



Danish Cancer Society Research 2019

Annual Research Impact Report



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Danish Cancer Society

Version 1
March 2020

Editorial staff

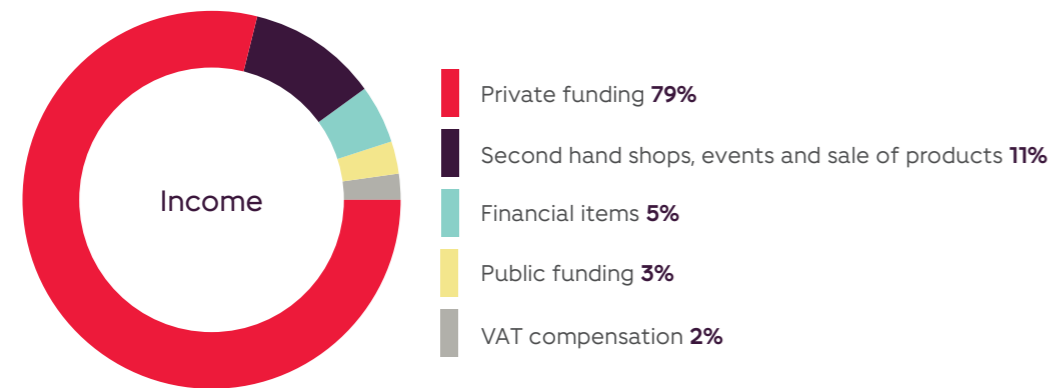
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Danish Cancer Society Research

The foundation for the Danish Cancer Society was laid in 1928 and ever since, we have been working to heighten awareness, provide support and generate knowledge in the field of cancer. The Danish population's support for the Danish Cancer Society is overwhelming and inspiring. In a country of 5.8 million inhabitants, the Society has almost 46,000 volunteers and all of 402,992 members. Members, volunteers, researchers and other professionals work together to forward our mission that fewer people get cancer, that more people survive the disease and that those who have had cancer have a good life afterwards.

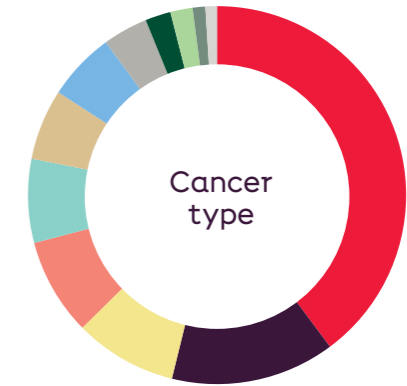


The Danish Cancer Society receives income from several sources, but the vast majority comes from private funding. The breakdown specified is from 2018.

Throughout this report a series of financial calculations are presented. None of the specifications includes research grants in the form of short travel grants.



The figure shows how the Danish Cancer Society's financial support was dispersed over four main areas of research in 2019.



The figure depicts the breakdown of financial support from the Danish Cancer Society for the various types of cancer in 2019.

Research points the way to a future without cancer and the Danish Cancer Society assists throughout the process – from the initial discoveries up until the results reach the patients. In other words, we are involved in basic research, population-based studies, translational research and clinical research, and we support research into all types of cancer, across age groups and throughout Denmark. Support for research comprises 62 pct. of the organization's net budget and is allocated through open calls for applications, strategic initiatives and research grants to the Danish Cancer Society's own Cancer Research Center (DCRC).

The Danish Cancer Society's research policy describes the basic principles for the organization's research efforts and prioritizes innovation and

high quality within basic research, creativity and relevance in epidemiological research and relevance and implementation in clinical research.

Guideposts lay the course

In 2019, the Danish Cancer Society adopted three guideposts which – towards 2025 – will help the Society achieve its mission of reducing the number of cancer cases, increasing cancer survival rates and improving life with and after cancer for patients and relatives. The three guideposts are "One step ahead of cancer", "Less inequality in cancer" and "No one should have to face cancer alone". Research plays a vital role to each guidepost.



This report presents selected examples of the results achieved and research initiatives launched in 2019. The cases presented here are from the Danish Cancer Society Research Center (DCRC), from research supported through the independent scientific committees and from projects supported through the Knæk Cancer fundraising campaign.

The DCRC is keenly focused on developing and sharing knowledge. Researchers at the DCRC generate knowledge which support efforts to prevent cancer and ensure early diagnosis and better treatment outcomes. The DCRC assists in keeping the rest of the organization up to date with new, relevant issues in cancer research, assists in designating and developing research-based evidence and takes part in communicating this knowledge to authorities, other organizations and the general public.

The Danish Cancer Society Scientific Committee supports research in all of Denmark and al-

locates funding for medical biologically-oriented research, while the Danish Cancer Society's Psychosocial Committee supports research into psychosocial issues.

Each October, the Danish Cancer Society and TV2 sponsor the Knæk Cancer fundraising campaign. The proceeds are used to fund strategic initiatives such as research, campaigns and patient support.

This report takes a closer look at how research supported by the Danish Cancer Society makes a difference in preventing, detecting and curing cancer so we can continue to deserve the trust and support of the Danish population far into the future.

We hope you enjoy your reading!



Communicating research

It is important to communicate the results made possible by contributions to the Danish Cancer Society from the Danish population. This is our responsibility as a credible organization and an opportunity to thank everyone who supports our research.

As a culmination of the increasing focus in recent years on research communication, the DCRC and the Danish Cancer Society's Communication Department appointed a research editorial staff. Based at the DCRC, the staff aims to strengthen the communication of research results across the organization.

Credible, balanced and up-to-date communication of research results is a high priority at the DCRC, as defined in both the research communication strategy and the strategy for the DCRC. Our ambitions include communication to members, volunteers and patients about results arising directly from research donations and the provision of new evidence-based knowledge to authorities, public bodies, etc.

