

INSTITUTE FOR CANCER RESEARCH

ANNUAL REPORT 2021

**EXCELLENCE
IN FIGHTING
CANCER**

“Uniting biological and medical research to cure cancer”

EDITORIAL COMMITTEE:

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Ragnhild A. Lothe
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Kari Aalrust Berger

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Helse Sør-Øst
Apeland / Katrine Lunke
Thea Tønnessen, OUH

The photographic theme of this year's
Annual Report is Humans at ICR.
- The most important part of ICR is
by far its human resources and our
collective competence.

PAPER: 150/300 Profimatt
CIRCULATION: 800

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Dedicated to Cancer Research



I am happy to present our Annual Report for 2021. With less text than before we think it effectively communicates the key features of what we do. The twelve key topics of the report encapsulate the work and output from our research organisation, the Institute of Cancer Research (ICR). With outstanding research, the ICR should also excel in recruitment, training and career development, translation and innovation, dissemination and public outreach, and in collaboration in Norway and abroad (all covered in the following chapters). In addition, members of the institute at work are presented, and the report also features the architecture of the wonderful building that houses the ICR.

One aspect of the present report is that we now visualize that in addition to the 6 research departments, the 24 research groups and 6 core facility units, the ICR has a whole layer of scientifically independent project groups (31 on total) within the research groups bringing the number of PIs to well over 50 on total (chapter 4). In the same spirit, you can read about our efforts in training and career development in chapter 11.

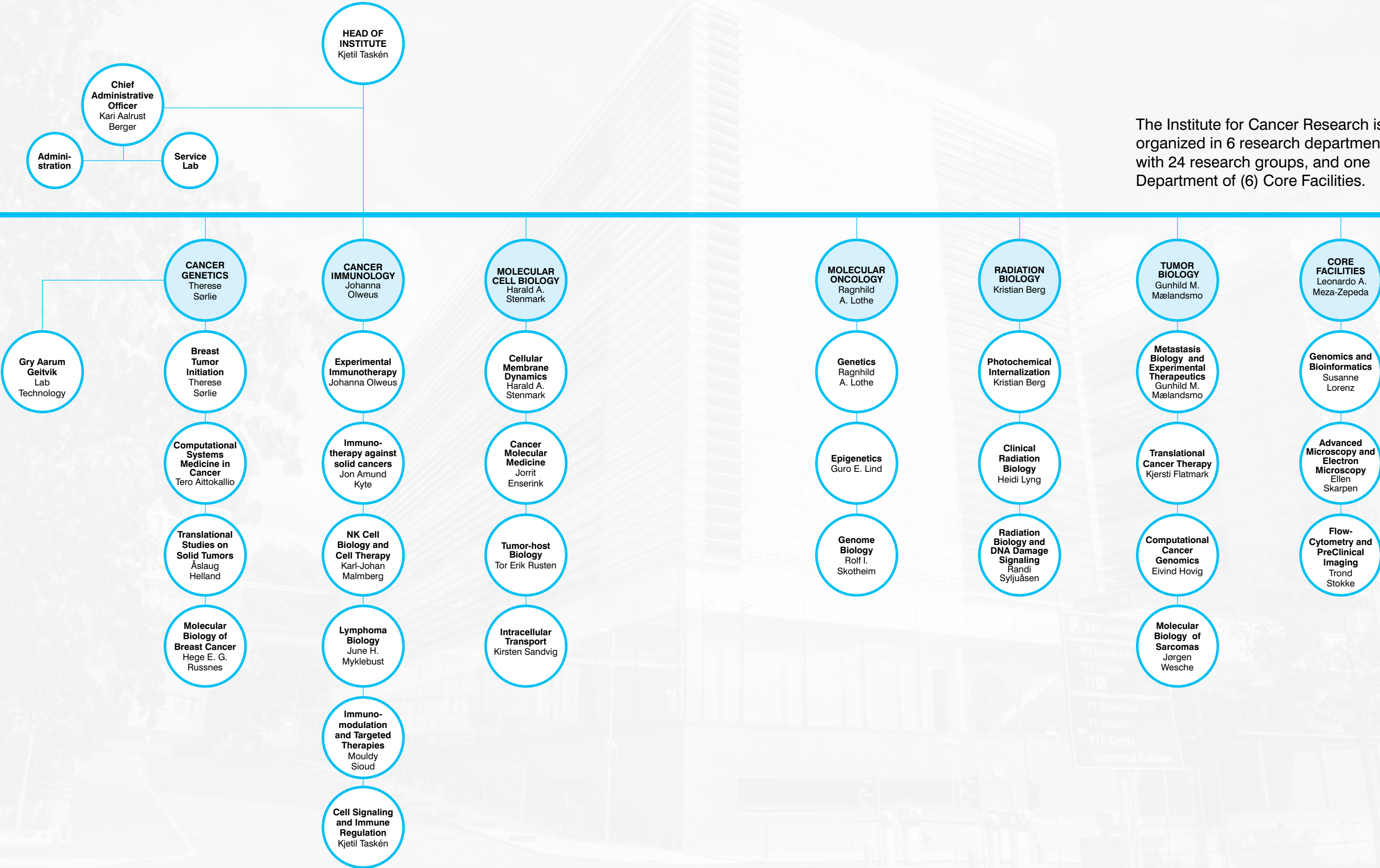
I encourage you to go through the report and read highlights from our exciting research. In line with our vision, values and objectives, the ICR sets out to maintain the excellent science and to further contribute to the grand challenges in cancer medicine and to position the ICR in national and international alliances and consortia.

March, 2022

Kjetil Taskén
Head of the ICR

“the ICR sets out to maintain the excellent science and to further contribute to the grand challenges in cancer medicine”

The Institute

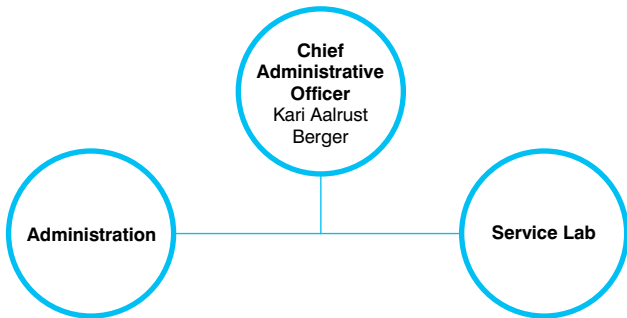


The Institute

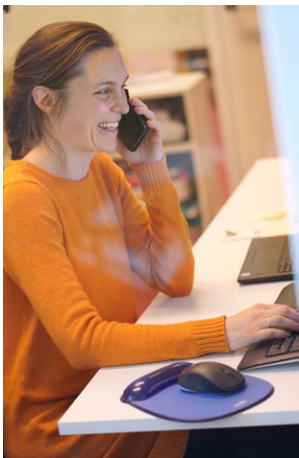
Administration



Kari Aalrust Berger, Mona Hagen, Marit Osland Haugli, Linda Uv Mjøen, Ikram Mahnin, Gro Live Fagereng, Helene Wold Ranum. Absent: Yong Fang Po, Yili Gan, Peter Wiedswang



EMPLOYEES: 10



Under the leadership of Kari Aalrust Berger, the ICR administrative unit of ten people provides support on a wide range of tasks:

- Budgeting and accounting for around 400 externally funded projects
- Support in application processes and grant writing
- Handling all HR-related tasks
- Health, Safety and Environment and management of technical installations in the building
- Public relations and ICR web site, coordinating the ICT-support group
- Responsibility for ICR conference and meeting facilities
- Operating Service Lab with washing and autoclaving facility for the building

“Serving to let our scientists excel at the ICR”

The Institute

Scientific Advisory Board members



Professor Carl-Henrik Heldin
Department of Medical Biochemistry and Microbiology, Uppsala University, Sweden. SAB Chair
[READ MORE](#)



Professor Carl Figdor
Head, Dept of Tumor Immunology, Institute for Molecular Life Sciences, Radboud UMC, The Netherlands
[READ MORE](#)



Professor Margaret C. Frame
FRSE, FmedSci, OBE, Professor of Cancer Research and Director, MRC Institute of Genetics and Molecular Medicine, University of Edinburgh, UK
[READ MORE](#)



Professor Ruth Palmer
Institute of Biomedicine, University of Gothenburg, Sweden
[READ MORE](#)



Professor Karen-Lise Garm Spindler
Department of Experimental Clinical Oncology, University of Aarhus; Consultant Oncologist, Aarhus University Hospital, Denmark
[READ MORE](#)



Professor Giulio Superti-Furga
Scientific Director, Research Center for Molecular Medicine (CeMM) of the Austrian Academy of Sciences, and Professor for Medical Systems Biology, Center for Physiology and Pharmacology Medical University of Vienna, Austria
[READ MORE](#)

Evaluation report by the Scientific Advisory Board

The Scientific Advisory Board (SAB) of the Institute met January 18-19, 2021. They reviewed vision, research strategies and future plans as well as performance of the Institute and its different departments.

From the written SAB evaluation:

- “Overall, the SAB was very impressed by the excellent standard of the scientific activities at ICR.
- The Institute houses some internationally leading groups and excellent papers reporting significant scientific discoveries have been published.
- ICR is very well organized The ICR Director and Leadership Team are to be congratulated on their excellent leadership, and to be commended for the formulation of a vision for ICR emphasizing quality, integrity and teamwork.
- There has been a noticeable development of ICR during the last few years.”

The SAB provided feedback and recommendations to the Institute and each department. We have worked with SAB feedback and made plans for how to use and integrate the SAB feedback in our forward strategic work.

“Overall, the SAB was very impressed by the excellent standard of the scientific activities at ICR.”

The Highlights

Institute researchers central in organizing the scientific program of >40 national and international scientific and popular meetings, including the EACR-OECI conference “Molecular Pathology”.

Institute researchers published >50 outstanding scientific papers with impact factor >10.

Institute researchers received 10 prizes and honors, including the Fridtjof Nansen Award for Excellence in Science to Harald Stenmark.

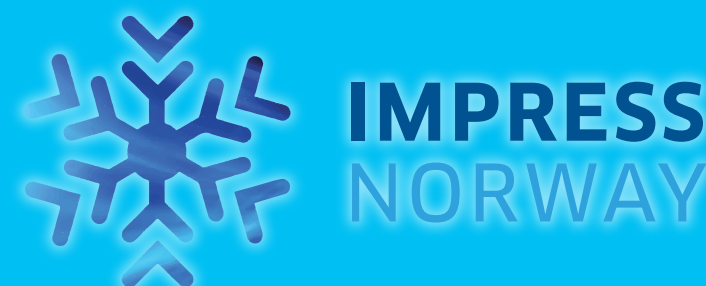


Institute investigator Prof. Åslaug Helland receives 128 mill NOK from the Research Council of Norway to lead a new clinical research centre, «MATRIX».

Institute researchers document >25 ongoing innovation projects and >10 industry collaborations, including renewed industry collaboration with Fate Therapeutics and six public-private collaborations for drugs and diagnostics to IMPRESS.



Institute Core Facilities accelerate their high throughput sequencing. Granted a NovaSeq6000 (Illumina) from the Norwegian Cancer Society and Radium Hospital Foundation.

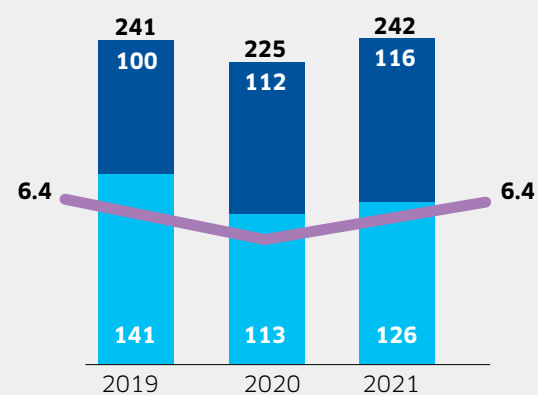


Institute researchers in the management of IMPRESS-Norway, a national researcher-initiated precision cancer medicine intervention trial, that opened in 2021 (>200 patients screened in InPreD and >50 included in treatment cohorts by Jan 2022). 20 trials open for cancer patients that depend on key collaborations with the Institute scientists.

The Achievements

Articles published

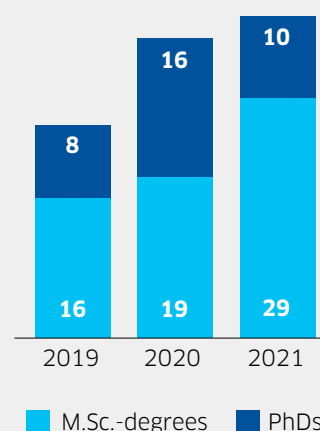
■ First or last authorship ■ Co-authors
— Impact factor median



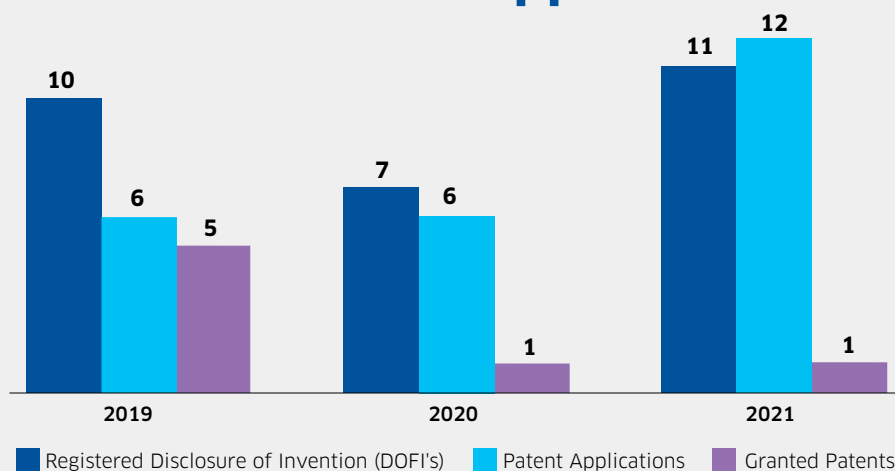
IMPACT FACTOR

	2019	2020	2021
Mean	8.5	7.6	8
Median	6.4	5.9	6.4

Completed PhDs and M.Sc.-degrees



DOFIs and Patent Applications



Selected papers with key authors from the Institute:

EMBO J 2021, 40:e107336 R. Khezri et al., and T.E. Rusten.

