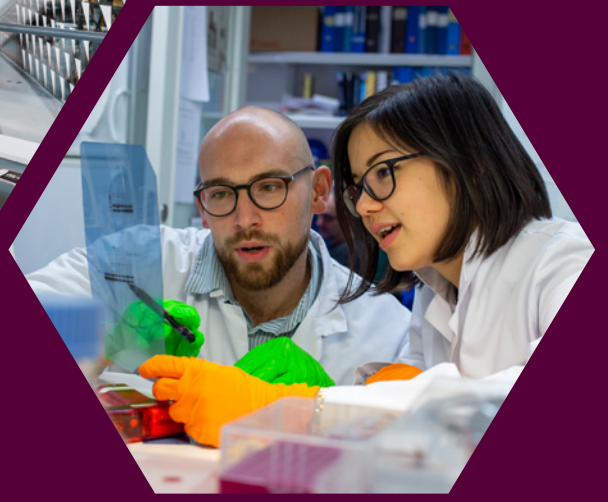
Welcome to the Department of Oncology–Pathology



Karolinska Institutet

Department of Oncology-Pathology

We are part of Karolinska Institutet, dedicated to advancing cancer research and offering educational programs at the undergraduate, master's, and doctoral levels. Bringing together more than 35 research groups, the department integrates cancer research at multiple levels, spanning basic, translational, and clinical studies - from investigating cancer development mechanisms and biomarkers to pioneering new technologies for precision cancer medicine. Additionally, our forensic medicine research contributes to advancements in legal and medical investigations.

Building on fundamental discoveries, our mission is to identify and implement cancer biomarkers that support early diagnosis and enhance personalized therapy, while also driving drug discovery through innovative clinical trials. We are committed to educating the next generation of scientists and healthcare professionals in these critical areas.

Our research teams are primarily based at two leading research facilities—BioClinicum and Science for Life Laboratory (SciLifeLab) in Solna—as well as within hospital settings, including the Clinical Pathology unit and New Karolinska University Hospital (NKS) in Stockholm.

SciLifeLab

Individual research groups are part of both the department of Oncology-Pathology and the SciLifeLab national infrastructure.

BioClinicum

We are located on floors 5 and 6 with skyways connecting us to NKS, Karolinska Institutet campus Solna and Biomedicum.

Clinical Pathology and NKS

We combine our health care responsibilities with education at doctoral and postdoctoral levels, clinical research and clinical trials.