We focus on providing professional information about research emanating both from the DCRC and research supported by the Danish Cancer Society but conducted by researchers throughout Denmark. We also attended the annual conference organized by the European Society for Medical Oncology and reported back on the latest news and developments in international cancer research presented at the conference.

During 2019, we have uploaded news articles to the Danish Cancer Society's website, we have ensured the coverage of new research results by cooperating with the media and we have tak-

en part in the public debate. We have also provided updated research results to Relay for Life representatives and at a number of local events arranged by our counselling units. We also assist other departments of the Danish Cancer Society with scientific issues and the communication of new knowledge. We have presented research and discussed scientific issues at the international World Cancer Day, at the Danish Cancer Society's meeting of its Committee of Representatives, at The People's Democratic Festival on the island of Bornholm and at a meeting of the European Society for Medical Oncology in Barcelona.

Our communication focuses on providing information across platforms and target groups. For instance, one week we focused on registry-based studies through background articles, image galleries, news and films on both website and social media.

Cooperation is also a goal of the DCRC when it comes to communicating research results. During 2019, we reinforced our collaboration with research information departments at several Danish hospitals and universities to increase the coverage of research and promote the communication of information through multiple channels. At The People's Democratic Festival on the island of Bornholm, we joined forces with Trial Nation and the Danish Comprehensive Cancer Center to host two panel discussions on clinical trials.

We also participate in a network of communication staff from the cancer societies of the Nordic countries. During a meeting in Oslo in June, the participating countries exchanged focus areas and initiatives in research communication, and discussed the possibilities of sharing research news and stories for translation in our separate countries.

Researchers provide the information

A key aspect of the communication of research from the DCRC is that the researchers themselves actively take part in a wide range of communication activities. The list for 2019 is long and comprises guided tours and lectures at the DCRC at an open-house event on the occasion of the Danish Science Festival, guided tours and presentations about research to new employees of the Danish Cancer Society, US students and other visitors. Researchers from the DCRC are in demand and active speakers at scientific meetings in both Denmark and abroad. In Denmark, our researchers present their research for local committees, patient associations, fundraising events, Relay for Life and much more besides. In addition, our researchers often step forward in local and nationwide media and serve as experts and lecturers for ministries, universities, hospitals and scientific committees.



Post-doc Despoina Sakellariou was one of the representatives from the DCRC who attended the meeting of the Committee of Representatives of the Danish Cancer Society. At the meeting, visitors were given an opportunity to have their DNA purified, which they then could take home with them in a small tube. Photo: Danish Cancer Society

As part of the 2020 strategy for the DCRC, a series of initiatives have been planned to strengthen collaboration with patients and the public:

- » All researchers at the DCRC must have basic knowledge on clinical practice and of cancer treatment, the promotion of popular science and research communication
- » Job descriptions introduce requirements for research communication and communication in general
- » Contributions to communication activities will be included in annual performance reviews and research evaluations
- » A list of experts and an archive comprising materials for the communication of popular science, resources and services for internal use will be set up to ease the prioritization and distribution of tasks among researchers
- » Internal communication will be strengthened through heightened awareness of online resources and by prompting better communications between researchers and communication staff
- » Heightening visibility by proactively organizing and participating in 'citizen science' activities and by contributing to current, societally relevant discussions and debates
- » Support for researchers in relation to promoting popular science through tools and resources which reinforce initiatives from the Danish Cancer Society
- » Appointment of a panel of patients and relatives for involvement in research at the DCRC
- » Implementation of principles for how to specifically involve patients and the public in each field of research



The Danish Cancer Society Research Center

A research environment with proud traditions and the willingness to address contemporary challenges

Danish Cancer Society Research Center (DCRC) provides the framework for a research environment with proud traditions. The groundwork for epidemiological research was laid in 1942 when the Danish cancer register was founded. Experimental cancer research was added in what was named the Fibiger Institute in 1949, after the Danish cancer researcher and Nobel laureate Johannes Fibiger. Today, these two lines of research coalesce at the DCRC, and the aim of both areas is to ensure translational research – applying knowledge derived in the laboratory to address critical medical needs so new discoveries benefit patients in the clinical settings.

The DCRC builds on a number of highly specialized research programmes and on having access to unique proficiencies, technologies, databases and cohorts. Thanks to collaboration between researchers and other experts at the Danish Cancer Society, we are able to proactively address the challenges and opportunities which rapid scientific development brings with it in a modern society.

The strengths of the DCRC:

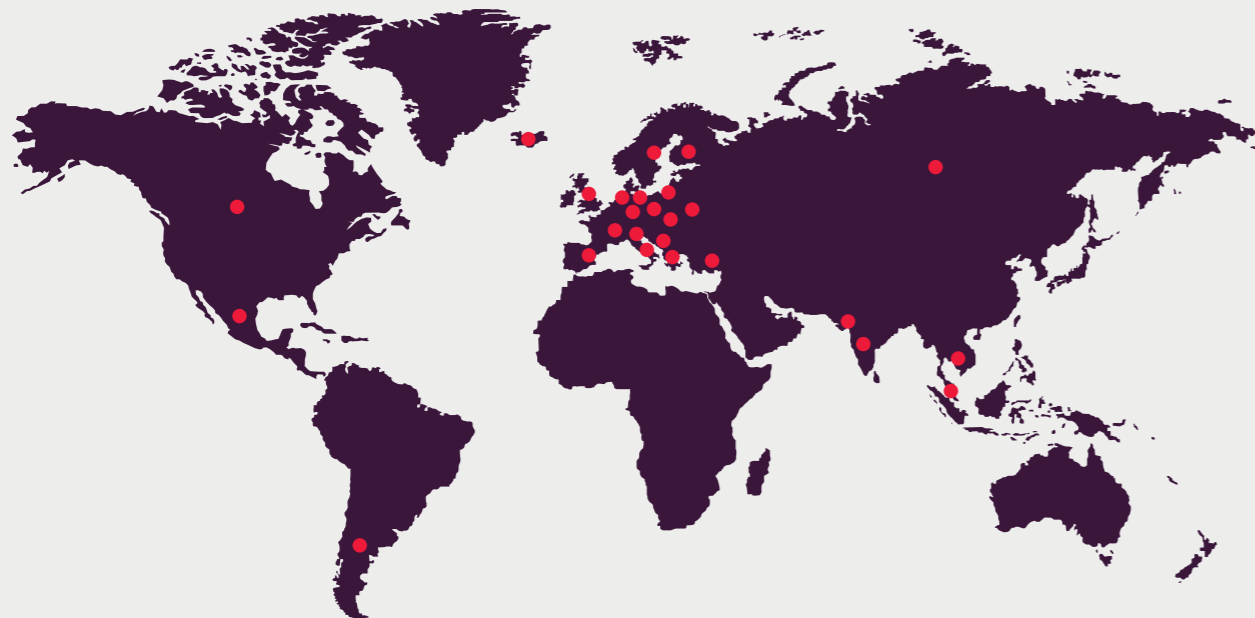
- » Our international orientation and the fact that we conduct leading research in a multicultural research environment
- » Our focus on quality and on ensuring continual improvements through follow-up and evaluation of our work and results
- » Setting ambitious standards for knowledge-sharing and scientific communication

This annual report highlights our progress and presents the key performance indicators. But we also define areas of development to continuously ensure that we are using the funds donated to our research in the best possible way.

Multidisciplinary

The DCRC is a multidisciplinary research environment comprising 250 researchers and students from 26 countries, organized into 25 research units and groups. Researchers from the DCRC published a total of 326 articles in scientific journals in 2019.

At the DCRC, we aim to engage in dynamic collaboration with other researchers and experts. We achieve this by prioritizing our involvement both in Denmark and abroad. For example, many of the research directors at the DCRC also hold an academic position at a Danish university. We often receive international visitors, such as in 2019 when we hosted cancer societies from Finland, Norway, Sweden, Cyprus, the Netherlands and Greece.



The DCRC has an international environment with employees from a wide variety of countries (indicated by red dots). Accordingly, the working language is English.

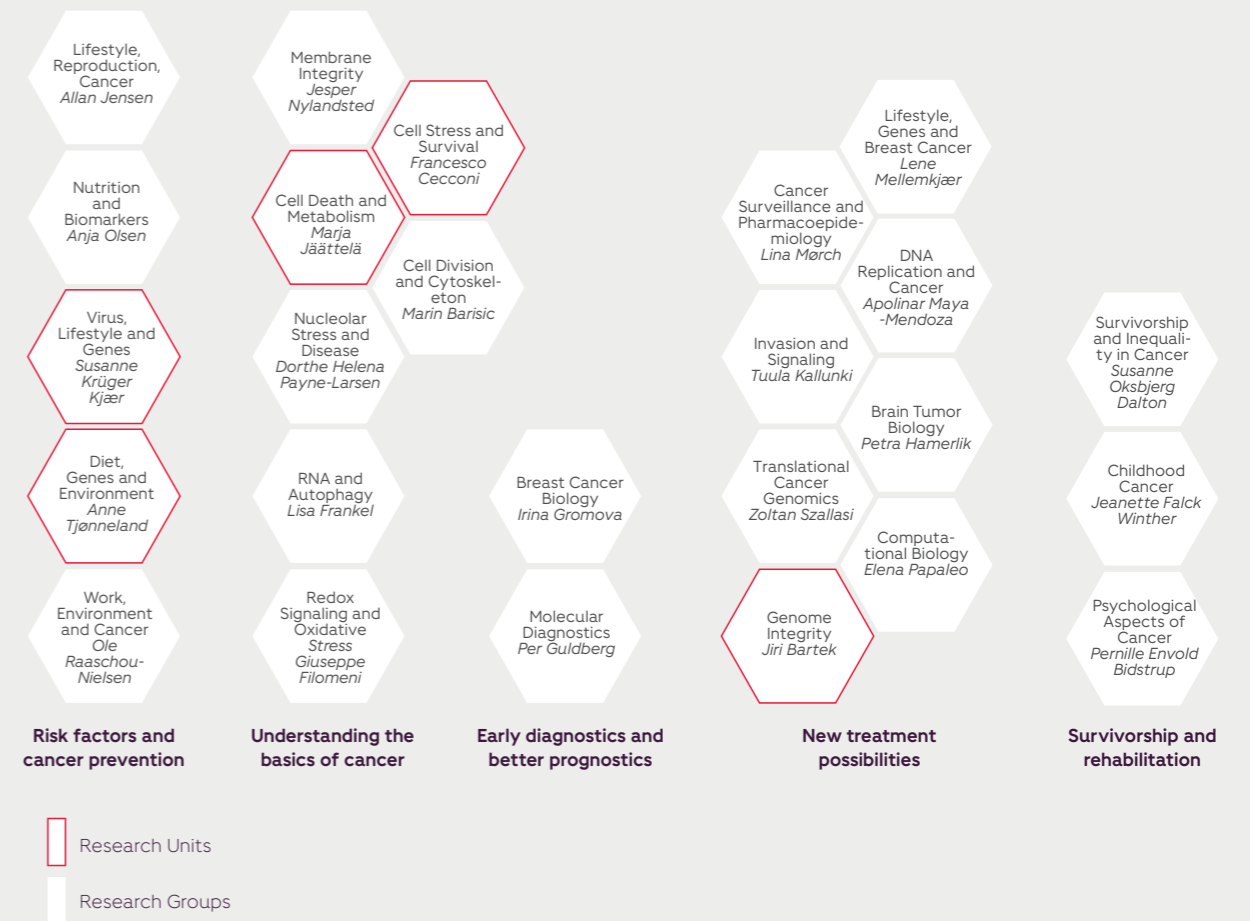
To ensure high-quality research and that our development aligns with our research strategy, an international scientific advisory board is associated with the DCRC. The board regularly serve as advisors to the management and evaluate the research. Every two years, they also evaluate our scientific efforts. In 2019, the board conducted an evaluation of the organization and key tasks at the DCRC, and also evaluated two research groups in more detail.

