organizations. This collaboration helps to accelerate starting up and following through large-scale projects. Focus on three promising projects.

KAZIA Therapeutics and EVOTEC

Developed by researchers at Evotec, Toulouse, EVT801 is a new molecule targeting the formation of new lymphatic vessels involved in tumor growth. Partnership with the Australian biotech Kazia Therapeutics made it possible to rapidly initiate a phase I clinical trial, coordinated by Dr Carlos Gomez-Roca. The first inclusion took place at the IUCT-Oncopole in November 2021.



The THEMIS Project

Prof. Loïc Ysebaert obtained funding from PRIME (a medico-economic research program) to launch a medico-economic evaluation of the nursing care coordination for chronic lymphoid leukemia (CLL) patients treated by targeted therapies. This multi-centric national study, furthering the development of the AMA (Assistance in ambulatory care) program, was endowed with €880,000.



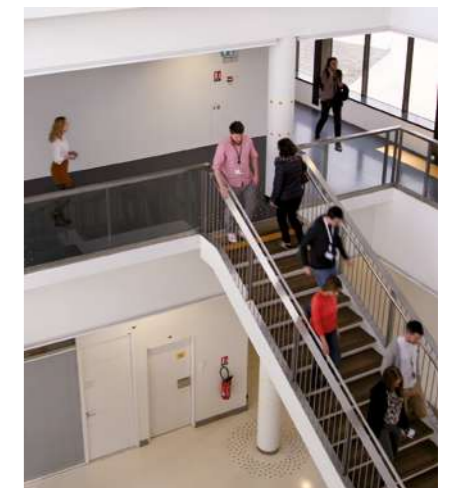
The IALYMPH Project

The project team (Prof. P. Brousset, Prof. L. Ysebaert, C. Laurent) forged a partnership with Roche Laboratories around the IALYMPH project. It aims to identify predictive response or recurrence factors by means of artificial intelligence in IUCT-Oncopole patients with lymphoma. The agreement amounts to €1.5M from 2021-2025.



Research funding and support agencies, along with official regulatory bodies, accompany, support, certify, and equip our projects, research teams and health-care services. Thank you all.

Inserm – CNRS – Université Toulouse III Paul Sabatier – UNICANCER – Institut National Du Cancer – ANR – Université Fédérale Toulouse Midi-Pyrénées – La Région Occitanie – Les Investissements d’Avenir – Le Cancéropôle Grand Sud-Ouest – L’Etablissement Français du Sang – l’Union Européenne. Fondation pour la recherche médicale – Fondation ARC pour la recherche contre le cancer – Ligue nationale contre le cancer – Ligue contre le cancer 31 – Institut Carnot Opale – Fondation Toulouse Cancer Santé – Chaire Pierre Fabre – Fondation de France – Fondation RITC – Fondation Bettencourt Schueller – Laurette Fugain.



Distinctions

THESE STAFF MEMBERS HAVE DISTINGUISHED THEMSELVES IN 2021 BY RECEIVING PRIZES AND RECOGNITION. CONGRATULATIONS TO ALL.



24th Oncology nursing conference



Anne-Cécile Rouanet, Registered nurse, department of Medical oncology, **1st prize**
Elia Alayrac, Registered nurse, Consultation Service and **Chantal Dantin**, Registered nurse, Oncorehabilitation, **3rd prize**



Congress of the French Society of Hematology



Morgane Gourvest, Post-doctoral researcher, R'n Blood team, **Laurette Fugain Prize 2021**



Young researchers' day Fondation ARC



Lucie Piram, radiotherapist, Radiotherapy department, **Hélène Starck Poster Prize**



ESMO Congress 2021



Iphigenie Korakis, Medical oncologist, Clinical Research Unit, **Best poster**
Emily Alouani, Intern, department of Clinical oncology, **Best poster**
Audrey Lumeau, Post-doctoral researcher, ImPact team, **2021 Post-doctoral fellowship of the French Pancreas Club**



FEHAP 11th Innovation Awards



Handicap & Cancer team, **Winner** of the 11th FEHAP Innovation Awards (Federation of Private Non-profit-making Hospitals and Medico-social facilities)



L'Oréal Foundation for Women in Science



Laura Poillet-Perez, Researcher, METAML team, **Young Talents Prize 2021**



National order of the Legion of Honor



Gilles Favre, Director of the CRCT, **Knight of the Legion of Honor**



SysMod, ISMB ECCB 2021



Nina Verstraete, Post-doctoral researcher, NetB(IO)² team, **Best poster**



French Society of Medical Physics



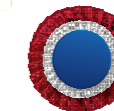
Alexia Delbaere, Doctoral student, department of Medical physics, **Best poster**