First and last author from Dept Molecular Cell Biology
Main finding: Host autophagy mediates organ wasting and nutrient mobilization that is utilized for tumor growth demonstrated in an in vivo model

Genome Medicine 2021 A. Sveen et al., and R.A. Lothe

First and last author from Dept Molecular Oncology
Main finding: The majority of somatic mutations in colorectal cancer are not expressed and the “expressed mutation dose” has prognostic and therapeutic relevance.

Hepatology 2021, 75:59-73. H.M. Vedeld et al., and G.E. Lind.

First and last author from Dept Mol Oncology
Main finding: Early detection of cholangiocarcinoma up to 12 months prior to diagnosis by tumor biomarkers in bile as the liquid biopsy source.

J Immunother Cancer, 2021, 9: DOI 10.1136/jitc-2021-003109. Flatmark K et al.
First author from Dept Tumor Biology
Main finding: Peptide vaccine targeting mutated GNAS may have application as treatment for pseudomyxoma peritonei.

Mol Oncol 2021, 16, 88-103. I.H. Rye et al., H.G. Russnes

First and last author from Dept Cancer Genetics
Main finding: Single cell immune profiling of lymph nodes with and without metastatic cells show that immune suppression occurs already in early stages of breast cancer progression.

Mol Syst Biol, 2021, 17, e9526, Jaiswal et al., and K. Aittokallio

Last author from Dept. of Cancer Genetics
Main finding: Identification of ECHDC1 as a novel breast tumor suppressor.

Nat Biotechnol 2021, Dec ahead of print. M. Ali*, E. Giannakopoulou* et al., and J. Olweus.
First authors and last author from Dept. of Cancer Immunology

Main finding: T-cell receptor-modified T cells targeting a lymphoid-specific enzyme (TdT) suggested as a promising immunotherapy for B-ALL and T-ALL that preserves normal lymphocytes.

Nat Commun 2021, 12:6427. O. Engebråten et al. A. Weyergang.

First and last authors from Dept Tumor Biology and Dept. Radiation Biology, respectively.
Main finding: Novel predictive biomarker for response to trastuzumab-emtansine in HER2+ breast cancer.

Nat Commun 2021, 12: 6577. K.O. Schink et al., and H. Stenmark.

First and last author from Dept Molecular Cell Biology
Main finding: Identification of a new regulator of macropinocytosis, the protein Phafin2 shown to modulate the cellular cytoskeleton and required for “cellular drinking”.

Nat Commun, 2021, 12, 5307 DOI 10.1038, Taavitsainen S, Engedal N, et al and Urbanucci A. Shared first (Engedal) and last author from Dept Tumor Biology.
Main finding: Gene patterns can predict prostate cancer treatment responses.

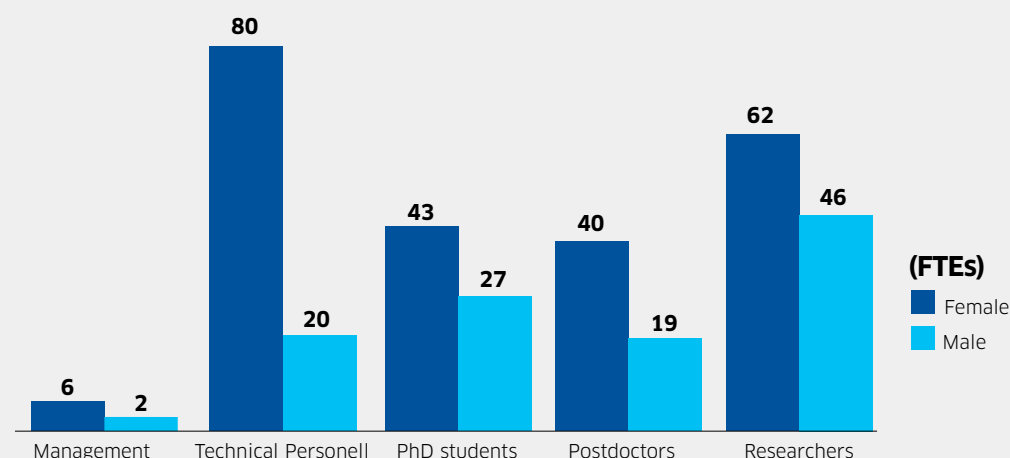
Nature 2021, 591, 142-146. Agudo-Canalejo J, Schultz SW, et al
Shared first author (Schultz) from Dept of Mol Cell Biol.

Main finding: Wetting whereby a liquid establishes a contact with a surface, is important for droplet sequestration during autophagy.

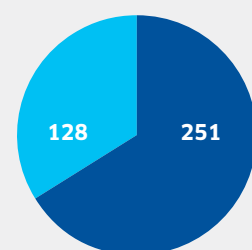
Science Signaling 2021 14(703):eabc8579. A.M. Lone et al., K. Taskén

First and last author: Dept Cancer Immunology
Main finding: Downstream signaling network through the EP1, EP2, EP3 and EP4 GPCRs on T cells involve more than 1,500 regulated phosphosites in receptor specific and shared signaling pathways.

The People

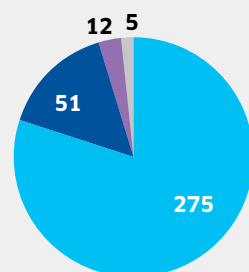


Employees by Gender
(total 379)



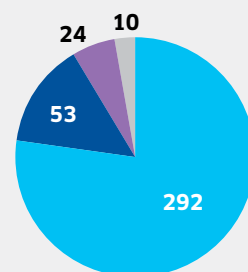
■ Female ■ Male

FTEs by Employer
(total 343)



■ ICR ■ UiO ■ OUH* ■ Other
*other than ICR

Employed by
(total 379)



■ ICR ■ UiO ■ OUH* ■ Other
*other than ICR

Prizes and Honors

- Fridtjof Nansen award for Excellence in Science to Harald Stenmark
- Oslo University Hospital "Excellent Researcher Award" to Ragnhild A. Lothe
- Oslo University Hospital "Early Career Award" to Marina Vietri
- Ragnar Mørk's Legacy's Prize for excellent cancer research to Anita Sveen
- Institute for Cancer Research "Researcher of the year 2021" to Kay Oliver Schink
- Institute for Cancer Research "Employee of the year 2021" to Idun Dale Rein
- Kolbjørn Brambani's cancer research grant awarded to Muhammad Ali at Oncology Forum
- Oslo University Hospital "Excellent article" prize to Eivind Heggernes Ask (Med 2021, 2:180-195.e5)
- Oslo University Hospital "Excellent article" prize to Sebastian W Schultz (Nature 2021, 591: 142-146)
- Oslo University appoints three new strategic research areas for young scientists: Spatial and multi-omics characterization of single cells to overcome treatment resistance in cancer has Thomas Fleischer and Mads Haugland Haugen from the Institute as co-leads (lead: Xavier Tekpli)

Completed PhDs 2021

Maxi-Lu Böschen

Cancer Immunology
Towards new T cell receptor-based cancer immunotherapy

Kristina Totland Carm

Molecular Oncology
Genomic aberrations and molecular subtypes in multifocal prostate cancer

Vegar Johansen

Dagenborg
Tumor Biology
Molecular and Immune Landscape of Colorectal Liver Metastases

Maria

Mastrangelopoulou
Radiation Biology
A novel approach to inner cancer treatment through the activation of photosensitizers by protons

Christian Naucke

Radiation Biology
Development of a large scale flow cytometry screening method to identify novel treatment options for cancer

Tonje Sønstevoid

Molecular Cell Biology
Implications of poly(alkyl cyanoacrylate) nanoparticle-induced cellular stress

Olaf Sørensen

Tumor Biology
Pharmacology of intra-peritoneal mitomycin C in pseudomyxoma peritonei

Kia Wee Tan

Molecular Cell Biology
Membrane Remodeling in Macropinocytosis

Judit Jing Wen Wong

Radiation Biology
Photochemical Strategies to Eliminate Cancer Cells

Asa Kristina Öjlert

Cancer Genetics
The non-small cell lung cancer tumor immune microenvironment: implications for treatment and prognosis

New project leaders



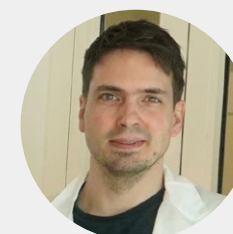
Nikolai Engedal,
Department of Tumor Biology



Vilde Drageset Haakensen,
Department of Cancer Genetics



Bjarne Johannessen,
Department of Molecular Oncology



Alf Håkon Lystad,
Department of Molecular Cell Biology



Sigrid Skånland,
Department of Cancer Immunology



Marina Vietri,
Department of Molecular Cell Biology

The People

International Staff Distribution

118

PEOPLE IN TOTAL
FROM OUTSIDE
NORWAY

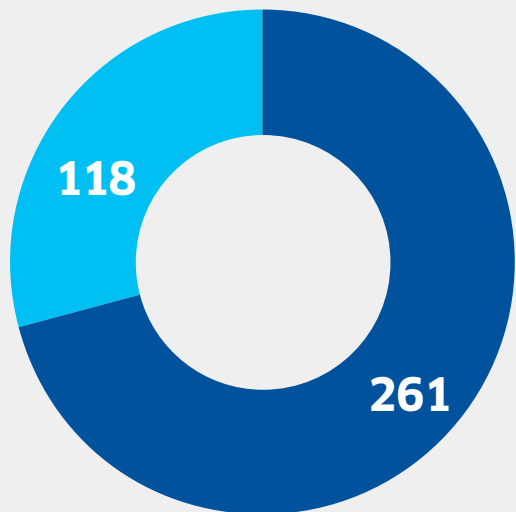
33

NATIONS ARE
REPRESENTED

01

Countries
represented
by one person

Australia
Brazil
Colombia
Croatia
Egypt
Estonia
Holland
Peru
Russia
Singapore
Switzerland



■ Norwegian: 261 (69%)*
■ International: 118 (31%)
*Including naturalised foreigners