From RNA structures to cancer inequity

The researchers at the DCRC excel in a number of cancer research fields, ranging from: describing the mutation of a normal cell into a cancer cell, identifying factors that increase the risk of cancer, using biomarkers for early diagnosis and focusing on the prevailing inequity within cancer treatment and the disparity in the survival rate of different groups of patients.

The DCRC provides four core facilities which offer a number of the latest techniques and services used in research: biostatistical analysis, bioimaging, lipidomics and a technical experimental-animal service unit. The leaders of our research groups and core facilities meet on a monthly basis to discuss scientific developments and strategic directions.

Research areas at the DCRC





One of the most recently founded research groups at the DCRC in 2019 is the group 'RNA and Autophagy' led by Lisa Frankel. Left to right: Marie Holm Abildgaard, Lisa Frankel, Sólvieg Hlín Brynjólfssdóttir and Aida Rodriguez-López. Photo: Büro Jantzen

New talent at the Danish Cancer Society

In early 2019, cancer researcher Lisa Frankel set up a new research group at the Danish Cancer Society.

In 2018, Lisa Frankel was one of just a handful of Denmark's most talented and promising researchers to be honoured with the Lundbeck Foundation's fellowship. The fellowship includes a grant of DKK 10 million to be used over a five-year period. This became part of the foundation for the research group initiated by Lisa Frankel in early 2019.

Lisa Frankel's group focuses on how normal cells work and the changes that occur when they mutate into cancerous cells. Learning more about the ways in which cancer cells differ from normal cells can be the first step towards finding new treatments for inhibiting the growth of cancer cells.

The group is particularly interested in autophagy, i.e. the natural, regulated mechanism of the cell that removes unnecessary or dysfunctional components. Lisa Frankel has conducted research in

autophagy for a number of years and one particular question she hopes to answer is: whether autophagy is at work in the cellular components responsible for translating our DNA into proteins. This could provide knowledge about the basic characteristics of cellular function and about one of the areas where normal cells may differ from cancerous cells.

This is the first time that Lisa Frankel is starting up her own research group and, in her view, the fact that it is happening at the DCRC is a big advantage.

"The Danish Cancer Society provides a dynamic, international and competitive research environment which is ideal for starting up a new research group. As many other biological research groups have overlapping fields of interest, I consider it largely beneficial for my group to integrate into a research centre with great potential for multidisciplinary collaboration," Lisa Frankel says.

Result from 2019

Cancer discriminates between the rich and the poor

Denmark is a welfare society which ensures equal access to the healthcare system. Even so, there is pronounced social inequity from start to finish in the cancer trajectory. A scientific charting of the scope of the inequity together with the founding of the first research centre for equity contributed to counteract social inequity.

The higher your educational or income level, the lower your risk of getting cancer. Your chances of surviving cancer are greater, too. This was the conclusion in the spring of 2019 when researchers from the DCRC compiled the available knowledge on social inequity in cancer in Denmark in a white paper on the topic. These results were used to support the Danish Cancer Society's political efforts to counteract social inequity in cancer.

The white paper was based on a review of 139 studies involving cancer patients in Denmark, and the results are clear: cancer patients with a low educational level, low income, minority background or who live alone do not benefit from the progress made in cancer prevention, diagnostics and treatment over the past thirty years to the same extent as better-off cancer patients.

And these differences have noticeable consequences, explains Professor Susanne Oksbjerg Dalton from the DCRC, who co-authored the white paper.

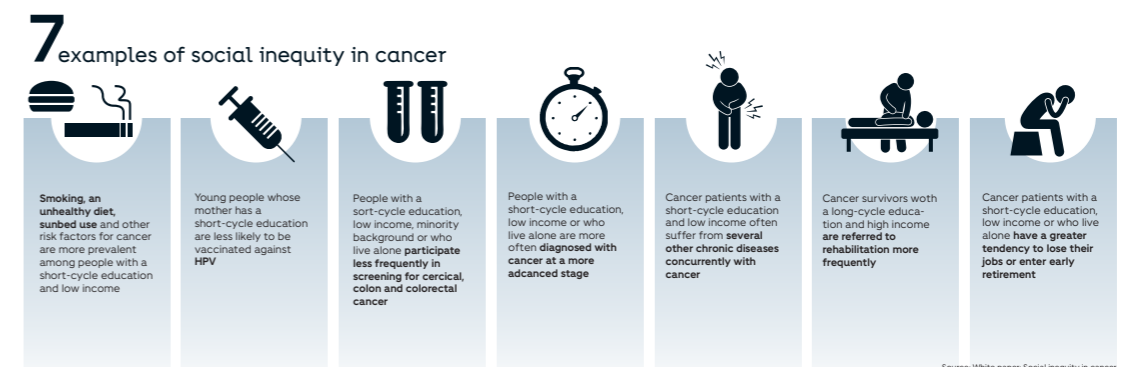
"If we could increase the cancer survival rate among low-income patients to the same level as those with the highest incomes, more than 11,000 additional patients would still be alive five years after being diagnosed with cancer," she says.

Susanne Dalton emphasizes that it is not only a matter of inequity for the weakest patients. Instead there is an incremental difference in terms of how cancer patients manage compared to for example one's income or education.