Fondation ARC



CRCT GENIM team, **"Team to be honored" Prize 2021**



Medal of honor for work accomplished



Sandrine Digout, **Silver medal** for her 20 years of seniority in the catering service



PART IV

A UNIQUE SITE

A UNIQUE SITE

The IUCT-Oncopole



The IUCT-Oncopole, a center for care, research, and training in cancerology, mobilizes on a single site in Toulouse the expertise of 2000 professionals. Several state-of-the-art clinical cancer care facilities join forces with a world-class research infrastructure on an integrated campus uniting public and private stakeholders, including industrial partners. The IUCT-Oncopole brings together the Institut Claudius Regaud (Comprehensive Cancer Center) and several teams from the Toulouse University Hospital.

The site comprising the IUCT-Oncopole and the Toulouse Cancer Research Center (CRCT) has been certified as a Comprehensive Cancer Center by the Organisation of European Cancer Institutes (OECI). This label of excellence proves the high level of integration of research into patient care and the comprehensive nature of treatment provided on-site.

The strength of this model – a pioneer in France – lies in pooling the skills of care and research teams who work together on a daily basis so patients can benefit from comprehensive care at the cutting edge of innovation.

8 years after its opening, the IUCT-Oncopole offers patients twice as many clinical trials and publishes twice as much research in international scientific journals.



The IUCT-Oncopole groups together more than twenty healthcare activities and medico-technical platforms. Its organization is structured around 18 medico-clinical departments and 12 Organ Coordination Committees (OCC), associated with three other OCCs based at the Toulouse University Hospital's Rangueil and Purpan sites.

ORGANISATION

The IUCT-Oncopole is organized as a healthcare consortium (Groupement de Coopération Sanitaire - GCS) set up under private law as an equal partnership between the Institut Claudius Regaud (ICR) and the Toulouse University Hospital (CHU). The General Manager of the Toulouse CHU presides over the General Assembly, and the General Ma-

nager of the ICR, the functions of GCS administrator. Internal rules of procedure specify the distribution of disciplines and competences, the governing bodies and the operating modes of the main technical and logistics activities of the site.

A COMMITTED SCIENTIFIC COUNCIL

A joint Scientific Directorate for the hospital and the CRCT, as well as a Scientific Council, work in concert to oversee the governance of the site. All translational research programs are steered jointly by a physician and a researcher.



Pr Jean-Pierre Delord,
General Manager of the ICR
Administrator of GCS IUCT-Oncopole



Jean-François Lefebvre,
General Manager of the Toulouse University Hospital
President of the General Assembly of the GCS
IUCT-Oncopole



A UNIQUE SITE

The Toulouse Cancer Research Center (CRCT)

The only center in Toulouse dedicated entirely to cancer research, the CRCT groups together 18 teams of fundamental and translational research (UMR 1037 Inserm, University of Toulouse III-Paul Sabatier | UMR 5071 CNRS, University of Toulouse III-Paul Sabatier).

Its ambition is to respond to major therapeutic challenges in cancerology through excellence in fundamental research in four areas of expertise:

ONCOGENIC PATHWAYS: FROM MODELING TO TARGETED THERAPY

The aim is to federate CRCT researchers, clinicians, engineers, technicians, and students to share multidisciplinary expertise towards a common goal of understanding and targeting the autonomous and non-autonomous mechanisms of oncogenic pathways.

RNA & CANCER

CRCT researchers explore the mechanisms of RNA deregulation, key actors in controlling gene expression, and their role in cellular landscape alteration possibly leading to cancer initiation, progression, and metastatic development.

TUMOR MICROENVIRONMENT AND METABOLISM

The aim of this research focus is to understand and identify targets in both tumor cells and stroma. This co-targeting would make it possible to render tumors sensitive to therapies and/or to arrest their metastatic potential.

ONCO-IMMUNOLOGY

This axis aims to promote collaboration among several teams by studying the cancer/immunity confrontation through different, but complementary, approaches.



Pr Gilles Favre,
Head of the CRCT since 2017

Two additional cross-cutting programs are being developed:

- Resistance mechanisms and new targets: from molecular pharmacology to clinical pharmacology.
- Development of mathematical, physical, and computational approaches in oncology.

Each of the 18 CRCT teams includes IUCT-Oncopole physicians. This interconnection results in accelerated transfer of CRCT discoveries towards IUCT-Oncopole clinical research.