02

People

Chile
Czech Republic
Finland
Japan
Lebanon
Serbia
USA

03

People

Great Britain
Iran
Portugal

04

People

Austria
France

05

People

Hungary

06

People

Greece
Lithuania
Poland
Spain
Sweden

07

People

Italy

08

People

India

12

People

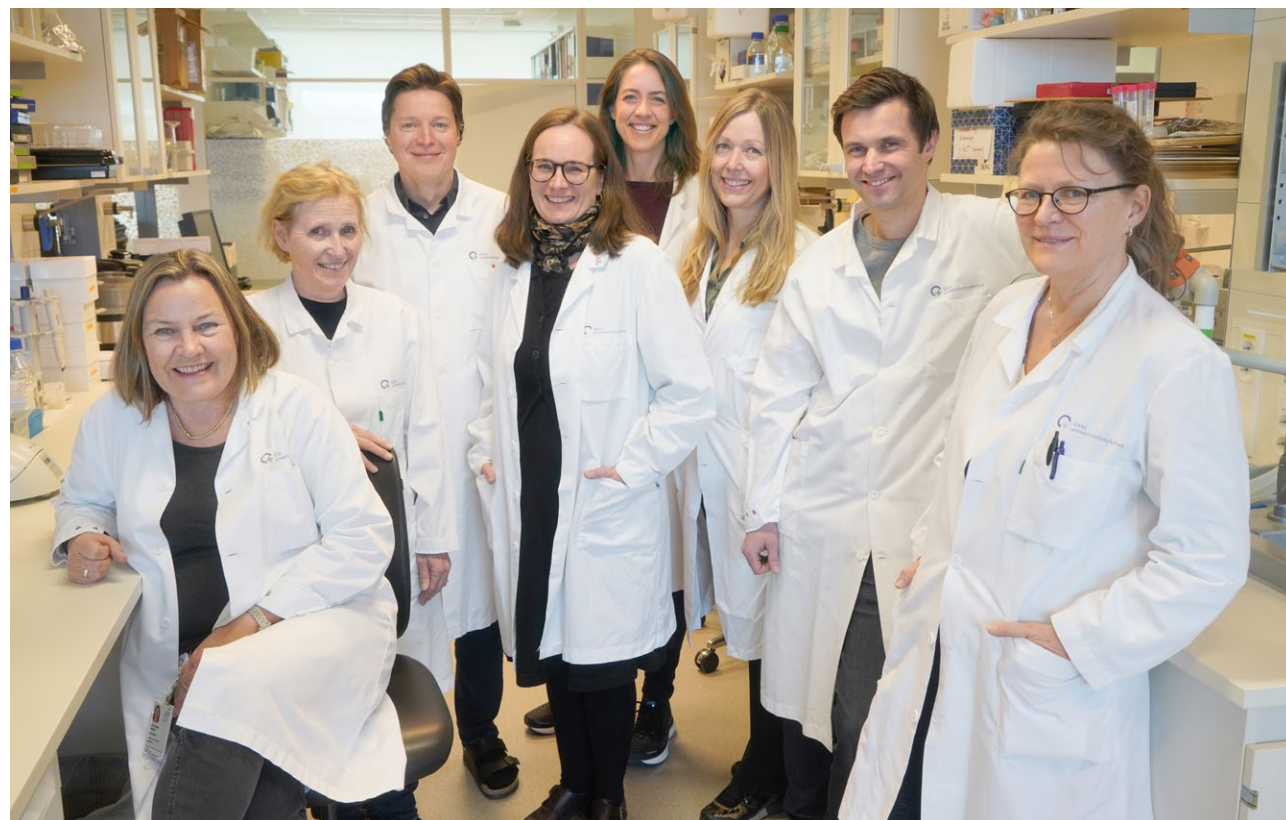
Germany

14

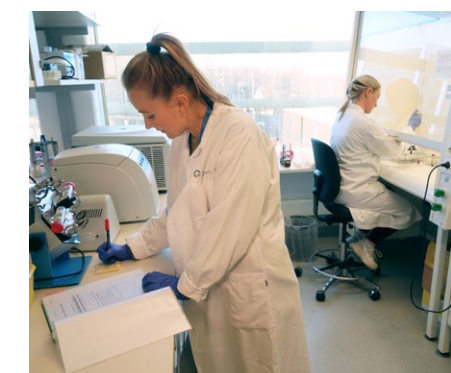
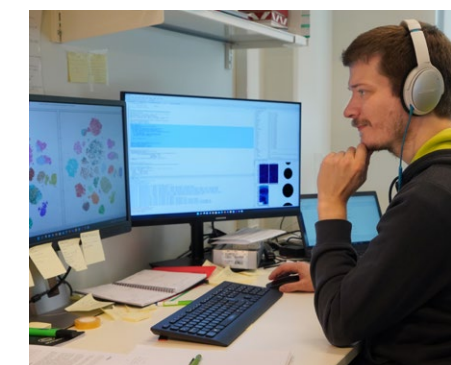
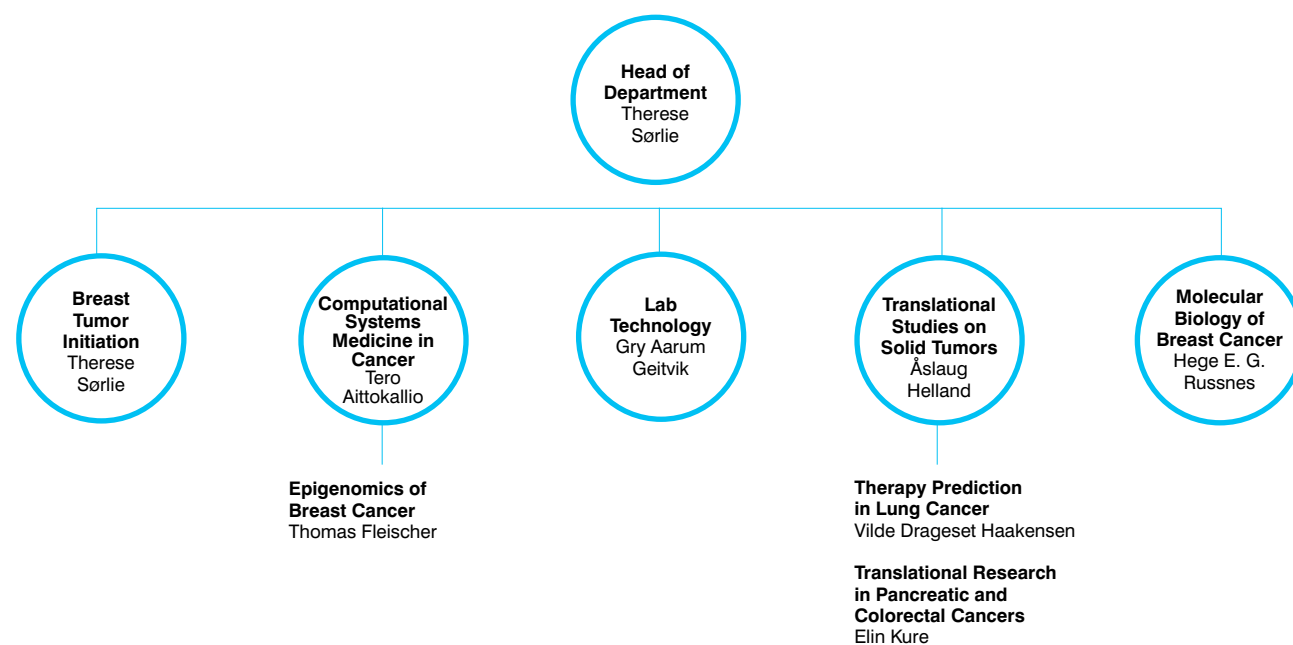
People

China

Department of Cancer Genetics



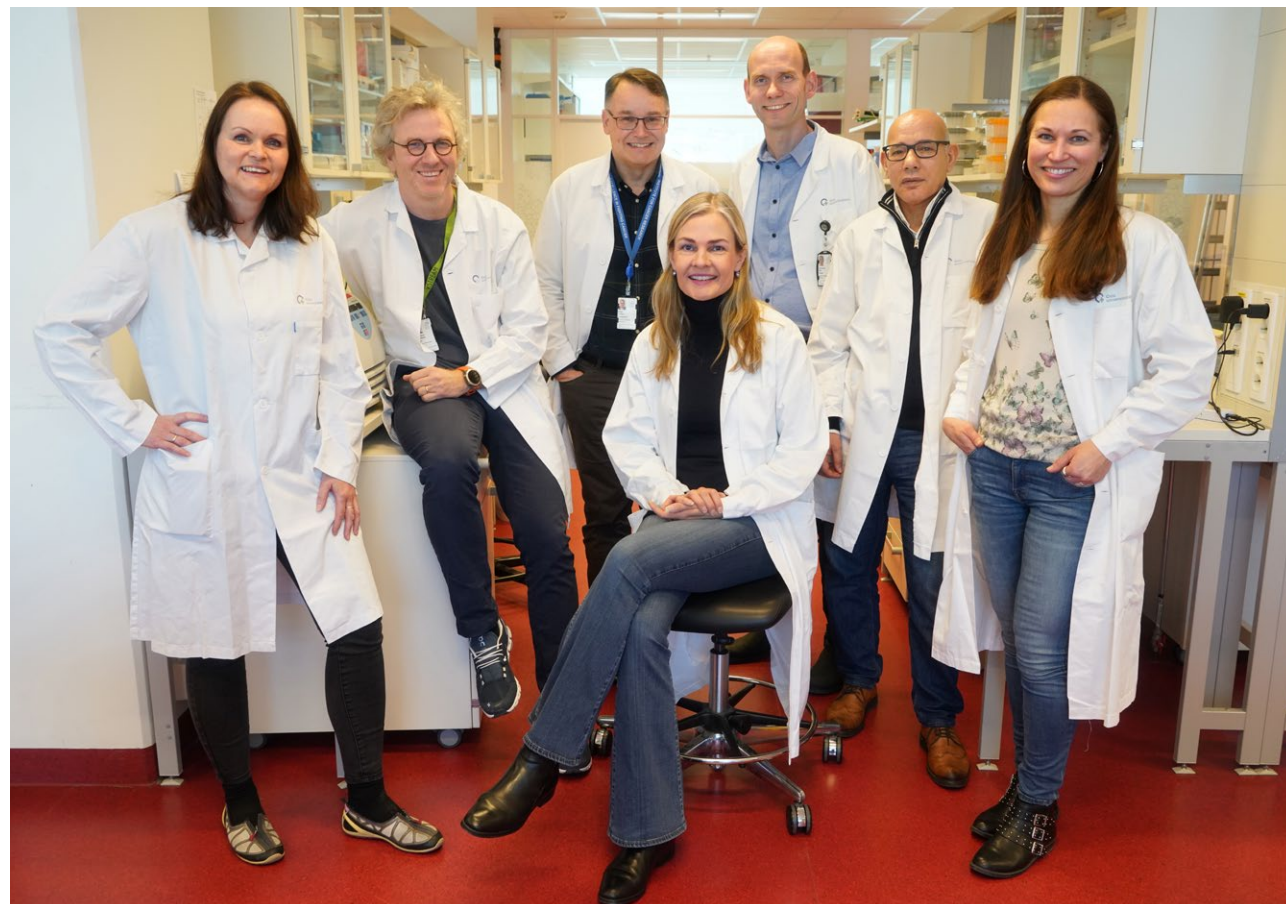
Gry Aarum Geitvik, Elin Kure, Tero Aittokallio, Hege E. G. Russnes, Vilde Drageset Haakensen, Therese Sørli, Thomas Fleischer, Åslaug Helland



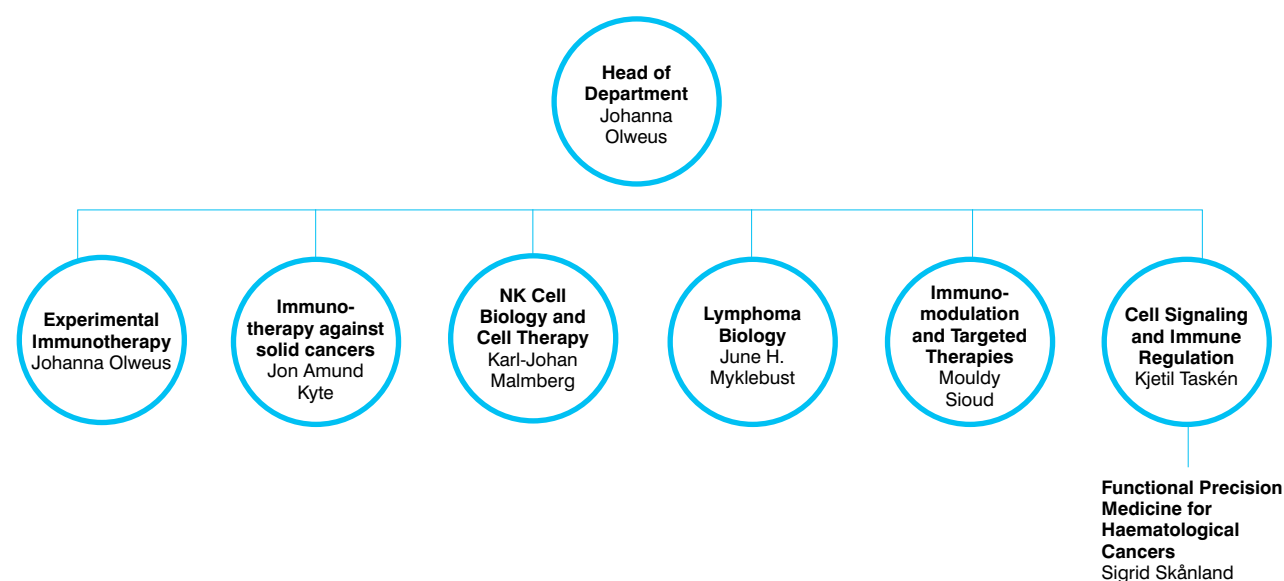
- Integrated molecular and clinical studies to reduce risk, diagnose early, improve prognosis, and tailor treatment for breast, lung and pancreas cancer
- We published 52 scientific articles in 2021
- We secured 30 million NOK in grant funding for our research groups (including personal grants to T Sørli and T Fleischer)
- IMPRESS-Norway- national prospective precision medicine study included the first patients in 2021. Key leaders from DCG H. Russnes and Å. Helland
- MATRIX-128 mill NOK funding secured to a new research center for cancer treatment. PI Å Helland
- Partner in PANCAIM – “Pancreatic cancer AI for genomics and personalized Medicine”, Horizon 2020 EU project, secured 1.18 mill EUR (partners T Aittokallio, E Kure)
- Initiated two observational studies in breast cancer with extensive biobanking and translational research (LATE, AXL) (H Russnes PI, I Rye, co-PI)
- Leading two lung cancer clinical trials (DART/NIPU) (Å Helland PI, V Haakensen co-PI)

“Our mission is to improve the lives of cancer patients through scientific advances in precision oncology”

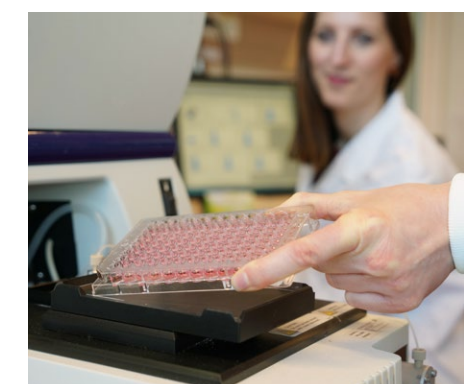
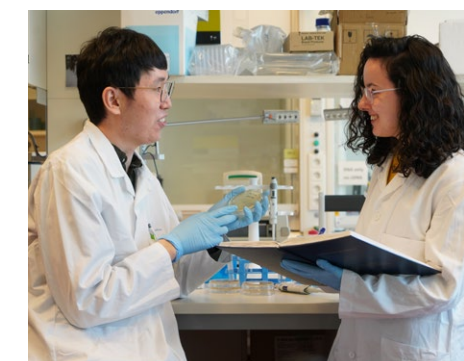
Department of Cancer Immunology



June H. Myklebust, Karl-Johan Malmberg, Kjetil Taskén, Johanna Olweus, Jon Amund Kyte, Mouldy Sioud, Sigrid Skånland



EMPLOYEES: 79



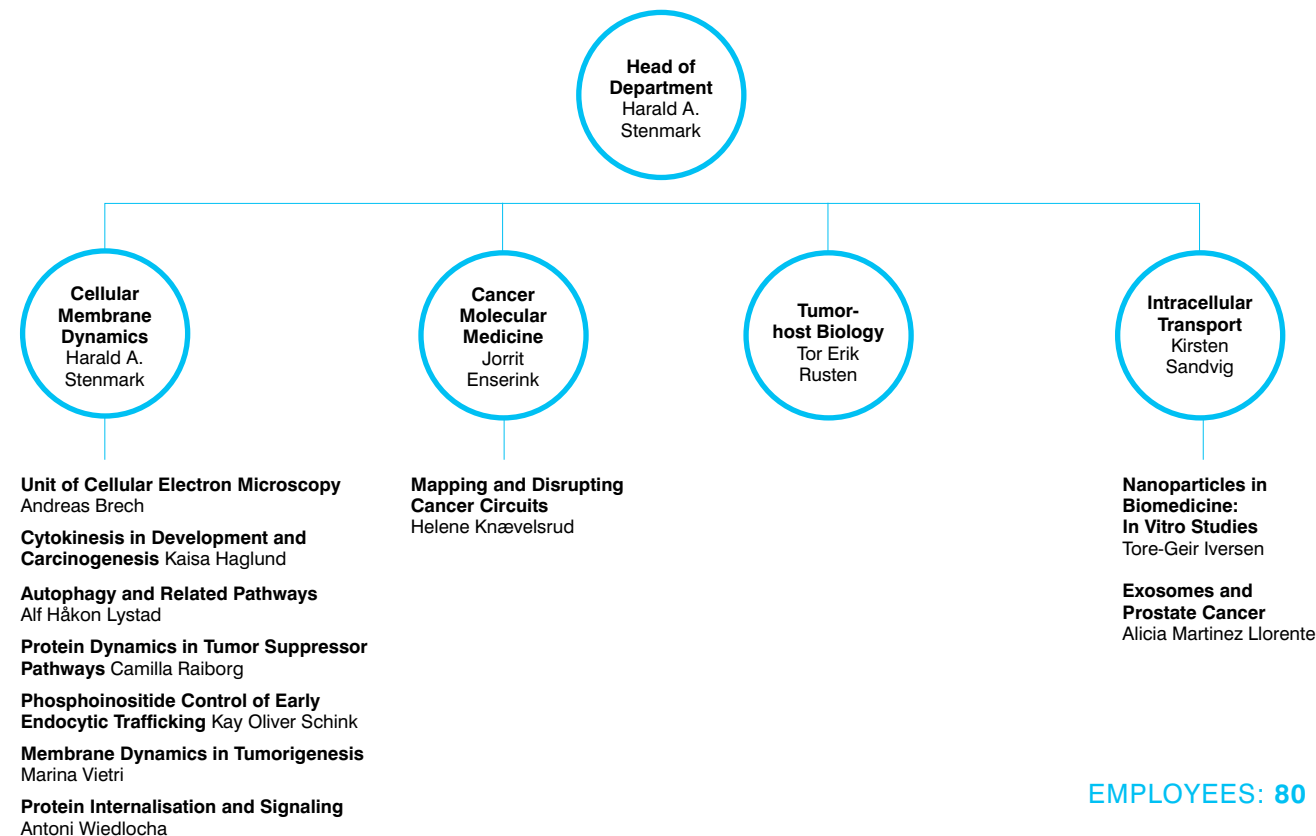
- Published 34 articles; median IF of >8 and >50% with first and/or last authors from DCI, graduated one PhD, submitted 5 priority/PCT patent applications and got 1 granted patent
- Publication highlights: Articles in Nature Biotechnology, Blood and Science Signaling as first/last authors, and in Nature and Cell Stem Cells as co-authors
- Contributed to development of machine-learning framework Ecotyper for large-scale profiling of cell states and cellular ecosystems in lymphoma (first author, Cancer Cell)
- National funding: Norwegian Centre for Clinical Cancer Research (MATRIX) funded with 128 mill NOK, with several DCI members involved in leadership/as PIs. Renewed Open Call grants from HSØ and The Norwegian Cancer Society.
- International funding: DCI group partner on EU funded consortium – cell and gene therapy project (GeneTiga – Charité Berlin coordinator)
- Renewed Industry collaboration with Fate Therapeutics 18 mill NOK.
- Organized Nordic conference on chronic lymphocytic leukemia for >200 participants
- PI for three clinical experimental immunotherapy trials that completed patient enrollment in 2021