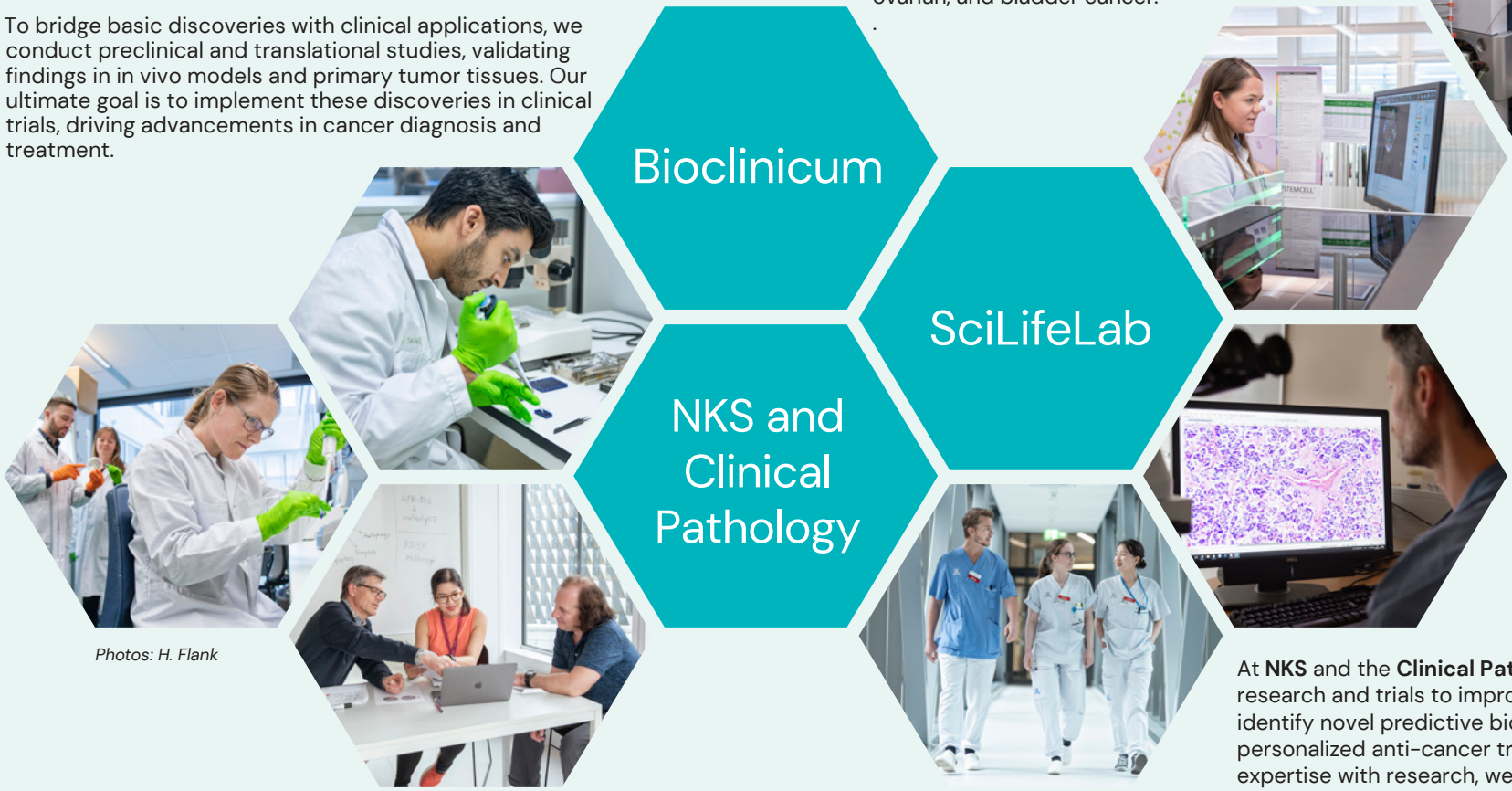
Photos: H. Flank

Photos om frontpage: H. Flank, Erik Cronberg, E.H. Cheteh & S. Ceder

Our research areas

At **BioClinicum,** we investigate the fundamental molecular mechanisms that govern cellular and physiological functions, both under normal conditions and during cancer development and progression. Our research focuses on key cell types and processes involved in cancer, including cancer cells and cancer-initiating cells, as well as cancer-associated stromal cells such as fibroblasts and endothelial cells. We also study angiogenesis, immune cells and inflammation, cell migration, and metastasis.

To bridge basic discoveries with clinical applications, we conduct preclinical and translational studies, validating findings in in vivo models and primary tumor tissues. Our ultimate goal is to implement these discoveries in clinical trials, driving advancements in cancer diagnosis and treatment.



Photos: H. Flank

At **SciLifeLab**, we develop innovative technologies and high-throughput platforms in proteomics, drug discovery, and drug repurposing. These platforms enable the identification of novel anti-cancer drugs and biomarkers, advancing functional precision medicine for cancer treatment.

Our multidisciplinary teams bring together experts in engineering, chemistry, and data science alongside oncologists, nurses, and physicians. Together, we drive precision cancer medicine programs across a range of cancer types, including leukemia, sarcoma, lung, breast, ovarian, and bladder cancer.

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At **NKS** and the **Clinical Pathology Unit**, we conduct clinical research and trials to improve early cancer diagnosis and identify novel predictive biomarkers for more efficient and personalized anti-cancer treatments. By integrating our clinical expertise with research, we accelerate the implementation of groundbreaking discoveries for the benefit of cancer patients.

Our clinical studies lead to the development of innovative diagnostic and prognostic tools, and integration into clinical practice. Oncologists and pathologists work collaboratively to develop and evaluate targeted therapies, while also collecting tumor tissues and samples in Biobanks to support ongoing and future translational research projects.