In 2021, the CRCT established two partnerships to develop converging expertise and knowledge in mathematics, physics and in computer science.



A joint team between the CRCT and the Toulouse Institute for Computer Research (IRIT) was set up to develop new scientific approaches, based on modeling cellular and tissue processes from massive data bases (see page 21). Artificial intelligence serves research to identify new avenues of patient care.



A research convention was signed with the engineers and physicists of the Systems Analysis and Architecture Laboratory (LAAS-CNRS) to develop microfluidic (see page 26) and medical imaging technologies.

A UNIQUE SITE

Cutting-edge technologies

ACQUISITION OF THE CELLSEARCH® SYSTEM

Since 2021, the oncology biomedical laboratory has benefited from the CellSearch® system, a benchmark automated platform –the only system approved by the American Food & Drug Administration– to identify, enrich and enumerate circulating tumor cells, as well as circulating endothelial cells, in a single blood sample. Its objective is to develop innovative projects based on the detection and phenotypic and molecular characterization of circulating cells.



A STATE-OF-THE-ART SEQUENCER FOR THE CRCT

To accompany recent advances in exploring genomes and transcriptomes, the CRCT Technology Cluster just acquired, thanks to funding by Prof. Hervé Avet-Loiseau, a NovaSeq 6000. This is the most recent and powerful Illumina sequencer currently available on the market.

Aside from the classic techniques, the Technology Cluster offers expertise in RNA sequencing at the single-cell level, as well as the development of software tools adapted to bio-informatic data processing. This expertise has been recognized in the framework of the CSP program (Certified Service Provider) of the Genomics 10X company.



3D printing takes its place

RECONSTRUCTION AND MEDICAL DEVICES

In collaboration with the Toulouse national polytechnic institute and the MARLE/3D Medlab company, the head and neck surgery team (Prof. Sébastien Vergez) set up an on-site 3D printing workshop to improve management of complex surgeries – such as mandibular reconstruction– by directly producing instruments or single-use cutting guides. These medical devices will be certified according to the National Agency for the Safety of Medicines and Healthcare Products (ANSM) norm, the ultimate goal being obtaining CE marking.



BIOMEDICAL ENGINEERING AND MEDICAL PHYSICS

The engineers and technicians of the Biomedical engineering unit (GBM) rely on a 3D printing platform, acquired by the Department of Medical physics, to produce their own parts needed for maintenance of high-tech medico-technical equipment and platforms (imaging, radiotherapy, surgery). This autonomy allows them to avoid constraints linked to supply chains and to carry out tailor-made operations.

A skills development plan in 3D design/printing is currently underway to create applications linked to GBM and medical physics. Dr Laure Parent, medical physicist, is developing several utilizations for radiotherapy, for example 3D printing of skin devices from scanned images of patients undergoing treatment in order to increase the dose targeting skin lesions.