“Our goal is to improve cancer diagnostics and therapy through cutting edge research on tumor immunology and lymphocyte biology”

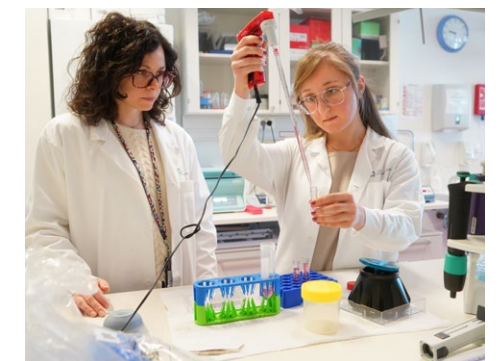
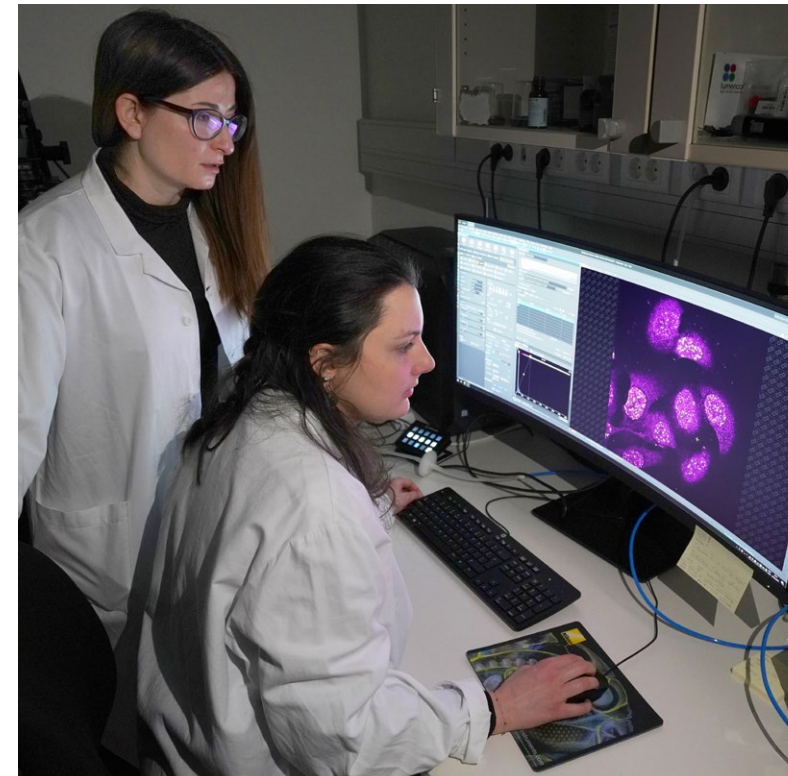
Department of Molecular Cell Biology



Kaisa Haglund, Kirsten Sandvig, Camilla Raiborg, Harald A. Stenmark, Antoni Wiedlocha, Kay Oliver Schink, Marina Vietri, Alf Håkon Lystad, Tor Erik Rusten, Alicia Martinez Llorente, Tore-Geir Iversen. Absent: Jorrit Enserink, Andreas Brech, Helene Knævelsrud



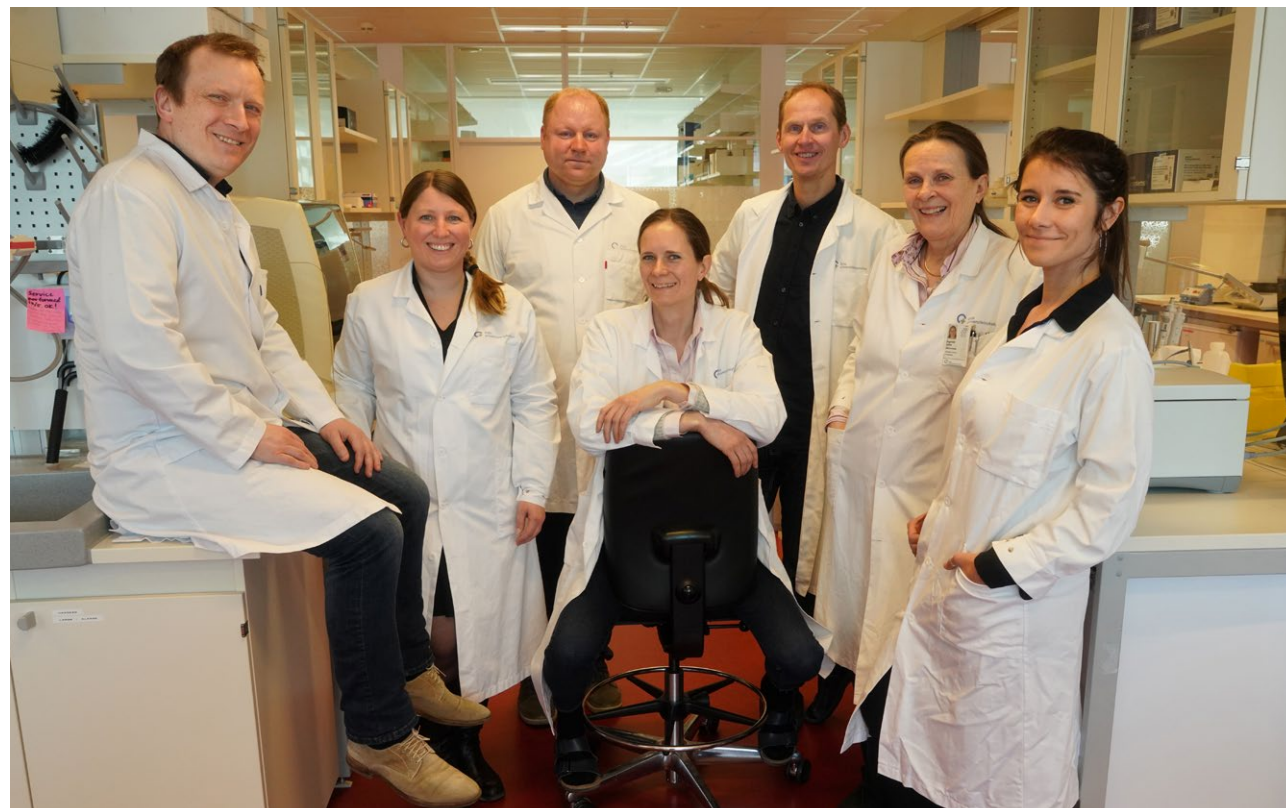
EMPLOYEES: 80



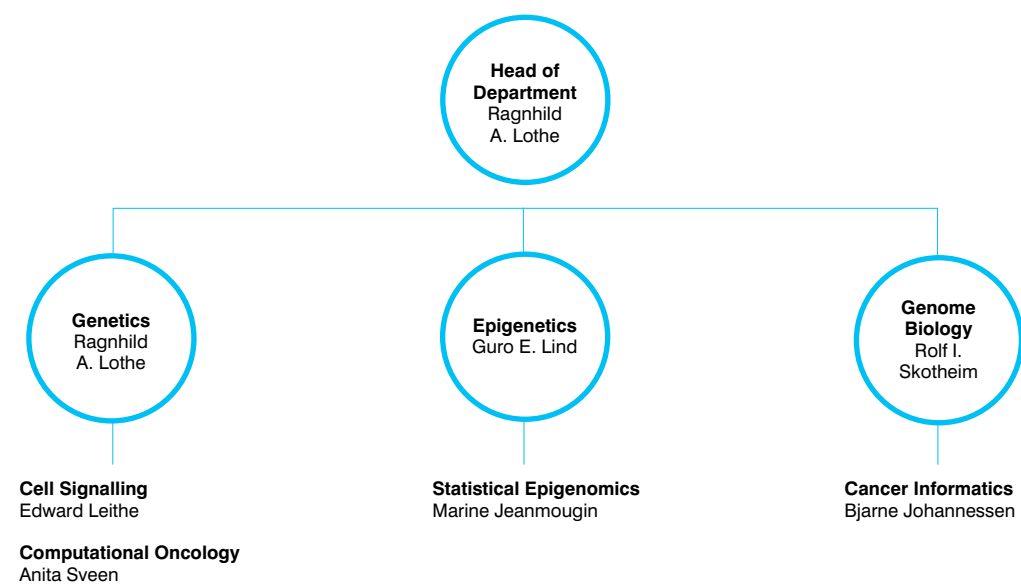
- MCB scientists published 44 papers in 2021 and were lead authors of articles in important journals such as *Nature*, *Nature Communications*, *EMBO Journal*, *Cell Reports*, *Nano Today*, *European Urology*, *Journal of Extracellular Vesicles*, and *Autophagy*.
- Kia Wee Tan and Tonje Sønstevold received their PhD degrees in 2021
- Marina Vietri received “Early Career Award” from Oslo University Hospital
- Kay O. Schink was awarded “Researcher of the Year” at Institute for Cancer Research
- Alf Håkon Lystad received a Young Research Talents grant from the Research Council, “DETECT and PROTECT - Surviving Insults to intracellular compartments”.
- MCB scientists were awarded two UiO Life Science Convergence Grants – “Modeling human multi-organ Interaction in disease - cancer cachexia” led by Tor Erik Rusten, and “Role of autophagy in healthy aging” with participation of Jorrit Enserink and Helene Knævelsrud
- Alicia Llorente received an EEA Baltic Research Program grant - “Exploring the molecular mechanisms behind the effects of physical exercise on breast cancer prevention”
- Helene Knævelsrud received a grant from the South-Eastern Norway Regional Health Authority, “Unraveling the role of autophagy in kidney cancer”.

“Uncovering the cellular basis of cancer development”

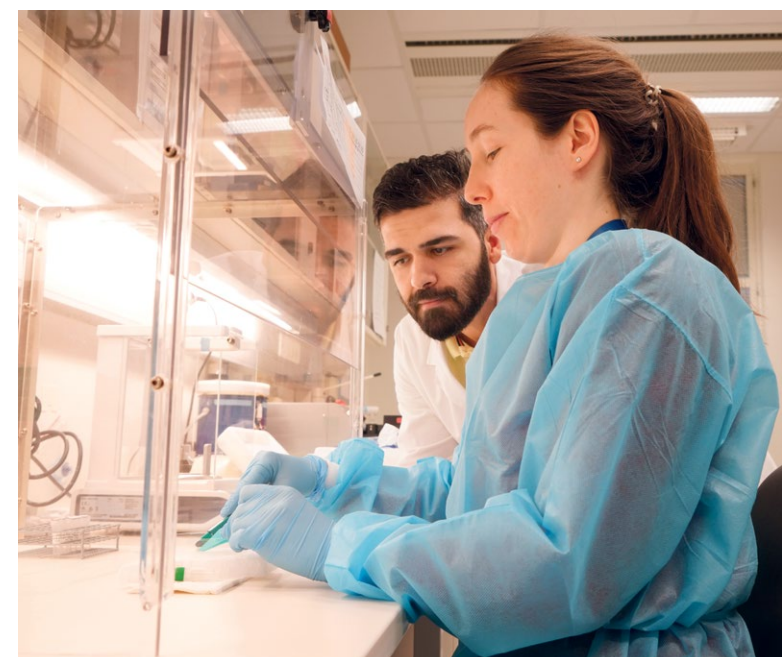
Department of Molecular Oncology



Bjarne Johannessen, Guro E. Lind, Edward Leithe, Anita Sveen, Rolf I. Skotheim, Ragnhild A. Lothe, Marine Jeanmougin