Our goals and strengths

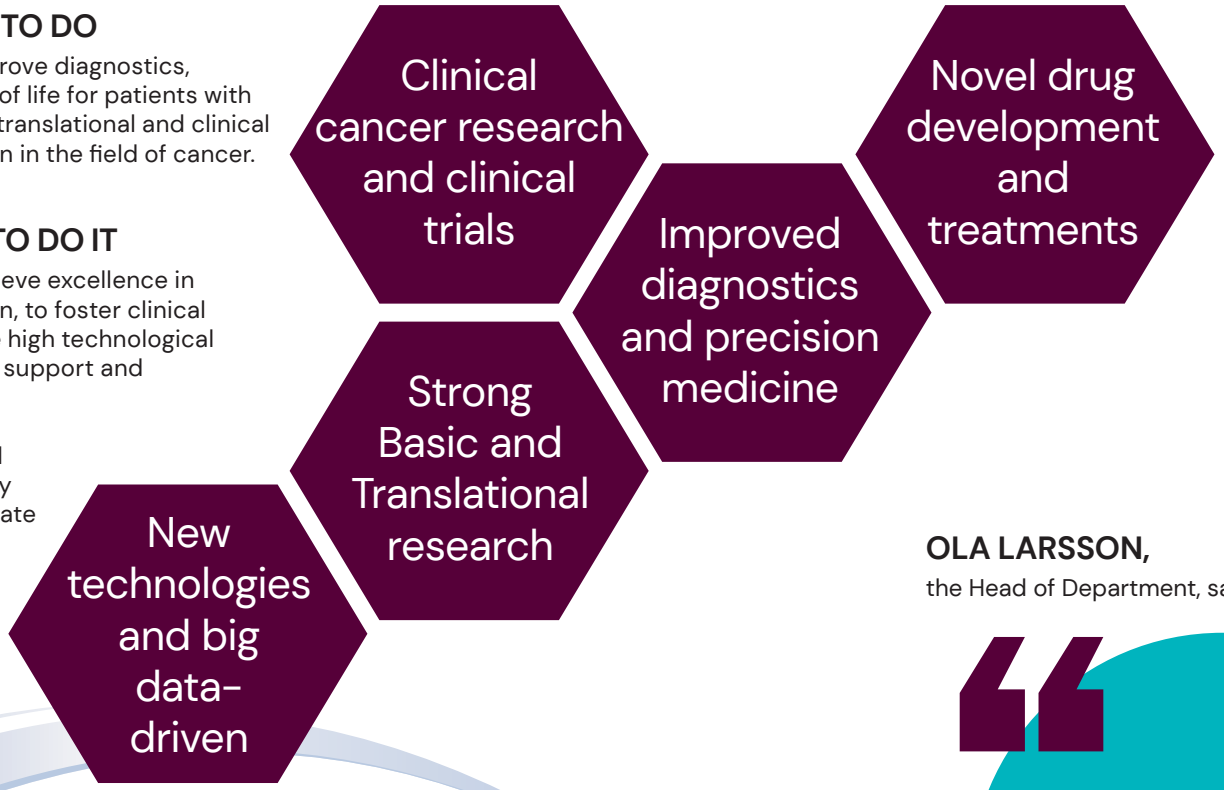
WHAT WE WANT TO DO

Our **MISSION** is to improve diagnostics, treatment and quality of life for patients with cancer through basic, translational and clinical research and education in the field of cancer.

HOW WE WANT TO DO IT

Our **GOALS** are to achieve excellence in research and education, to foster clinical research and to create high technological platforms for research support and innovation.

Our **VALUES** are based on ethics, high diversity and equality. We cultivate openness, networking and collaborations to consolidate national and international forces to cure cancer.



OUR STRENGTHS

- Translating basic knowledge and discoveries into practice
- Improved and personalized cancer diagnostics
- Ex vivo drug screenings for precision medicine
- Immune and gene therapy
- Clinical trials validating novel drugs and drug combinations
- Novel treatment regimen for improved quality of life
- New drug development and therapies
- High quality courses and educational programs
- Nurturing junior scientists for future leadership

OLA LARSSON,

the Head of Department, says:

We share skills, knowledge and resources through national and international networks, collaborations, conferences, courses and seminars and by building strong and advanced modern technological platforms."

Photo: S. Zimmerman

OUR NETWORKS ARE:

Cancer Research KI – network at Karolinska institutet
ki.se/en/cancerresearchki/cancer-research-ki

Cancer Core Europe – European Cancer Association
cancercoreeurope.eu/karolinska

Clinical cancer research

INSIGHTS FROM THE PANTHER TRIAL

The PANTHER trial has brought new hope to patients with high-risk early breast cancer by testing a tailored dose-dense (tDD) chemotherapy regimen. This approach, which differs from the standard treatment schedule, aims to better prevent cancer recurrence. The trial's results are promising, showing that patients who received the tDD chemotherapy had a higher chance of remaining cancer-free for 10 years compared to those who underwent the standard treatment.