White paper compiles knowledge about cancer 'Social ulighed i kræft' (social inequity in cancer) was written by researchers from the Danish Cancer Society Research Center. The white paper was presented at a conference on social inequity in cancer in Denmark. The conference was held on 7 March at Christiansborg, Copenhagen, and was organized by the Danish Cancer Society and oncologists from the Multidisciplinary Cancer Groups.

The white paper can be read here: www.cancer.dk/hvidbog



The figure depicts seven examples of the correlation between cancer and social inequity. Illustration: Dorte Kayser.

Achievements during 2019

Over the year, the DCRC focused on developments in a number of areas – based on proposals submitted by the scientific advisory board and on developments at the Danish Cancer Society and in society in general. The DCRC’s researchers have:

- » **Welcomed** a new research group in the field of cancer surveillance and pharmacoepidemiology led by Lina Mørch
- » **Continued our knowledge-sharing initiatives** by means of monthly meetings, weekly seminars and workshops and, for most research groups, weekly laboratory and research-group meetings
- » **Widened our work** in research, evaluation and communication by adding staff from the former department for Documentation and Quality at the Danish Cancer Society
- » **Provided supplementary training** within prioritized areas: scientific writing and applications for scientific funding
- » **Redefined** our core facilities so they now include biostatistical services, bioimaging, lipidomics and a technical experimental-animal service unit
- » **Conducted a workshop** on gynaecological cancer
- » **Carried out an analysis** of strengths and opportunities, which helped form the basis for an updated strategy
- » **Renewed the PhD network**, which organized a highly valued poster session at the day-long event for all employees of the DCRC
- » **Developed a new strategy** for the DCRC, starting in 2020. The strategy defines four action areas: Impactful cancer research; translational ambitions and potential; a preferred environment for training and qualifying researchers; and partnering with patients and the general public
- » **Established a research editorial staff** to boost our research communication to ensure that we achieve our aims of proactive popular science communication
- » **Held a day-long event** for all employees of the DCRC featuring, among other things, research presentations and poster presentations
- » **Strengthened** the promotion of popular science communication, including through Science Slams, organized by the post-doc network
- » **Heightened the visibility** of our research cohorts on our website
- » **Brought focus** to staff development in selected areas such as stress management and supplementary training for administrative and technical staff and a management programme for fifteen research leaders





During her PhD programme, Inger Ødum Nielsen has assisted in the communication of research results. She is shown here giving a guided tour of the DCRC to visitors, as part of the 2019 Danish Science Festival. Photo: Danish Cancer Society

New PhD with expertise in cellular fatty acids

In 2019, Inger Ødum Nielsen became a PhD graduate in the field of "Membrane Systems Biology" at the DCRC.

Her work involves studying the fatty acids found in the body's cells, and much of her PhD was about developing analytical procedures for analyzing fatty acids in the cell membrane and inside the cell itself.

Fatty acid content is interesting because the type of fatty acid of which the cell membrane consists is significant to cellular function.

"For instance, the membrane's flexibility, stability and ability to absorb substances from its surroundings depends on whether its fatty acids are

short-chain or long-chain or consist of saturated or unsaturated fat," Inger Ødum Nielsen explains.

Within the cells, Inger Ødum Nielsen has focused particularly on the cells' "digestive system", their lysosomes. Previous research from the DCRC shows that a specific type of allergy medicine can reinforce the effect of chemotherapy, an effect that includes the lysosomes, and this is the area in which Inger Ødum Nielsen's research has provided new knowledge:

"Allergy medicine changes the composition of fatty acids in the lysosomes. This knowledge may enable us to eventually develop new therapies," Inger Ødum Nielsen says.

After completing her PhD, Inger Ødum Nielsen has continued as a postdoc at the DCRC.

PhD graduates from the DCRC in 2019

Inger Ødum Nielsen: Shotgun lipidomics explores perturbations in the lysosomal lipid metabolism by cationic amphiphilic drugs

Thilde Bagger Terkelsen: Bioinformatic analysis of breast tumor interstitial fluids – insights into a pan-molecular secretome

Charlotte Skriver: Associations of low-dose aspirin or other non-steroidal anti-inflammatory drug use with prostate cancer risk and mortality

Riccardo Vanzo: Functional interplay between DNA damage response and autophagy machineries under cellular stress conditions and during tumorigenesis

Cristina Boschini: Excess risk estimation in matched cohort studies

Claudia Guasch Boldú: Functional study of tubulin post-translational modifications in cell division

Christina Witt Bæksted: Patient involvement and integration of new methods in health care – development of a PRO-tool for registration of side effects from cancer therapy

Thea Helene Degett: Short-term outcome after acute colorectal cancer surgery – risk factors and prediction

Anne Kirstine Eriksen: The role of whole grains and lignans in lifestyle diseases – emphasis on prostate cancer and type 2 diabetes and their risk factors

Filippa Nyboe Norsker: Late effects in survivors of neuroblastoma and soft-tissue sarcomas

Gunn Ammitzbøll: LYCA – the effect of progressive resistance training after breast cancer surgery with axillary lymph node dissection

Kajsa Ugelvig Petersen: Adverse occupational health effects in firefighters – mortality, cancer and infertility

Theresa Louise Boye: Annexins in plasma membrane repair

Rikke Langballe: Contralateral breast cancer – preventive therapy and survival

Hanin Salem: Psychological late effects in parents of children with cancer

Key figures

Key performance indicators are part of the monitoring of research achievements. To get as precise a picture as possible, the indicators are combined with internal monitoring, an external scientific evaluation and advice provided by the scientific advisory board.

In 2019, the DCRC published 326 articles in peer-reviewed journals within a wide range of fields.

Karolinska Institutet, German Cancer Research Centre, Imperial College and the International Agency for Research on Cancer.