EMPLOYEES: 42



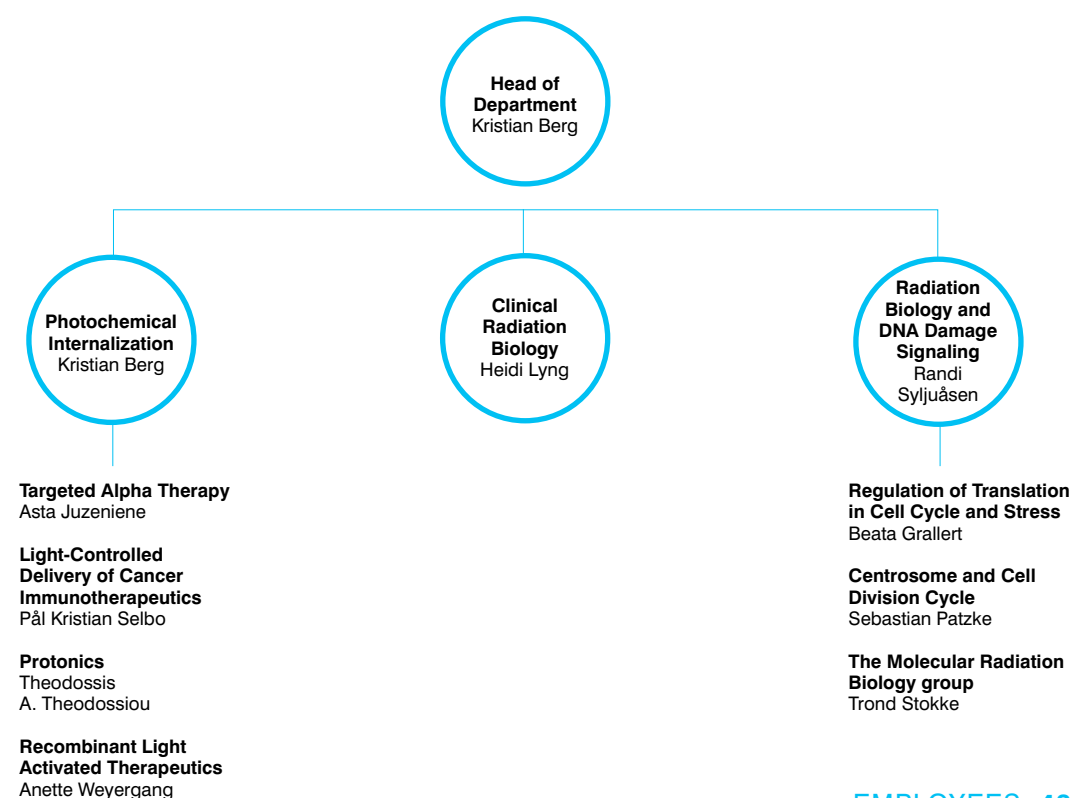
- Our department celebrated its 15th anniversary in 2021 with successful completion of the 75th University degree (34PhD and 41MSc)
- Early detection of cholangiocarcinoma up to 12 months prior to diagnosis by tumor biomarkers in bile as the liquid biopsy source (Vedeld et al. Lind, Hepatology, 2021)
- Development of a metastasis-oriented framework for gene-expression based subtyping of colorectal cancer (Moosavi et al. Sveen, Genome Med 2021), and continues as an innovation project
- We demonstrated that the majority of somatic mutations in colorectal cancer are not expressed, and showed proof-of-concept that “expressed mutation dose” has prognostic and therapeutic relevance (Sveen et al. Lothe, Genome Med 2021)
- New genetic risk loci for testicular cancer identified by The Global Testicular Cancer Consortium (partner Skotheim) analyzing 10 000 patients (Pluta et al., Nat Comm)
- We completed the reference database of organoid lineages of metastatic colorectal cancer screened for sensitivity to 47 anticancer agents for the EVIDENT trial of ex vivo pharmacogenomics-guided experimental therapies
- Ragnhild A. Lothe received the Excellent Researcher award from Oslo University Hospital and Anita Sveen received Dr. Ragnar Mørk’s legacy prize for excellent cancer research
- President of the Norwegian Association for Researchers, group leader Lind, appeared in 170 news coverages in national media, discussing early career development and employment conditions for researchers

“Biological discoveries for improved precision cancer medicine”

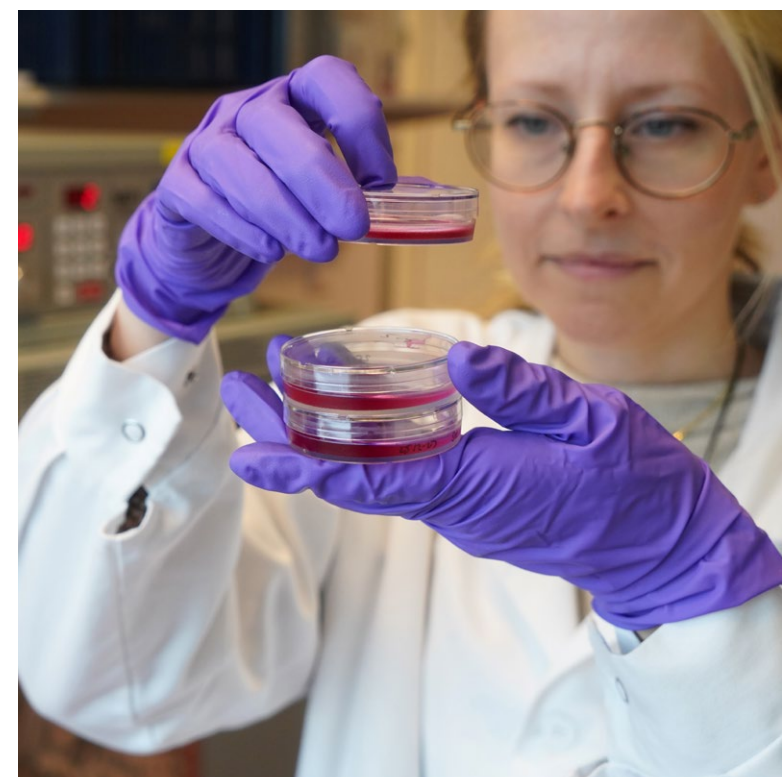
Department of Radiation Biology



Asta Juzeniene, Kristian Berg, Anette Weyergang, Sebastian Patzke, Randi Syljuåsen, Pål Kristian Selbo, Heidi Lyng,
Absent: Theodossis A. Theodossiou, Beata Grallert, Trond Stokke



EMPLOYEES: 43



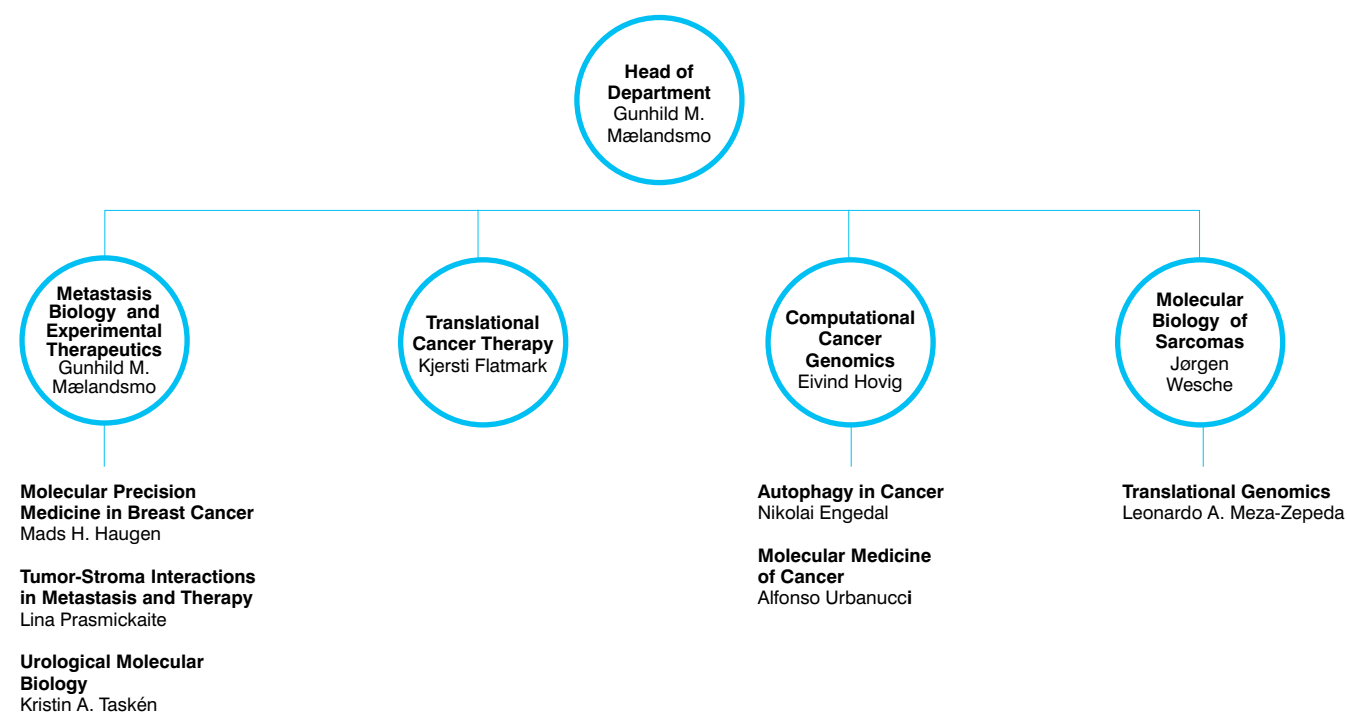
- Rab5A documented as a novel biomarker for treatment outcome for antibody drug conjugates published in Nat. Comm (Weyergang/Berg).
- New knowledge about ATR and WEE1 inhibitors in the presence and absence of radiation published in Cancers (Rødland/Syljuåsen)
- Our publications have provided preclinical data for the regulatory approval for a clinical trial of 212Pb-NG001 (Nucligen AS) in Norway (Juzeniene)
- Established genetic and super-resolution microscopy protocol to solve molecular mechanism underlying a genetically caused loss of hearing and vision (Patzke)
- Organizer of the Norwegian part of the international Biology-Guided Adaptive Radiotherapy (BiGART) conference (Lyng and Syljuåsen, by NIRO)
- Biomarker project admitted to the SPARK innovation program (Weyergang)
- Initiated collaboration with Kortuc Inc (Japan) for the implementation of our imaging biomarker in a clinical radiotherapy trial in cervical cancer patients in USA (Lyng, Hompland).
- Appointed chair of the Radiobiology Committee in the European Society for Radiation Oncology (ESTRO) (Lyng)

“Our goal is to develop new predictive methods and treatment strategies for improved radiation therapy”

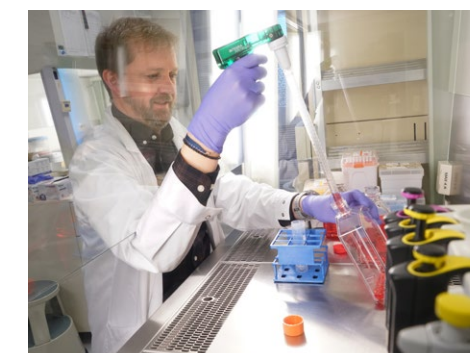
Department of Tumor Biology



Eivind Hovig, Alfonso Urbanucci, Lina Prasmickaite, Jørgen Wesche, Kjersti Flatmark, Leonardo A. Meza-Zepeda, Kristin A. Taskén, Mads H. Haugen, Gunhild M. Mælandsmo. Absent: Nikolai Engedal