The benefits of this tailored approach were observed across various patient groups, including women of different ages and those with specific types of breast cancer, such as luminal and HER2-positive. However, the advantage was less pronounced for patients with triple-negative breast cancer. Interestingly, the study also revealed that existing predictive tools underestimated the survival benefits of the tDD chemotherapy.

Moreover, the tailored chemotherapy provided consistent benefits across different risk levels, helping both lower and higher-risk patients. These findings suggest that tailored dose-dense chemotherapy could be a valuable option for treating high-risk breast cancer, offering better chances of long-term survival without recurrence.

Matikas A et al. Tailored Dose-Dense Versus Standard Adjuvant Chemotherapy for High-Risk Early Breast Cancer: End-of-Study Results of the Randomized PANTHER Trial. J Clin Oncol 2024; 10;42(26):3077-3082.

Matikas A et al. Benefit from dose-dense adjuvant chemotherapy for breast cancer: subgroup analyses from the randomised phase 3 PANTHER trial. Lancet Reg Health Eur 2024; 3;49:101162.

PHASE 1 TRIAL WITH TUMOR INFILTRATING LYMPHOCYTES AND DENDRITIC CELLS

Immunotherapy of cancer has achieved substantial progress, particularly when the Immune Checkpoint Inhibition, ICI, was introduced. This prolongs the survival of some patients with advanced melanoma. For those who fail, we are developing a new combination of two types of immuno-therapies. First, T-cells are extracted from the patient's tumor. These "Tumor Infiltrating Lymphocytes", TILs, an important part of the body's immune defense against cancer, are multiplied up to 50 billion cells and administered back to the patient in combination with Interleukin-2.

What makes this study unique compared to other clinical TIL trials is that the patients are at the same time treated with several doses of a tumor vaccine consisting of dendritic cells, DC, which activate the immune system and give the injected TILs an extra boost. Of the four severely ill patients with malignant melanoma that failed to respond to any other treatment, three have responded with a complete or near complete remission while patients treated with TILs mono-therapy did not have the same favorable response.

The method is a part of Karolinska University Hospital's efforts in cell-based therapy, and Rolf Kiessling, head of the study, has applied to the Swedish Medical Products Agency for approval to test the method on other types of metastatic cancer.

Lövgren T, Wolodarski M, Wickström S et al., Complete and long-lasting clinical responses in immune checkpoint inhibitor-resistant, metastasized melanoma treated with adoptive T cell transfer combined with DC vaccination. OncoImmunology 2020, VOL. 9, NO. 1, 1–11

THEO FOUKAKIS,
MD, Professor and group leader, says:

"Our mission is that all women with breast cancer will be cured with minimal negative HRQoL effects from the treatment. We therefore continue our clinical research that includes novel therapeutic regimens and a careful follow-up of the combined disease and quality of life parameters to improve the clinical management of breast cancer."

STINA WICKSTRÖM,
Group leader, head of TIL production and immune monitoring, comments:

"Our clinical study has shown that Cell therapy with T-cells and DC vaccine has remarkable strong clinical effects on metastatic advanced malignant melanoma. We hope that the same approach will be efficient in other solid tumors, such as gynecological cancer. This demonstrates the strength of interdisciplinary collaborations between basic scientists and clinicians at Karolinska Hospital in Solna and Huddinge."

Novel Drug Discovery and Biomarkers

TARGETING THE DNA DAMAGE RESPONSE

Understanding the basic science of DNA repair is key to develop novel treatment concepts, targeting proteins with small molecules. We work in multidisciplinary teams to combine our groundbreaking and strong basic understanding of cancer biology with novel technologies and expertise in drug discovery to perform translational research and identify and develop novel treatments.

In 2005 the Helleday team demonstrated that targeting the enzyme PARP was a promising anti-cancer therapy for BRCA mutated cancer, harnessing a novel synthetic lethal concept for treatment of cancer. This treatment is now approved in BRCA mutated ovarian, breast, prostate, and pancreatic cancers and widely used in the oncology clinic. Since then, the team has developed inhibitors to oxidative DNA repair proteins MTH1 and OGG1, which are promising strategy for treatment of cancer and inflammation, evaluated in clinical trials. Recently, compounds that increase the repair by OGG1 have been characterized and a novel way of targeting the DNA damage response through cancer-specific metabolism.