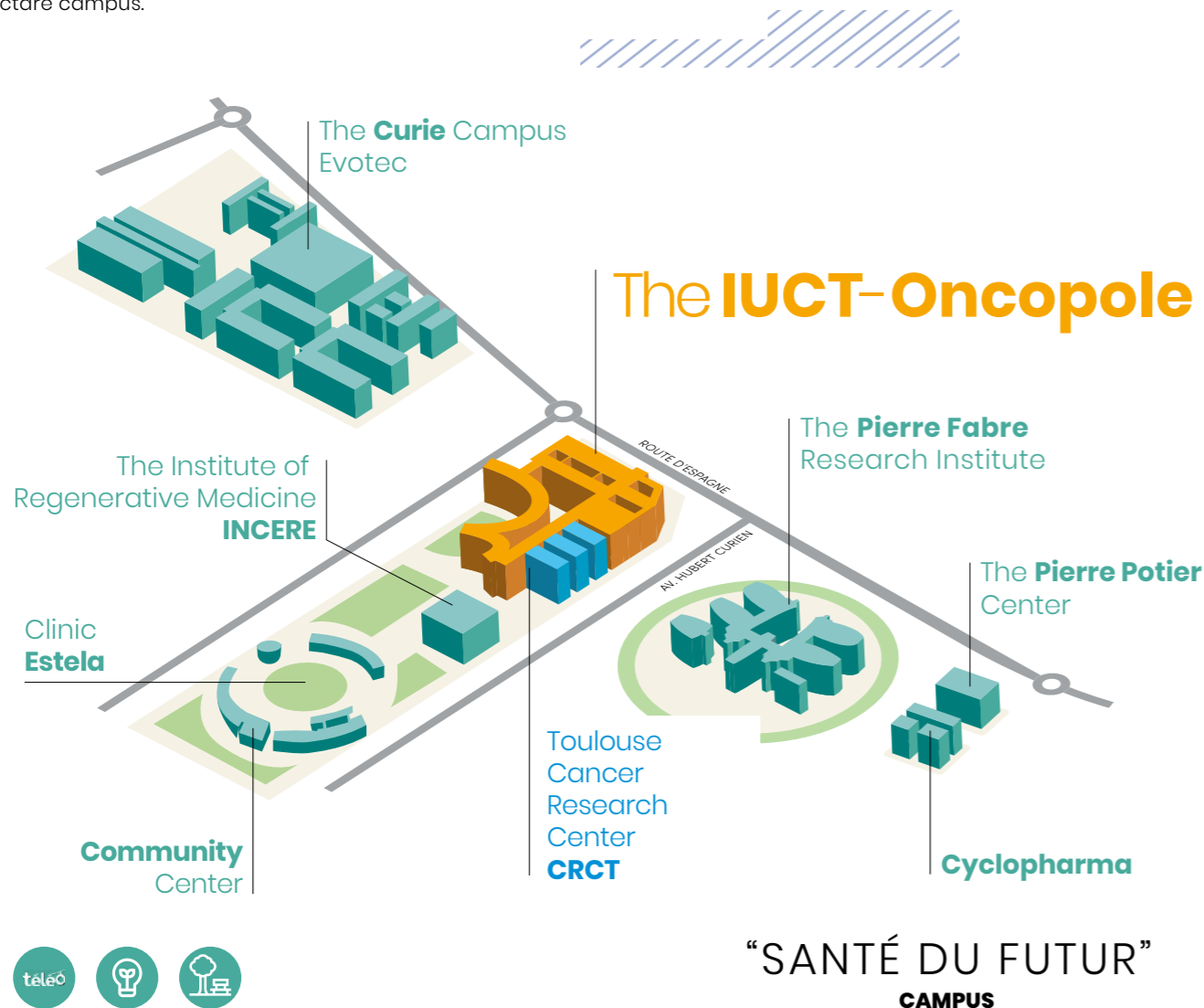
A UNIQUE SITE

At the heart of the “Santé du Futur” Campus

The IUCT-Oncopole and the Toulouse Cancer Research Center (CRCT) join forces to offer a unique continuum between research and care for the benefit of patients.

“SANTÉ DU FUTUR” CAMPUS

The IUCT-Oncopole and the CRCT are located on the “Santé du Futur” Campus, concentrating the competences from the academic, scientific, medical, clinical, and industrial public and private sectors striving for the same objective – the fight against cancer. More than 4,000 professionals work together every day on this 220-hectare campus.



“SANTÉ DU FUTUR”
CAMPUS



A UNIQUE SITE

Complementary on-site expertise

The **Etablissement français du sang – EFS (French National Blood Service)** has two teams on-site: a unit for sampling hematopoietic stem cells (HSC) from adults to meet the needs of the IUCT-Oncopole and a cellular therapy unit to prepare and store bone marrow and stem cell samples to respond to requests from other centers in the region, France and abroad. The CREFRE is a joint Inserm/ University of Toulouse III-Paul Sabatier research unit featuring state-of-the-art equipment housing zootechnics core facilities. The unit is hosted by the CRCT.



Specific regional cancer networks are mandated to coordinate all the stakeholders involved in cancerology within their remit. In Occitanie, the **Onco-Occitanie Network** federates health professionals in the region, offering resources, reliable information and common protocols facilitating patients' cancer care pathways. These missions enable the Network to help harmonize and improve professional practices, thereby improving care for cancer patients.

Several **patients' associations** intervene with patients hospitalized on-site. Some of them are housed on Campus, notably the local branch (31) of the Ligue Contre le Cancer, in the Maison Commune, a community center also providing various nearby services and support to patients.

Aside from **Evotec**, several **biotech companies** have set up on the Campus. **Four start-ups** are hosted at the IUCT-Oncopole and at the CRCT.



COVID-19

THE 2021 HIGHLIGHT

Evotec, the German pharmaceutical research group will be building a plant on the Toulouse Santé du Futur Campus to produce monoclonal antibodies against infectious diseases such as Covid-19. This biotechnology unit will employ 150 people and require a 150-million-euro investment.

Announced opening of the 12,000 m3 plant: 2024.



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