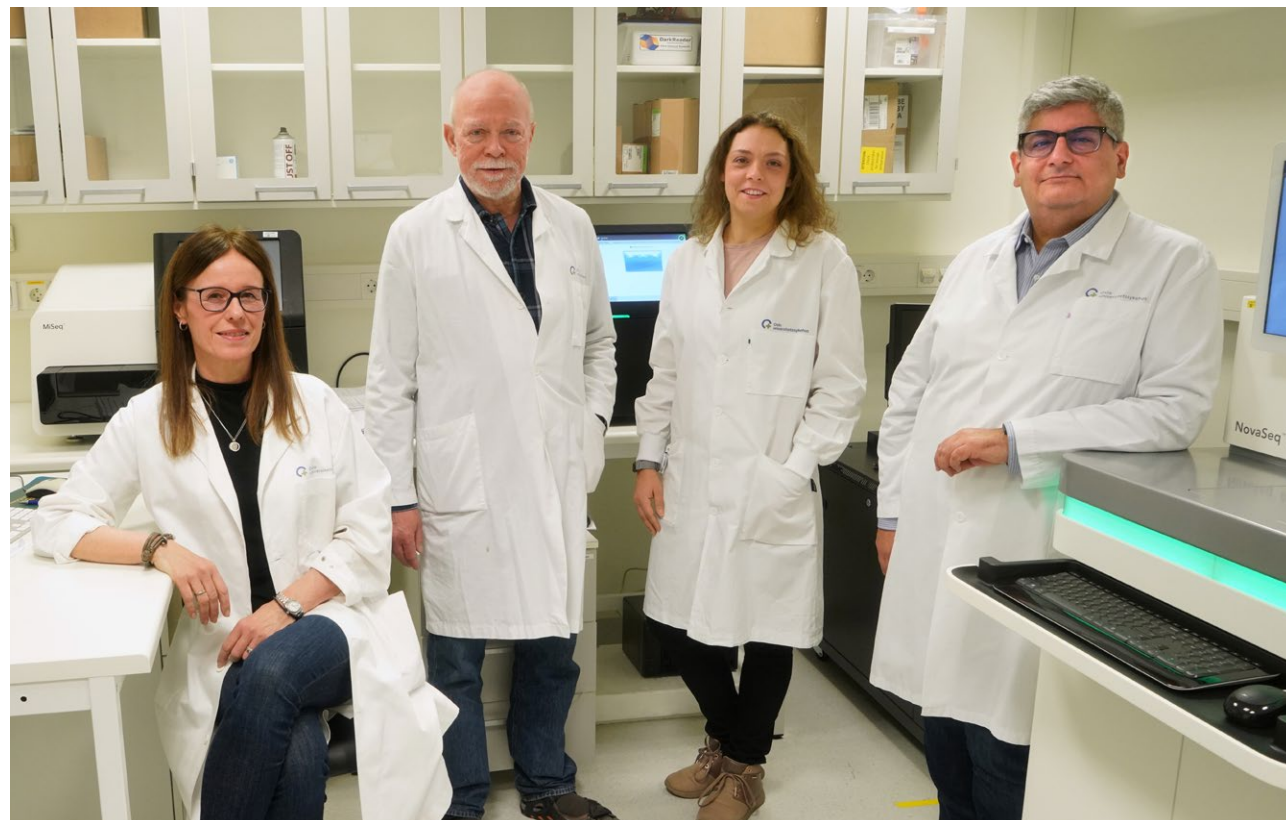
EMPLOYEES: 55



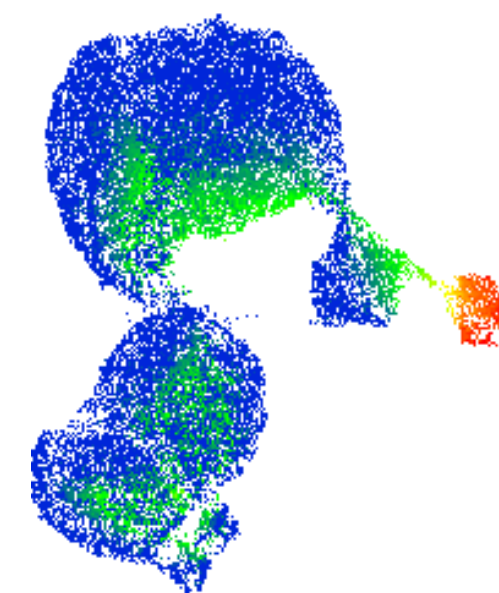
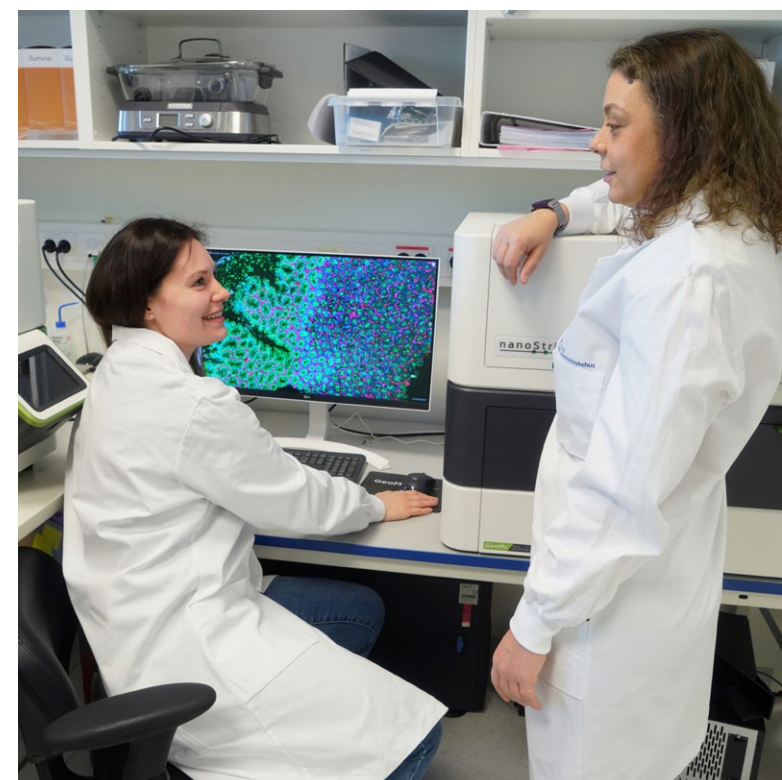
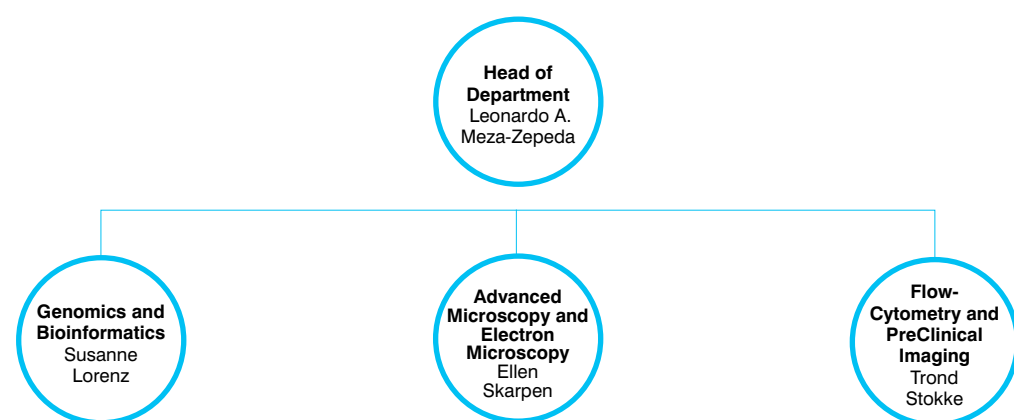
- Norwegian variant frequency database: Funding and responsibility for maintenance
- Breast cancer: Protein signature predicting response to chemotherapy and bevacizumab published, patent filed and funding for new clinical study ensured
- Pseudomyxoma peritonei: Mutated GNAS was identified as a target for peptide vaccination and a new clinical trial received funding
- Prostate cancer: association between β -blocker use and rate of recurrence after prostatectomy provides rationale and funding for a new clinical trial
- Sarcoma: Identification of *NAB2-STAT6* gene fusion variants as biomarkers to guide clinical decisions in solitary fibrous tumors
- Prostate cancer: Single-cell ATAC and RNA sequencing reveal pre-existing and persistent cells associated with relapse
- Education: Six MScs and two PhDs completed – both PhD projects in collaboration with Department of Gastroenterological Surgery
- Research funding: All four groups succeeded in receiving major grants ensuring continued high research activity

“Preclinical and clinical efforts towards precision oncology”

Department of Core Facilities



Ellen Skarpen, Trond Stokke, Susanne Lorenz, Leonardo A. Meza-Zepeda

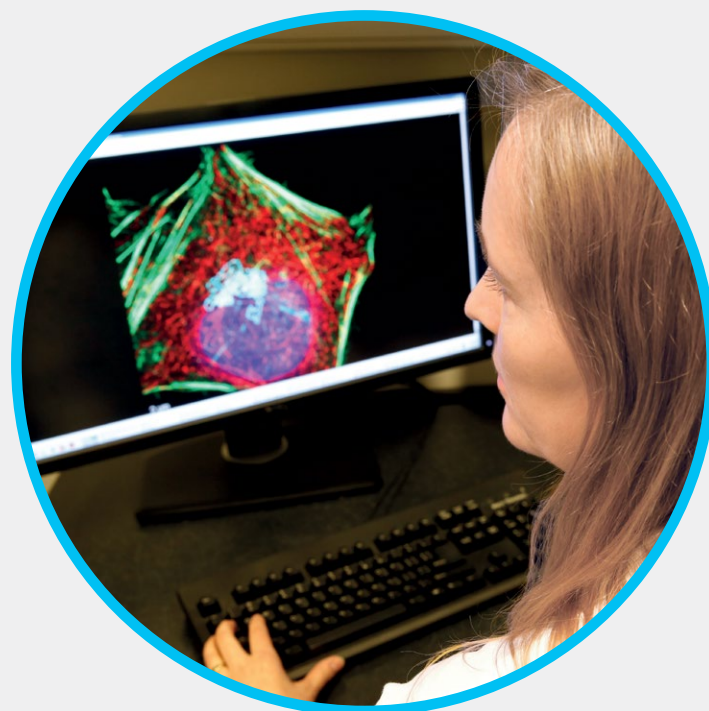


- The Advanced Microscopy unit obtained new funding from the Research Council of Norway to continue the Norwegian Advanced Light Microscopy Network (NALMIN-II)
- Funding for a live-cell light microscope with a photo-stimulation device was obtained by the Advanced Light Microscopy Facility from Fougner Hartmanns Familiefond and Oslo University Hospital
- The Flow Cytometry Facility has developed a comprehensive service for imaging mass cytometry using the Hyperion platform, from data generation to multiparameter analysis
- The Genomics unit has upgraded its sequencing infrastructure to accelerate high-throughput cancer genomics in Norway with an Illumina NovaSeq6000 and DRAGEN Bio-IT platform financed by the Norwegian Cancer Society and Radium Hospital Foundation
- The first Norwegian service for Digital Spatial Profiling to study cell interactions and heterogeneity in cancer was established by the Genomics Facility using the NanoString GeoMx DSP platform funded by the University of Oslo
- The Bioinformatics Core Facility contributes to ELIXIR Norway, the National bioinformatics platform financed by the Research Council of Norway (Funding renewed 2021)

“Providing cutting-edge-technology and competence to excel research”

EMPLOYEES: 19

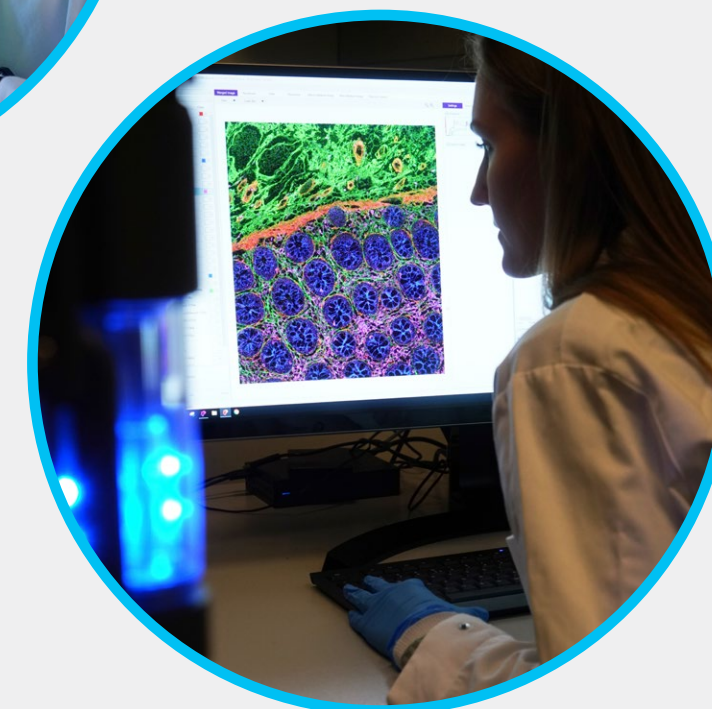
Core Facilities



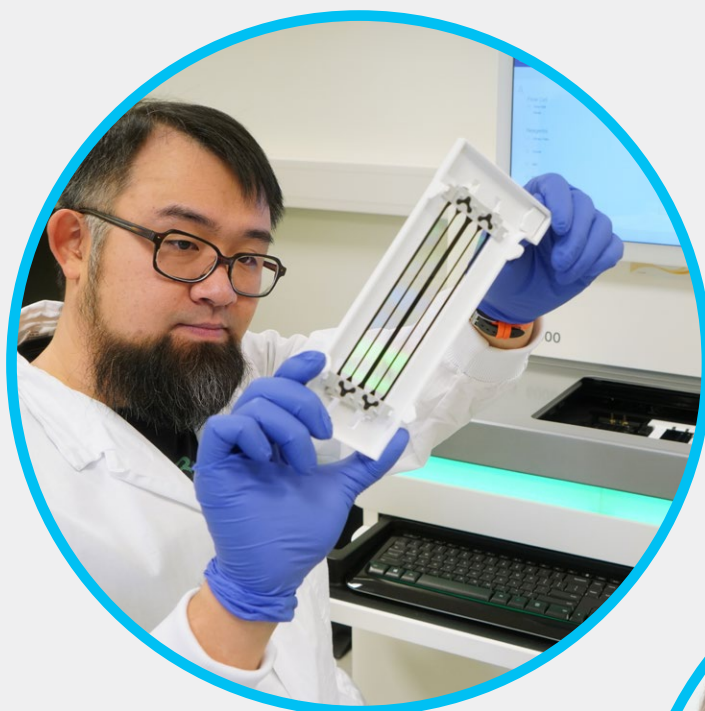
LIGHT MICROSCOPY



**ELECTRON
MICROSCOPY**



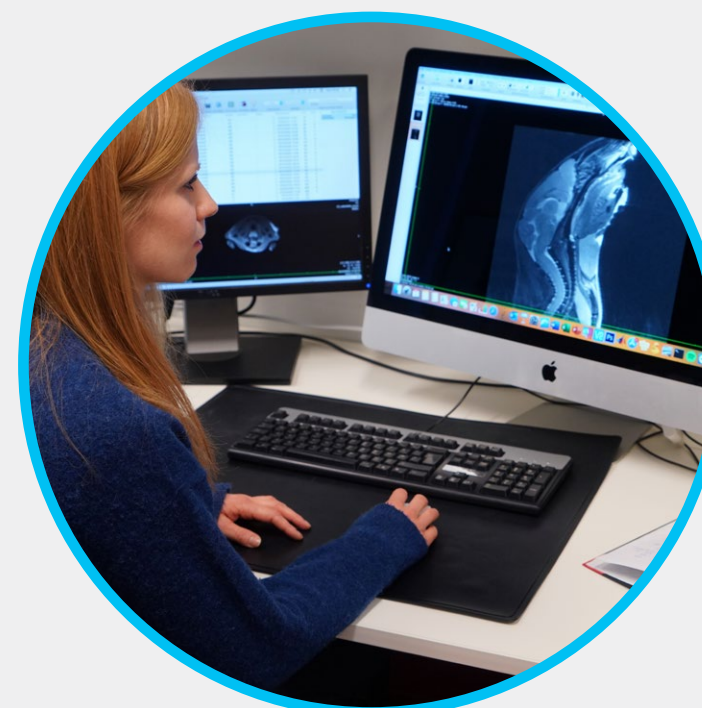
**FLOW
CYTOMETRY**



GENOMICS



BIOINFORMATICS



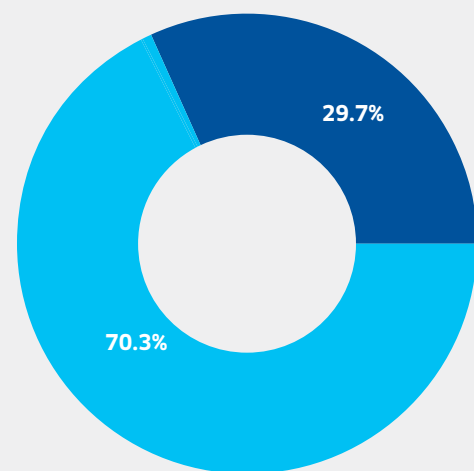
**PRECLINICAL
IMAGING**

The Funding

The Institute researchers received a total of >300 mill NOK in new grants from external sources in 2021.