1. Bryant H.E. et al ... Helleday T. Specific killing of BRCA2-deficient tumours with inhibitors of poly(ADP-ribose)polymerase Nature 2005, 434, 913-7.

2. Gad H. et al. ... Helleday T. MTH1 inhibition eradicates cancer by preventing sanitation of the dNTP pool. Nature. 2014, 508(7495):215-21.

3. Visnes T. et al. ... Helleday T. Small-molecule inhibitor of OGG1 suppresses proinflammatory gene expression and inflammation. Science 2018, 16;362(6416):834-839.

4. Michel M. et al. ... Helleday T. Small molecule activation of OGG1 increases base excision repair by gaining a new enzymatic function. Science 2022, 376(6600):1471-1476.

5. Bonagas N. et al. ...Helleday T. Targeting MTHFD2 kills cancer via thymineless-induced replication stress. Nature Cancer 2022 3(2):156-172.

BIOMARKERS AND DRUG TARGETS IN THE TUMOR MICROENVIRONMENT

Cancer-associated fibroblasts (CAFs) is an important but poorly characterized cell type. The Östman group aims to better understand how CAFs contribute to tumor growth, and to exploit these cells as biomarkers and drug targets. Monika Ehnman's Team has a special focus on the understudied sarcoma microenvironment.

The group have identified novel pro-tumoral and anti-tumoral CAFs. Importantly, CAF composition of tumors shows large variation and associates with tumor aggressiveness and treatment response. One type of CAFs was found to predict radiotherapy response in breast cancer patients. Findings have been patented and are now being developed with a diagnostics company for validation and commercialization.

Most studies are collaborations with oncology and pathology experts as partners. Also, collaborations with SciLifeLab allow competitive and innovative tumor biology research and drug discovery efforts.

1. Pellinen T. et al. Fibroblast subsets in non-small cell lung cancer: associations with survival, mutations, and immune features. J Natl Cancer Inst. 2022, doi: 10.1093/jnci/djac178.

2. Strell C. et al. High PDGFRb Expression Predicts Resistance to Radiotherapy in DCIS within the SweDCIS Randomized Trial. Clin Cancer Res. 2021, 27(12): 3469-3477.

3. Strell C. et al. Impact of Epithelial-Stromal Interactions on Peritumoral Fibroblasts in Ductal Carcinoma in Situ. J Natl Cancer Inst. 2019, 111(9): 983-995.

THOMAS HELLEDAY,
Professor, says:

"Multidisciplinary teams working together with scientists across the planet, both in academia and industry, is the key to our success"

Photos: H. Flank

ARNE ÖSTMAN,
Professor, says:

"OnkPat provides excellent opportunities to develop basic tumor biology findings towards clinically relevant diagnostic routines and treatments"