The leading international collaborations are primarily with researchers from Aarhus University,

Key figures for scientific articles published by the DCRC

Citations	
Total	39,700
Mean	20.5
Mean for national collaborative publications	5.9
Mean for international collaborative publications	33.4
Field-weighted citation index	2.55
Publications in the top 10 pct. of cited journals	55 pct.
Share of top 10 pct. most cited publications	33 pct.
Views	
Total views	76,400
Mean views	39.3
Top 10 pct. most viewed publications	26 pct.
Collaborations	
Percentage of co-authored publications with international institutions	66 pct.
Academic-corporate collaborations	6 pct.

Analysis based on Scopus, SciVal and Web of Science from 2014 to 2019. The publications comprise original articles (87%), reviews (6%) and other (7%).

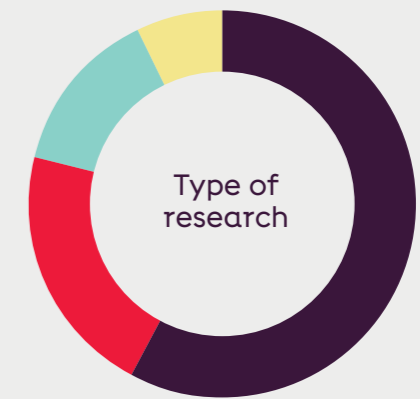
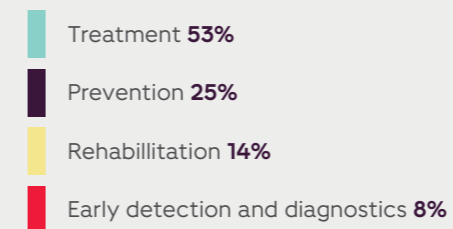
Funding

In 2019, the DCRC basis budget consisted of DKK 96.9m from the Danish Cancer Society. Of this money, DKK 33.4m went to housing and IT costs, DKK 5.4m went to research governance and communication and DKK 58.1m were distributed between the 25 research groups. In open application

processes during 2019, researchers at the DCRC were awarded research grants of DKK 70m from a large number of foundations, for research project to be carried out within the next years. In total, 53 pct. of the budget and 29.8 pct. of the costs for research staff, covered by funding from the Danish Cancer Society.



The funding granted to the DCRC in 2019 went to research in different stages of the cancer trajectory. The diagram shows funds allocated after open calls, and includes external funding.



Funds allocated to the DCRC in 2019 were dispersed on the above areas of research. The diagram shows funds allocated after open calls, and includes external funding.



Efforts for the future

The DCRC drew up a new strategy in 2019 that will apply from 2020. It describes both current and future options, identifies and clarifies weaknesses and outlines the direction for the development of the DCRC. The purpose is to help research-unit leaders, employees and students develop and prepare for the four core areas: impactful cancer research, a preferred environment for training researchers, translational ambitions and potential as well as partnering with patients and the public.

The upcoming tasks of the DCRC in 2020 include launching the initiatives described in the new strategy, according to which we must achieve our research goals, clarify and promote our research profile, prioritize areas of investment and recruitment, and ensure coherence and commitment. In addition, we plan to continue efforts to follow up on the evaluation provided by the Scientific Advisory Board in 2019.

The initiatives planned include:

- » **Develop principles** for recognizing and highlighting excellent research
- » **Identify and develop the potential** for translational research by, among other things, strengthening cooperation between clinical practice and academic research
- » **Establish action plans** with quantifiable, achievable goals within the various research groups to follow up on the new strategy and support the strategic ambitions
- » **Continue efforts** to define and strengthen national and international research collaboration
- » **Consolidate** the four research support units and develop new services
- » **Pursue efforts** within responsible data processing and research integrity
- » **Further develop** research communication





Anja Olsen: new professor in lifestyle and cancer

In 2019 senior researcher and group leader, Anja Olsen, was appointed to a professorship in Lifestyle and Cancer at the Department of Public Health at Aarhus University.

Much of Anja Olsen's research is based on the Danish Cancer Society's large population study 'Diet, Cancer and Health', which has contributed important new knowledge about the causes of cancer.

Among other things, Anja Olsen's research has shown how whole grains affect our health and that whole grains can reduce the risk of developing colorectal cancer. Another field of her research is phytoestrogens, hormone-like substances found in many of the plants we eat. Anja Olsen has studied the correlation between phytoestrogens and breast cancer in particular, both as it relates to the development of breast cancer and the prognosis for women who already have breast cancer.

Professorship strengthens research

The population-based study 'Diet, Cancer and Health' has been carried on in recent years by establishing the population study 'Diet, Cancer and

Health – Next Generations', in which children and grandchildren of the original subjects are invited to participate.

This means that knowledge and biological samples spanning generations and years are now available, which provides a unique opportunity to learn more about the effects of lifestyle through generations and to study the correlation with brand-new lifestyle-related factors such as intestinal bacteria. Managing this type of epidemiological data is a complex task, however, this is where collaborating with Aarhus University can make a big difference.

"Aarhus University has a dynamic environment for methodological epidemiology, which will be a valuable tool for future research based on 'Diet, Cancer and Health – Next Generations'. I am personally looking very much forward to this collaboration and the opportunities it provides to learn and absorb new knowledge. It also gives me an interesting opportunity to work with new colleagues and establish new relationships," Anja Olsen says.

Building bridges

Being an active partner and team player are important to the DCRC. This is true in terms of both society in general and other research and knowledge institutions in Denmark and abroad. One way this is achieved is through dual-position employment in which researchers are employed by both the DCRC and a university. This strengthens the research because it enables researchers to work in research groups at both institutions, and they can be primary supervisors of PhD students from the university, for example. One of these researchers is Anja Olsen, Senior Researcher and head of a research group at the DCRC. She was appointed a professorship in Lifestyle and Cancer at the Department of Public Health at Aarhus University on 1 September 2019.