THIS INCLUDED:

- 128 mill NOK from the Research Council of Norway to a new clinical research centre "MATRIX" led by Åslaug Helland
- 18 mill NOK in renewed grant from the commercial company Fate Therapeutics to Kalle Malmberg
- Three new grants to Therese Sørli (>20 mill NOK in total) from the Norwegian Cancer Society, the Regional Health Authority for South-Eastern Norway and the Research Council of Norway,
- 12 mill NOK to pancreas cancer research, EU grant to Elin H. Kure and Tero Aittokallio

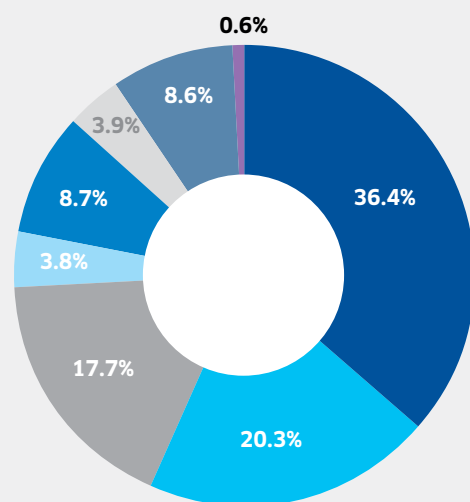


Funding

Percent

Actual Institute expenditure for 2021 by internal and external funding sources (total 347,3 MNOK = approx. 35,3 M€)

- Internal funding
- External funding



External funding by source

Percent

Sources of external competitive funding for 2021, based on actual expenditure (total 244,2 MNOK= approx. 24,8 M€)

- South-Eastern Norway Regional Health Authority
- The Research Council of Norway
- The Norwegian Cancer Society
- University of Oslo
- EU
- Other international sources
- Other private sources
- Other public sources





The Centres



Centre for Cancer Cell Reprogramming (CanCell)

Headed by Director Harald Stenmark, Co-Director Anne Simonsen.
Hosted by Institute of Clinical Medicine, UiO.

- CanCell’s scientists published 35 papers in 2021 and were lead authors of articles in important journals such as Nature, Nature Communications, EMBO Journal, Cell Reports, and Autophagy. In particular, progress was made in understanding the role of autophagy in cell metabolism and cancer cachexia, and macropinocytosis in nutrient acquisition of cancer cells.
- CanCell’s young scientists obtained 3 PhD degrees and 8 MSc degrees in 2021.
- CanCell scientists were awarded two UiO Life Science Convergence Grants – “Modeling human multi-organ Interaction in disease - cancer cachexia” led by Tor Erik Rusten, and “Role of autophagy in healthy aging” led by Anne Simonsen and with participation of Jorrit Enserink and Helene Knævelsrud.
- Other major grants to CanCell scientists included a Pioneer grant from the Cancer Society and a Project grant from the Children Cancer Society to Jørgen Wesche, a Research Project grant from the Cancer Society to Anne Simonsen, a PhD student grant from Helse sør-øst to Helene Knævelsrud, a Mobility grant from the Research Council to Dagim Tadele, and a Young Research Talents grant from the Research Council to Alf Håkon Lystad.
- CanCell’s scientists had extensive outreach activity in 2021 in the forms of talks, podcasts, blogs, social media posts, and media interviews. A special form of outreach was CanCell’s collaboration with Butoh Encounters for the dance performance, “Rebellion of the Cell”.

“Reprogramming of cancer”

The Centres

ACT (Centre for Advanced Cell and Gene Therapy)

To be headed by Incoming Director Anna Pasetto, Scientific Director Karl-Johan Malmberg
Hosted by Section for Cell Therapy, Dept. of Oncology, OUH, Co-hosted by the ICR

- Inauguration of the new ACT center, including a single point of entry, research and protocol board and streamlined workflow for new clinical cell therapy trials
- Acquisition and installation of the first Prodigy instrument for automated transduction and expansion of gene modified immune cells, and training of personnel
- Search for ACT Director led to recruitment of Dr. Anna Pasetto that will start April 2022



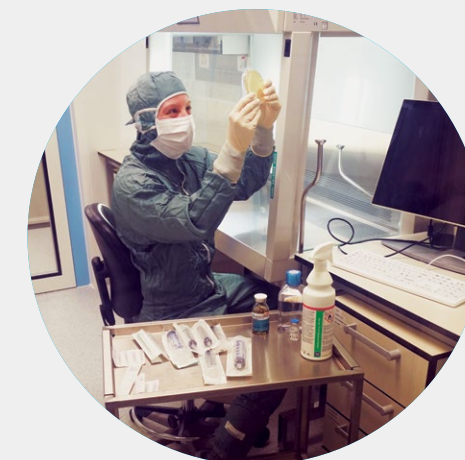
"Translating Basic Discoveries in Cancer Research Into Living Drugs"

STRATEGIC RESEARCH AREA FOR OSLO UNIVERSITY HOSPITAL

Strategic Research Area in Cell Therapy – StratCell

Headed by Karl-Johan Malmberg

- Supported the transition of the GMP facility into a core facility with the launch of the Center for Advanced Cell and Gene Therapy (ACT)
- Technical support for the development of the first in house protocol for gene editing of primary T cells
- Identified key areas of improvement including regulatory competencies and physical pre-GMP space



"Bringing First in Class Cell and Gene Therapy to Norwegian Patients"

K.G. Jebsen Centre for B-cell malignancies

Headed by Ludvig A. Munthe and June H. Myklebust.
Hosted by Institute of Clinical Medicine, UiO

- Leading position in Norway, running clinical studies for patients with B-cell malignancies (total 80 studies, 26 actively recruiting patients)
- Active translational research in developing genetic biomarkers, functional assays for precision medicine, CAR T cell design and tumor microenvironment characterization
- Breaking research discoveries related to COVID-19 pandemic - SARS-CoV-2, with papers published in NEJM, Eur Heart, Lancet Rheumatology



"From basic research and preclinical studies to precision medicine for B-cell malignancies"

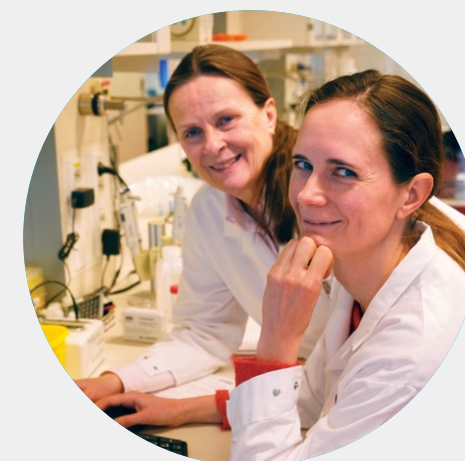


STRATEGIC RESEARCH AREA FOR OSLO UNIVERSITY HOSPITAL

TEAM-ACT: Tumor Evolution in Advanced Models to Accelerate precision Cancer Therapy

Headed by Ragnhild A. Lothe

- 200 tumor organoid lineages of metastatic colorectal cancer established. Pharmacogenomics data from organoids and 110 cell lines are used to identify mechanisms of treatment response and resistance
- EVIDENT: ongoing trial of experimental- and standard of care- therapies (n=23) guided by the pharmacogenomic profiles of the patients' own colorectal cancer models (organoid)
- ExCalibur: randomized controlled trials of metastatic colorectal cancer with extensive tumour burden in the liver, to evaluate the grey zone between technical feasibility and patient benefit from surgical modalities, including transplantation



"New treatment strategies of colorectal cancer"

The Clinic

The ICR as a gravity point in Oslo University Hospital Comprehensive Cancer Centre



Oslo University Hospital, a Comprehensive Cancer Centre since 2017, aims to be a leading cancer centre in Europe. The Institute for Cancer Research (ICR) is a competence hub with many world-leading research groups and environments and its research is a corner stone in our OECl-accredited Comprehensive Cancer Centre (CCC). The Institute is situated in close proximity to clinical cancer departments and diagnostic laboratories at the Radium Hospital, a cancer-oriented part of Oslo University Hospital and with Oslo Cancer Cluster and the Cancer Registry of Norway as neighbours.

More patients into clinical trials is an expressed aim for the CCC, and a number investigator-initiated clinical trials have been developed in close collaboration between researchers at ICR and clinical research groups at all locations of Oslo University Hospital. The tight connection among research groups at ICR and clinicians and diagnosticians in Oslo University Hospital is an important factor to

instigate and improve investigator-initiated clinical trials, by delivering new methodologies for patient stratification and including high quality translational research connected to trials.

The extensive international collaboration involving researchers at ICR is also an important asset for the CCC. In the integrated organisation of cancer-related activities, the ICR will be a gravity point in the further development of Oslo University Hospital as a leading cancer centre in Europe.

Sigbjørn Smeland
Head of Division of Cancer Medicine
Chair, OUH CCC Board

Since 2019 the ICR has aimed to strengthen our translational research as well as collaboration, coordination and cohesion with clinical and diagnostic environments in OUH CCC. From 2020 we established the Translational Research and Innovation Committee (TRIC) that meets every month and from 2021 we instigated and started planning a series of symposia where we invite key researchers in clinical and diagnostic departments to open discussions on

how we can interact more and improve research in specific areas (first two symposia held March 2022).

A survey of 120 translation and innovation projects originating from the Institute and their collaboration partners showed the following (non-exhaustive) distribution of collaboration partners in OUH, particularly in the CCC:

ICR
INTERNAL
25

DIVISION OF
CANCER
MEDICINE*:
72#

DIVISION OF
LABORATORY
MEDICINE:
15

DIVISION OF
SURGERY,
TRANSPLANTATION
AND
INFLAMMATION:
12

DIVISION OF
RADIOLOGY
AND NUCLEAR
MEDICINE:
6

OTHER
DIVISIONS:
7

*Other than ICR

#Distribution in Div. Cancer Med.: Dept. Oncology 59, Dept. Hematol. 6, Dept. Gynecol. Oncol. 3, Dept. Med. Physics 3, Inst. Cancer Genet & Informatics: 1

In addition, the same 120 translation and innovation projects has numerous other partners nationally and internationally (see also section on International Network).

Clinical intervention trials where Institute researchers play a prominent part

IMPRESS-Norway - Improving public cancer care by implementing precision medicine in Norway
ClinicalTrials.gov #: NCT04817956; <https://impress-norway.no/en>
Institute participants: National PI: Åslaug Helland, Trial Management Committee: Hege Russnes, Kjetil Taskén, Jon Amund Kyte; Trial Steering Committee: Eivind Hovig, Leonardo Meza-Zepeda, Ragnhild Lothe plus TMC members; Coordinator: Live Fagereng.

ALICE: Atezolizumab Combined With Immunogenic Chemotherapy in Patients With Metastatic Triple-negative Breast Cancer
ClinicalTrials.gov #: NCT03164993
PI: Jon Amund Kyte, partner labs.: J.A. Kyte, Hege Russnes

ASAC - Aspirin as secondary prevention in colorectal cancer liver metastasis
ClinicalTrials.gov #: NCT03326791; www.asac.no
PIs: Sheraz Yaqub and Kjetil Taskén

bTME; The Beyond TME Trial
ClinicalTrials.gov#: NCT02292641
PIs: Gina Brown (Royal Marsden University Hospital, UK) and Kjersti Flatmark (Norway)

ComIT - Combinatory ImmunoTherapy-1
ClinicalTrials.gov #: NCT03644823
PI: Åslaug Helland, partner lab.: Åslaug Helland

DART - Durvalumab after chemo-radiotherapy for NSCLC (multinational phase II trial)
ClinicalTrials.gov #: NCT04392505
PI: Åslaug Helland, partner lab.: Åslaug Helland

EVIDENT - Ex vivo drug sensitivity in metastatic colorectal cancer.
EudraCT #: 2020-003395-41.
PI: Tormod K. Guren, partner lab.: Ragnhild A. Lothe

I-BCT-1 - Improved breast cancer therapy in the neoadjuvant and metastatic setting: A phase 2 clinical trial protocol studying biological rationale for the optimal selection of treatment regimens
ClinicalTrials.gov #: NCT02546232
PI: Olav Engebråten, partner labs.: Gunhild M. Mælandsmo, Hege Russnes

ICON: Phase IIb Study Evaluating Immunogenic Chemotherapy Combined With Ipilimumab and Nivolumab in Breast Cancer
ClinicalTrials.gov #: NCT03409198
PI: Jon Amund Kyte, partner labs.: J.A. Kyte, Hege Russnes

LARC-EX; Locally Advanced Rectal Cancer - Exfoliated Peritoneal Tumor Cells
ClinicalTrials.gov#: NCT02113384
PI: Kjersti Flatmark, partner lab: Kjersti Flatmark

LD-VenEx - Phase II "feasibility" study of azacitidine in combination with low dose venetoclax in patients with acute myeloid leukemia-
EudraCT #: 2020-005461-14
PI: The Nordic AML Group, partner lab: Jorrit Enserink

METIMMOX; Colorectal Cancer METastasis - Shaping Anti-tumor IMMunity by OXaliplatin
ClinicalTrials.gov#: NCT03388190
PI: Anne Hansen Ree (AHUS), partner lab: Kjersti Flatmark

METOXY-LACC - Altered Tumor Oxygenation by Metformin, a Potential Step in Overcoming Radiotherapy Resistance in Locally Advanced Cervical Cancer (LACC)
ClinicalTrials.gov #: NCT04275713
PI: Kjersti Bruheim, partner lab: Heidi Lyng

NAVI-LARRC; Computer Navigation-assisted Surgery for Locally Advanced and Recurrent Rectal Cancer
ClinicalTrials.gov#: NCT04512937
PI: Kjersti Flatmark, partner lab: Kjersti Flatmark

NIPEC-OXA; Normothermic Intraperitoneal Chemotherapy - Long Term in Peritoneal Metastases from Colorectal Cancer
ClinicalTrials.gov#: NCT05056389
PI: Mariusz Goscinski (AGK), partner lab: Kjersti Flatmark

NIPU - Nivolumab and ipilimumab +/- UV1 vaccine in second line treatment of mesotheliomas
ClinicalTrials.gov #: NCT04300244
PI: Åslaug Helland, partner lab.: Vilde Haakensen

NorPACT-1/2 - Neo-adjuvant chemotherapy for pancreatic cancer
ClinicalTrials.gov #: NCT02919787
PI: Knut Jørgen Labori, partner lab: Elin Kure

PSM; Peritoneal Surface Malignancies - Characterization, Models and Treatment Strategies
ClinicalTrials.gov #: NCT02073500
PI: Kjersti Flatmark, partner lab: Kjersti Flatmark

REPORT; REirradiation and PD-1 blockade On Recurrent squamous cell head and neck Tumors
ClinicalTrials.gov #: NCT03317327
PI: Åse Bratland, Co-PI: Jon Amund Kyte, partner lab.: J.A. Kyte lab

Sequential neoadjuvant ifosfamide and doxorubicin in localized high-grade soft tissue sarcoma of extremities and trunk wall
ClinicalTrials.gov #: NCT04776525
PI: Kjetil Boye, partner lab.: Jørgen Wesche

The International Network

ICR members report collaborations with researchers at 146 institutions in 30 countries world-wide.