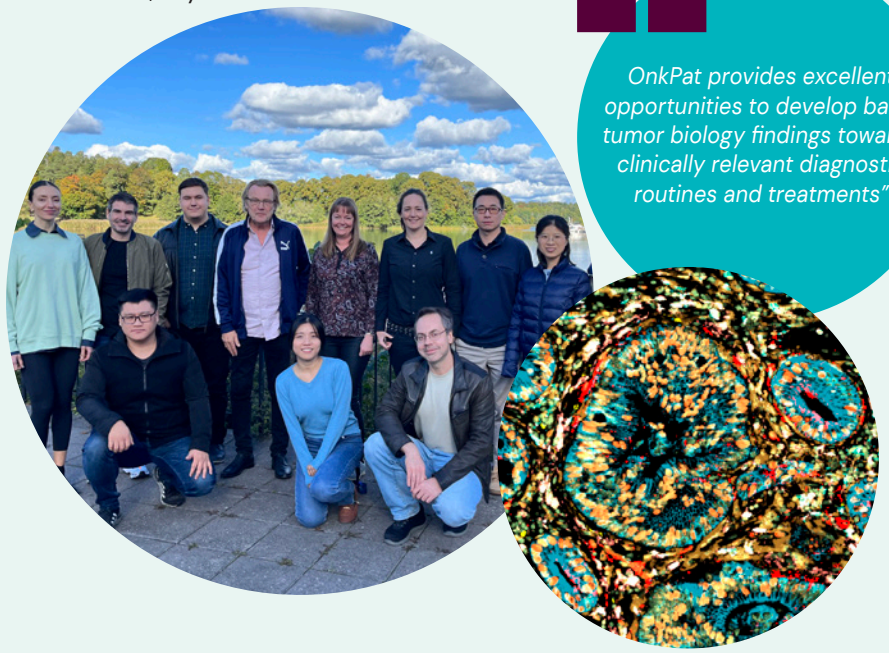
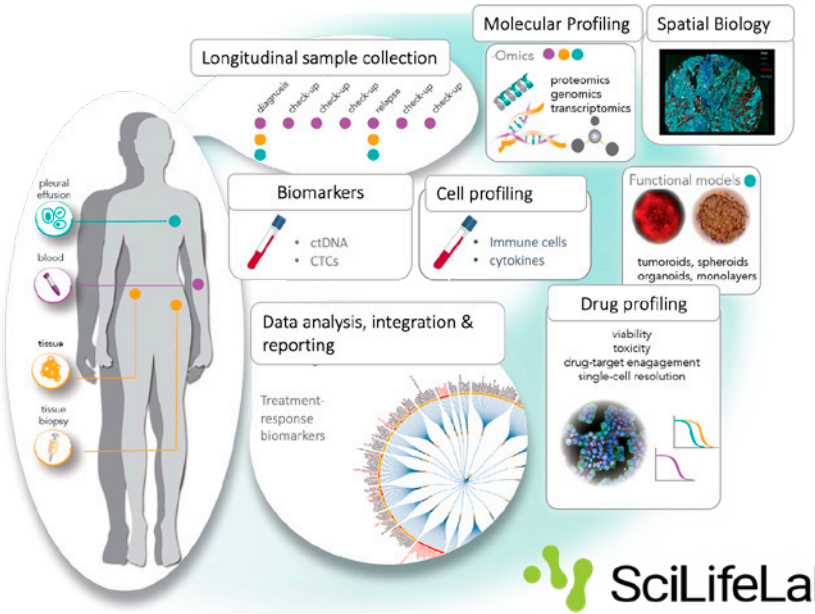


Photo: Linglong Huang

Precision Cancer Medicine Research

We are building a strong Precision Cancer Medicine (PCM) platform utilizing SciLifeLab technologies and in collaboration with Karolinska University Hospital. The combination of genomic and phenotype-level molecular profiling (multiomics) linked to drug efficacy profiling can improve how we match patients to potential treatments. The systematically generated data can also be applied to optimize drug discovery and development as well as help designing clinical trials for the cancer subtypes most likely to be responsive to the identified drugs or drug combinations.



PÄIVI ÖSTLING,
PI at SciLifeLab, says:

"We have established an efficient network and tight coordination between clinical and scientific teams, and put in place the technical solutions to screen the tumor cells from patients for sensitivity to a broad range of drugs and drug combinations. This is tricky but very rewarding when in the future the patients can benefit from the fine-tuned personalized treatment"

Photos: H. Flank

We teach cancer biology and oncology

We at The Department of Oncology-Pathology are enthusiastic teachers! Our main goal is to give the most comprehensive and state-of-the-art knowledge on mechanisms of cancer development, on cancer diagnostics and treatment as well as technical developments in these fields.

UNDERGRADUATE EDUCATION

- Courses in Tumor Biology, Medical and Molecular Oncology, advanced and palliative treatment, and Pathology and Forensic medicine. Target groups: KI students in Medicine and Biomedicine and Master students at KI.
- Commissioned courses in Tumor Biology-related subjects. Target groups: health care providers, pharmaceutical research companies.

GRADUATE EDUCATION

- Courses in Oncology, Tumor Biology, Tumor immunology, Molecular Methods, Omics, Bioinformatics. Target group: M. Sc., PhD students with full-time research at KI
- National research school (NatiOn) in clinical and translational cancer research. Target group: M.D. PhD students with a clinical or translational project in cancer research field, M.D. and future clinical researchers in the cancer field.
- Courses for physicians in specialist training.