Anja Olsen from the DCRC was in 2019 appointed professor in lifestyle and cancer at Aarhus University. Photo: Tomas Bertelsen

Diet, Cancer and Health

The population study 'Diet, Cancer and Health' is a scientific contribution to Danish history. 57,053 Danes have provided details about their lifestyle and have given samples including blood, urine, toenail clippings and fatty tissue samples. You can read about some of the knowledge generated by the study here.

Result from 2019

New knowledge about menopausal hormone therapy and the risk of breast cancer

In 2019, data from the 'Diet, Cancer and Health' cohort provided new knowledge about the consequences of using menopausal hormone therapy.

Currently, the Danish Cancer Society and other experts advise women to use menopausal hormone therapy only if they experience severe discomfort from hot flushes, mood disorders or vulvovaginal atrophy and dryness. Because even if menopausal hormone therapy can relieve these discomforts, it also increases the risk of breast cancer.

These results are confirmed in the new study published in the Lancet. The results show that the risk of breast cancer is increased no matter if the hormone therapy includes only oestrogen or a combination of the hormones oestrogen and

progesterone. However, the risk of breast cancer is not increased in women who take vaginal oestrogen suppositories.

It was previously believed that the risk of breast cancer diminishes relatively quickly after women have discontinued hormone therapy. But the new study shows that even ten years after a woman has discontinued hormonal therapy, she will still have a significantly higher risk of getting breast cancer.

The results are published here: Collaborative Group on Hormonal Factors in Breast Cancer: Type and timing of menopausal hormone therapy and breast cancer risk: individual participant meta-analysis of the worldwide epidemiological evidence. The Lancet, published online 29 August 2019.

Only use endocrine therapy when absolutely necessary, and then only as briefly as possible. Take occasional breaks in consultation with your doctor; the discomforts you originally experienced may have disappeared or lessened enough for you to phase out or completely discontinue the therapy.

Niels Kroman, Professor, Department of Breast Cancer Surgery, Rigshospitalet and Medical Director, Danish Cancer Society.

'Diet, Cancer and Health' is one of the biggest population studies at the Danish Cancer Society

Result from 2019

Yoghurt and fibre may prevent lung cancer

Yoghurt and dietary fibre are good for the gastrointestinal tract. In 2019, a study based on almost half a million people showed that yoghurt and fibre may prevent lung cancer. The research done was based on data from sources including the Diet, Cancer and Health cohort. The subjects in the study who had the highest intake of both dietary fibre and yoghurt had a thirty percent lower risk of getting lung cancer compared to subjects who had the least intake of these two food groups, even when taking account of smoking and other risk factors.

The effect cannot yet be explained, but might be linked to the composition of bacteria in our gut being of importance to our general health – a composition which can be affected by the food we eat.

The results are published here: Jae Jeong Yang et al.: Association of Dietary Fibre and Yoghurt Consumption with Lung Cancer Risk. JAMA Oncology, 24 October 2019

If you want to prevent lung cancer, the most important thing you can do is stop smoking.

Anne Tjønneland, Research Manager, DCRC, co-author of the study

'Diet, Cancer and Health' has made us wiser

- » Alcohol increases the risk of breast cancer. Therefore, the Danish Health Authority has lowered the maximum recommended weekly intake of alcohol
- » Whole grains reduce the risk of colorectal cancer. Therefore, the Danish Cancer Society work to urge Danes to increase their consumption of whole grains. According to 2019 statistics, more than half of the Danish population currently consumes the recommended amount of whole grains
- » Air pollution increases the risk of lung cancer. This knowledge has been instrumental in putting initiatives to reduce air pollution on the political agenda
- » Biological markers make it possible to detect bladder cancer by means of a urine sample instead of cystoscopy, which is otherwise the routine procedure today. In 2019, researchers from Hvidovre Hospital and the DCRC began an experiment where patients will test the technique in practice

The effect of yoghurt and dietary fibre on gut bacteria

Dietary fibres are **prebiotics**. They contain insoluble fibres that microbiota can ferment. This forms nutrition for cells in the intestinal mucosal barrier, and help form the bacterial composition in the intestines. Yoghurt are **probiotics**, comprising live microorganisms that can affect, and perhaps improve, the intestinal bacterial composition.



Result from 2019

Genetic analysis and artificial intelligence (AI) predict cancer survival

A newly developed genetic test may be able to help choose the best treatment in the future.

The technique was initially tried out on patients with non-small cell lung carcinoma (NSCLC), but it should be possible to apply the principle in the treatment of other types of cancer in the future, according to one of the researchers, Nicolai Juul Birkbak, Associate Professor, Aarhus University Hospital. The technique is named ORACLE, an acronym for Outcome Risk Associated Clonal Lung Expression.

By analyzing 23 genes in malignant tumours, the researchers could predict which tumours were aggressive and which were more placid. The results were directly linked to the patients' probability of surviving the disease and they classified the malignant tumours far more precisely than the methods available today.

According to another researcher, Jiri Bartek, Professor and head of the unit 'Genome Integrity' at the DCRC this holds exciting possibilities:

"We still need to verify our results through additional experiments, but if we could transfer this to patients, we might be able to save lives by giving an additional treatment to patients in the high-risk group," he says.

No genetic analysis up to now

Lung cancer is divided into four different stages, which describe the extent to which the cancer has spread. The classification determines whether a patient only needs surgery or also is in need of chemotherapy. For some of the patients who only undergo surgery, the disease returns, however. And for others who receive chemotherapy, the aggressiveness of the disease is in fact so minor that they should not have had to undergo chemotherapy in light of the risks entailed.