AUSTRALIA

- Kinghorn Cancer Centre, Sydney
- Monash University, Melbourne

AUSTRIA

- Institute of Pathophysiology Biocenter, Innsbruck Medical University, Innsbruck
- Medical University of Vienna, Vienna

BELGIUM

- Catholic university of Brussels, Brussels
- Ghent University, Ghent
- Katholieke Universiteit Leuven, Leuven
- Universiteit Hasselt, Genk

CANADA

- McGill University, Montreal
- Princess Margaret Hospital, Toronto
- University of Ottawa, Ottawa

CROATIA

- University of Zagreb, Zagreb

CZECH REPUBLIC

- Charles University, Prague
- Institute of Experimental Biology, Masaryk University, Brno
- National Institute of Public Health, Prague

DENMARK

- Aalborg University Hospital, Aalborg
- Aarhus University Hospital, Aarhus
- Copenhagen University Hospital, Copenhagen
- University of Copenhagen, Copenhagen
- University of Southern Denmark, Odense

FINLAND

- Biomedicum Helsinki, University of Helsinki, Helsinki
- Finnish Institute of Molecular Medicine, Nordic EMBL partner, Helsinki
- Pharmatest Services Ltd, Turku
- Tampere University of Technology, Tampere
- Zora Oy, Espoo

FRANCE

- Centre National de Génotypage, Paris
- EurOPDX - European Consortium on Patient-derived Xenografts, Paris
- Institut Gustave Roussy, Paris
- Institut National de la Santé et de la Recherche Médicale, Paris
- Institut Curie, Paris
- Institute of Systems and Synthetic Biology Genopole, UEVE, CNRS, Evry
- International Agency for Research on Cancer (IARC), Lyon
- Université de Lorraine, Nancy
- Université Lyon, Villeurbanne
- Université Paris-Sud, Orsay

GERMANY

- EMBL, Heidelberg
- Jacobs University, Bremen
- University of Bayreuth, Bayreuth
- University of Bochum, Bochum
- University of Cologne, Cologne
- University of Freiburg, Freiburg
- University of Heidelberg, Heidelberg
- University of Mainz, Mainz
- University of Marburg, Marburg
- University of Stuttgart, Stuttgart

GREECE

- National and Kapodistrian University of Athens, Athens
- National Centre for Scientific Research "Demokritos", Athens
- University of Ioannina, Ioannina

HUNGARY

- University of Szeged, Szeged

ICELAND

- University of Iceland, Biomedical Center, Reykjavik

INDIA

- Indian Institute of Technology, Hyderabad
- Savitribai Phule Pune University, Pune

IRELAND

- National Institute for Bioprocessing Research and Training (NIBRT), Dublin

ISRAEL

- Technion - Israel Institute of Technology, Haifa
- Weizmann Institute, Rehovot

ITALY

- IFOM, Milan
- International School for Advanced Studies, Trieste
- Istituto Nazionale di Tumori, Milano
- The Rizzoli Institute, Bologna
- University of Bologna, Bologna
- University of Padova, Padova
- University of Salento, Lecce

NORWAY

- Cancer Registry of Norway, Oslo
- Haukeland University Hospital, Bergen
- Norwegian University of Life Sciences, Ås
- Norwegian University of Science and Technology, Trondheim
- Stavanger University Hospital, Stavanger
- Trondheim University Hospital - St. Olavs Hospital, Trondheim
- University hospital of North Norway, Tromsø
- University of Bergen, Bergen
- University of Oslo, Oslo

POLAND

- Faculty of Biotechnology, University of Wrocław, Wrocław
- Jagiellonian University, Kraków
- University of Gdańsk, Gdańsk

PORTUGAL

- Institute of Molecular Pathology and Immunology, University of Porto
- Portuguese Oncology Institute, Porto

ROMANIA

- Horia Hulubei National Institute for Physics and Nuclear Engineering Bucharest - Magurele

RUSSIA

- Institute of Cytology and Genetics, Novosibirsk

SINGAPORE

- Cancer Science Institute of Singapore, Singapore

SPAIN

- Biocruces Bizkaia Health Research Institute, Barakaldo
- CABIMER, University of Sevilla, Sevilla
- Centre for Biological Studies, Madrid
- Fundacion Instituto Valenciano de Oncologica (FIVO), Valencia
- ICGC, Technical validation group and Ivo Gut, Barcelona
- University of Lleida, Lleida
- University of Valencia, Valencia
- Universitat Politècnica de València, Valencia
- Vall d'Hebron Institute of Oncology, Barcelona

SWEDEN

- Karolinska Institutet and University of Stockholm, Stockholm
- Lund University, Lund
- The Sahlgrenska Academy at the University of Gothenburg, Gothenburg
- Uppsala University Hospital, Uppsala

SWITZERLAND

- University Hospital Zurich, Zurich

THE NETHERLANDS

- Leiden University, Leiden
- Netherlands Cancer Institute (NKI), Amsterdam
- Radboud University Nijmegen, Nijmegen
- The Netherlands Proteomics Centre, Utrecht
- University Medical Center, Groningen
- Utrecht University, Utrecht
- VU Medical Center, Amsterdam

TUNISIA

- University of Tunis, Tunis

UNITED KINGDOM

- Cambridge Cancer Institute, Cambridge
- Hampshire Hospitals/Southampton University, Southampton
- Institute of Cancer and Genomic Sciences, University of Birmingham, Birmingham
- London Research Institute, The Francis Crick Institute, London
- Newcastle University, Newcastle upon Tyne
- Queen's University Belfast
- Royal National Orthopaedic Hospital, Stanmore, Middlesex
- The Beatson Institute for Cancer Research, Glasgow
- The European Bioinformatics Institute (EMBL-EBI), Hinxton
- University College London Medical School, UCL, London
- University of Cambridge, Cambridge
- University of Liverpool, Liverpool
- University of Oxford, Oxford
- Wellcome Sanger Institute, Hinxton

- Buck Institute for Research on Aging, Novato, California
- Dana Farber Cancer Institute, Boston, Massachusetts
- Dartmouth College, Hanover, New Hampshire
- Duke University Medical Center, Durham, North Carolina
- Fred Hutchinson Cancer Research Center, Seattle, Washington
- Georgetown University, Washington DC
- Harvard University, Boston, Massachusetts
- Johns Hopkins Medicine, Baltimore, Maryland
- Lawrence Berkeley National Laboratory, Berkeley, California
- Lineberger Comprehensive Cancer Center, Chapel Hill, North Carolina
- Masonic Cancer Center and University of Minnesota, Minneapolis
- Massachusetts General Hospital, Boston, Massachusetts
- MD Anderson Comprehensive Cancer Center, Houston, Texas
- MedKoo Biosciences, Morrisville, North Carolina
- Memorial Sloan Kettering Cancer Center, New York
- National Institutes of Health (NIH), Bethesda, Maryland
- Oregon State University, Corvallis, Oregon
- Princeton University, New Jersey
- Rutgers Cancer Institute of New Jersey
- Stanford University, California
- The Mount Sinai Hospital, New York
- The University of Kansas Hospital, Kansas
- Tisch Cancer Institute, New York
- UCSF, Helen Diller Family Cancer Centre, San Francisco, California
- University of Albany, New York
- University of California, Berkeley, California
- University of Chicago, Illinois
- University of Colorado, Denver, Colorado
- University of Illinois, Champaign, Illinois
- University of Washington, Seattle, Washington
- Washington University, St Louis, Missouri
- Weill Medical College of Cornell University, New York

The Radium Hospital site

CLINICAL BUILDINGS

INSTITUTE FOR CANCER RESEARCH

OSLO CANCER CLUSTER BUILDINGS

The Radium Hospital site after completion of new clinical buildings and the new proton therapy centre Q1 2024 (new buildings with green/black roofs) amidst older clinical buildings and present ICR and OCC buildings. OCC buildings houses also pathology and Cancer Registry of Norway. Note proximity of clinical and diagnostic activity to research and innovation at ICR and in OCC.

The Next Generation

Some of the new recruits of 2021:



Maria Aanesland Dahle
PhD-student
Member of the Mælandsmo group,
Metastasis Biology and Experimental
Therapeutics
Department of Tumor Biology



Marie Kristine Gillstrøm
Special engineer
Member of the Genomics and Bio-
informatics Unit (Lorenz)
Department of Core Facilities



Håvard Styrkestad Haukaas
PhD-student
Member of the Stenmark group,
Cellular Membrane Dynamics
Department of Molecular Cell
Biology



Caroline Lunder Jensen
PhD-student
Member of the Lothe group
Genetics
Department of Molecular Oncology



Riccarda Katharina Læret
PhD-student
Member of the Berg group,
Photochemical Internalization
Department of Radiation Biology



Lamberto Javier Torralba Raga
Postdoctor
Member of the Malmberg group,
NK Cell Biology and Cell Therapy
Department of Cancer Immunology



John Zobolas
Postdoctor
Member of the Aittokallio group,
Computational Systems Medicine in Cancer
Department of Cancer Genetics

Institute training

The ICR had some 70 PhD students and 59 postdocs employed in 2021, and 29 MSc students graduated. We provide student (MSc, PhD) and Postdoc mentoring and training. Our researcher track includes advancement levels to Scientist and Senior Scientist, and we have 31 Project Group Leaders in addition to Group Leaders. For Engineers advancement levels are to Head Engineer.

Internally, the ICR Postdoc forum and ICR PhD forum organise talks and serve as meeting places across our departments for students and postdocs.

Our trainees at different levels also benefit from and our staff members contribute to teaching and mentoring in the UiO PhD programmes, the UiO Faculty of Medicine Postdoc Career Dev Programme, the School of Health Innovation and SPARK programme and various research leadership training programmes.

ICR career development program

In 2021-22 we aim to develop a career development program that incorporates focus on project leaders as a resource, on mentorship, and scientific mobility.

A Working Group for Career Development for different categories of staff is in operation and will deliver:

- An overview of what career development activities that are available institutionally
- Survey courses for postdoc, researchers, method-specialists etc
- Examine mentoring arrangements for different categories of staff
- Look specifically at career development post-postdoc (scientists, project leaders)
- Formalize Career Plans
- Document practices and available courses and programmes
- Suggest additional dedicated activities based on a gap analysis

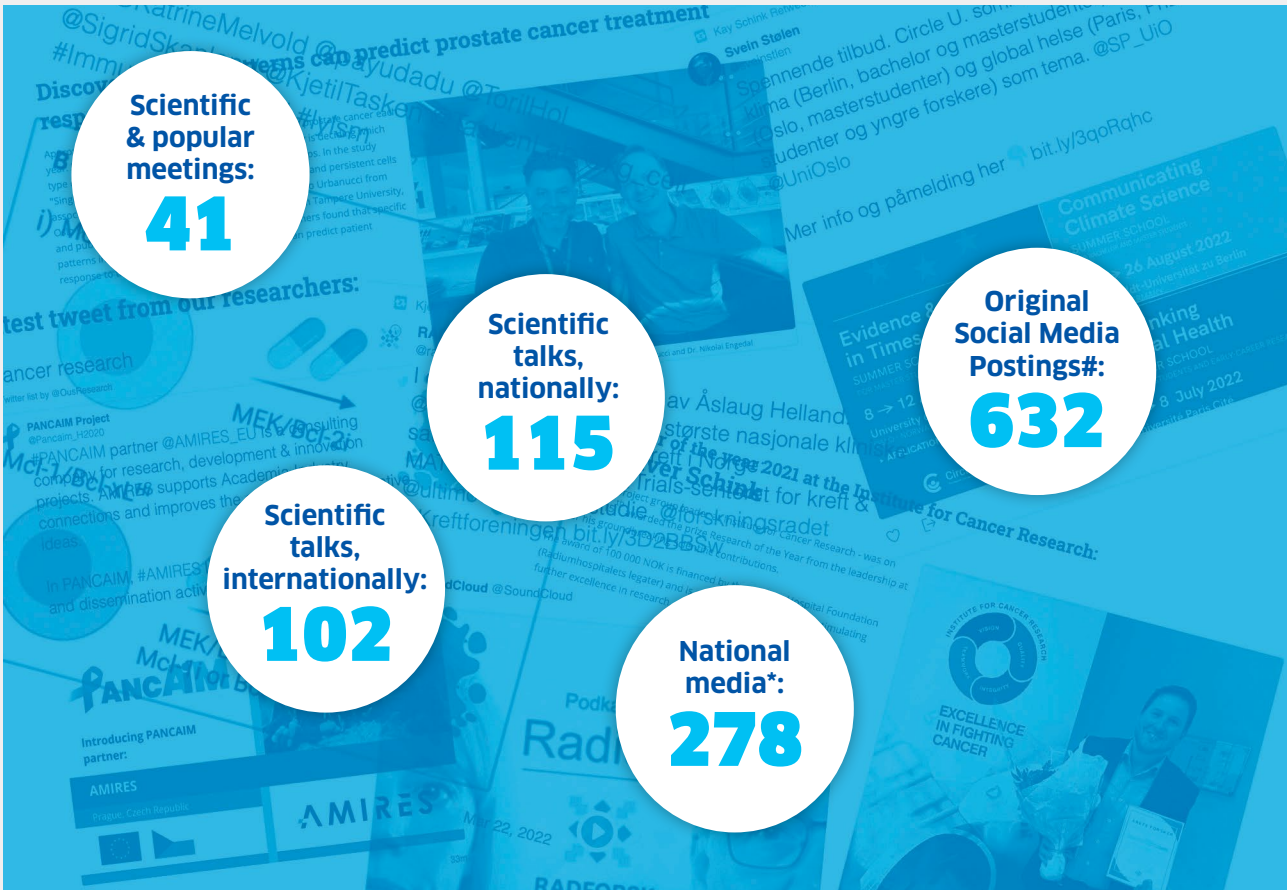
“In 2021-22 we aim to develop a career development program that incorporates focus on project leaders as a resource, on mentorship, and scientific mobility.”

The Communication is Key

We published more than 240 peer-reviewed original, scientific papers in 2021 which is an important part of knowledge-generation. In addition, ICR members were also active in public outreach.

The ICR organized a number of scientific and popular meetings nationally and internationally, and we gave

scientific talks in national fora and at international meetings, symposia and institutional seminars. Our researchers also disseminated knowledge in popular talks, interviews, newspaper correspondence, viewpoints and debate articles. We also communicated our science in more than 600 original postings in social media (Twitter, LinkedIn etc).



*: talks, interviews, newspaper correspondence, viewpoints and debate articles on popular science and research policy
#: original postings about science in social media (Twitter, LinkedIn etc)



Publications

Publications 2021

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