NATIONAL RESEARCH SCHOOL (NATION) IN CLINICAL AND TRANSLATIONAL CANCER RESEARCH

The program offers a tailored package of post-graduate courses primarily in molecular oncology and research methods for MDs clinically active in the cancer field. During a total of 18 weeks divided into blocks during 2.5 years, a solid and advanced foundation for clinical cancer research is provided. Completion of this program meets the requirements at KI and most other Swedish medical universities for tuition in doctoral (Ph.D.) studies. We have also included a program in personal leadership to provide a strategy for maintaining a sustainable apporach in clinical and academic growth thourghout the carrier.

NICK TOBIN,

PhD, Associate Professor and Director of Undergraduate Studies says:

"Our department prides itself on providing the highest quality of education through the integration of expert basic and clinical researchers throughout our programs. We consistently promote youth and see teaching as a means to support the long-term future of our researchers, whilst also attracting talented students who are interested in solving complex tumor biology and oncology questions"

SVETLANA BAJALICA LAGERCRANTZ,

M.D., PhD, Adj. Professor and Chairman of NatiOn says:

"We created this school more than 10 years ago as a unique package of courses to provide the mandatory research education for medical doctors who want to combine clinical work and doctoral studies. With today´s rapid advances in molecular oncology, doctors need to learn more about research tools in order to actively participate in and lead clinical trials and studies. Only translational research can accelerate the clinical implementation of radically improved cancer treatment based on novel discoveries and drug development, leading to a more personalized treatment of each cancer patient!"

Working at Department of Oncology-Pathology

As part of Karolinska Institutet, we are committed to excellence in research and education. At BioClinicum, our strategic location between Karolinska University Hospital and SciLifeLab strengthens our close collaboration with the clinic and enables us to leverage state-of-the-art technologies in our work.

We foster a dynamic scientific community through regular events that encourage collaboration and knowledge exchange. These include weekly seminars, an annual conference, and our much-anticipated monthly breakfast gatherings in a relaxed setting. Our diverse team, representing many nationalities, also comes together for our annual International Party—a cherished tradition where members share homemade dishes from around the world.

Above all, we strive to ensure an inclusive and supportive environment where everyone is treated equally and has the opportunity to pursue their ambitions in research and personal growth.

Photo: H. Flank

The monthly ***"breakfast gatherings"*** bring out the news from the Department Chair and brief individual presentations with the latest breakthrough research.

Once a year the Department gathers at a ***Kick-off:*** a 1-day retreat full with scientific presentations from the groups followed by a delicious dinner. Coffee combined with poster presentations and fruitful discussions inspires collaborations.

Breakfast gatherings

Annual Conference

Our ***Annual Conference*** of the Department, "Frontiers in Cancer Research and Therapy", is being held for 17 years. We invite speakers from Sweden and abroad. The prizes are distributed for the best poster at the conference, the best Teacher and the best Scientific Paper of the year as well as the Dan Grandér prize for the best PhD thesis of the year in the field of cancer.

Kick-off

International Party

Seminars

International Party. As we are more than 30 nationalities united at the Department, we gather every year to taste the best food from all the corners of the world followed by games and dancing.

Seminars. Friday seminars with both Swedish and international speakers are organized weekly, as well as PhD students' seminars that are included in PhD education at KI. TRAP (Translational Research Activity Program) seminars held monthly are specifically devoted to clinical and translational research.

Contact

Have questions or interested to learn more about our research and activities? Contact the Head of the Department, Associate Professor Ola Larsson, **ola.larsson@ki.se**

Want to get more information about the structure and function of our department or about financial questions? Contact the Head of our Administration, Ulrika Almquist, **ulrika.almquist@ki.se**

For donations, use KI's SWISH 123 202 32 08 or the bank account 5310-6217 and write K7 (the code of our Department) and the name of the group leader whose research you want to support. Questions? Contact **ulrika.almquist@ki.se**

Want to enquire about the possibilities to do internship or Master at our Department, look for ads at KI home page or contact the group leaders directly. For questions about PhD education at Department of Oncology-Pathology, contact our Director of doctoral education Associate Professor Per Hydbring, **per.hydbring@ki.se** or Administrator Erika Rindsjö, **erika.rindsjo@ki.se**

Karolinska Institutet is one of the world's leading medical universities. Our vision is to advance knowledge about life and strive towards better health for all. Karolinska Institutet accounts for the single largest share of all academic medical research conducted in Sweden and offers the country's broadest range of education in medicine and health sciences. The Nobel Assembly at Karolinska Institutet selects the Nobel laureates in Physiology or Medicine.

Photo: H. Flank