Several researchers are working to use genetic analysis as a guide, but these methods have yet to reach clinical practice. There are notably vast genetic differences, both between individual patients' malignant tumours and even in different areas of the same tumour.

Artificial intelligence

The ORACLE technique is based on knowledge of how cancer cells develop, combined with machine learning – a type of AI in which computers use existing data to recognize patterns and develop algorithms that can predict the results of new data.

To the individual patient, an ORACLE analysis provides a score (a risk value) linked to the probability of survival.

In a study of 904 patients tested for the selected genes and whose cancer outcome was known, the results showed that the ORACLE score provided a reliable estimate of the probability that the patients would survive.

After this, the researchers tested ORACLE on 103 lung cancer patients. The patients who were given a high-risk score by ORACLE had a three times greater risk of dying from their disease within five years of being diagnosed with cancer than the low-risk patients.

"The risk was independent on other known risk factors, such as the stage of the disease, or whether the patient had smoked. This indicates that ORACLE provides a new objective measurement of the aggressiveness of cancer at molecular level," Jiri Bartek says.

The researchers could also show that for the 60 patients who had stage 1 lung cancer, ORACLE could predict which of them had a significantly higher probability of surviving the disease. None

of the other methods available today could predict whether some patients had a higher probability of surviving than others.

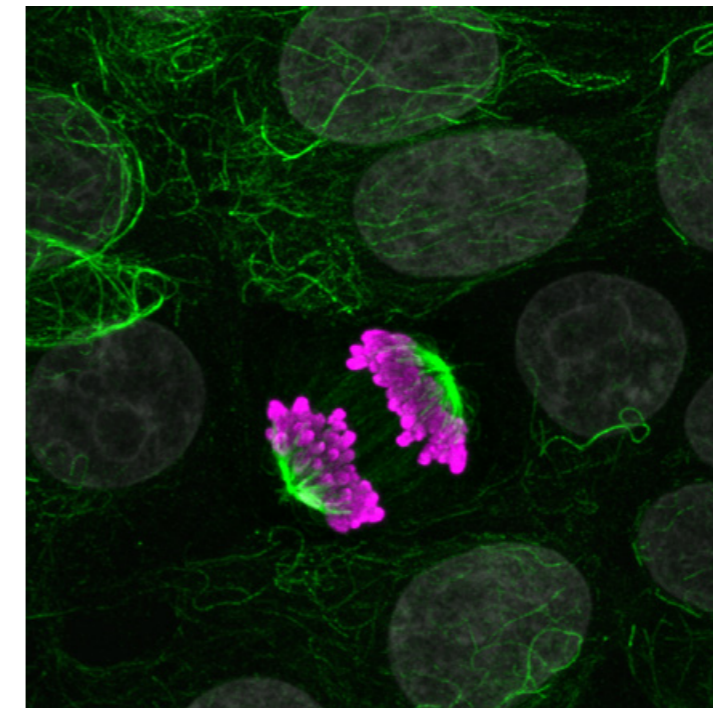
The next step will be to compare ORACLE with even more clinical data. If the results are positive, the researchers hope that it will be possible to try out ORACLE in experiments involving patients.

The results are published here: Biswas et al.: A clonal expression biomarker associates with lung cancer mortality. Nat Med. 2019 Oct;25(10):1540-1548

Collaborating researchers

The new results were achieved through international collaboration, led by British professor Charles Swanton of the Francis Crick Institute, London. Two groups of researchers from the DCRC took part; led by professor Jiri Bartek and group leader Zoltan Szallasi.

Nicolai Juul Birkbak, Associate Professor, Aarhus University and Aarhus University Hospital, took part in the project and was awarded the Danish Cancer Society's Junior Researcher Award. Read more about Nicolai Juul Birkbak on page 51.



A cell in the cell division phase in which the mitotic DNA (purple stain) is pulled apart by microtubules (green stain). Grey nuclei can be seen in the surrounding cells that are not dividing.
Photo: Jonathan Lucien Stahl.

Result from 2019

Children attending schools near an asbestos cement factory have a higher risk of a rare cancer

Of the 12,000 former students of four schools situated near the former Danish Asbestos Cement Factory in Aalborg, 38 have subsequently developed cancer due to the asbestos they were exposed to as children. This is shown in a study from Aalborg University Hospital, co-authored by Johnni Hansen, Senior Researcher at the DCRC.

These former schoolchildren developed malignant mesothelioma, a disease which in most cases manifests itself as pleural mesothelioma. Asbestos is the only known cause of malignant mesothelioma.

The study shows that, in adulthood, the former schoolchildren have a roughly seven-fold greater risk of getting the disease, compared to the general population of the same age.

Today, anyone who contracts malignant mesothelioma because they were exposed to asbestos at work is entitled to financial compensation

from Labour Market Insurance. Their spouses, partners and children exposed to asbestos dust in the home are entitled to a special remuneration.

The Danish Cancer Society wants to widen the scope of the law so that anyone who gets malignant mesothelioma – and who is not already eligible for compensation due to work-related exposure to asbestos – is entitled to remuneration.

Each year, malignant mesothelioma affects roughly 140 people in Denmark, the vast majority of whom have been exposed to asbestos at work.

The results are published here: Dalsgaard SB, Würtz ET, Hansen J, Røe OD, Ormland: Environmental asbestos exposure in childhood and risk of mesothelioma later in life. A long-term follow-up register based cohort study. Occupational & Environmental Medicine 2019



Senior researcher Johnni Hansen is an expert in registry-based studies. Listen to him tell about his research in a video on the Danish Cancer Society's website. <https://cancervideo.dk/> Photo: Tomas Bertelsen



Head of the DCRC unit 'Virus, Lifestyle and Genes', Susanne Krüger Kjær heads the new research project. Photo: Danish Cancer Society

New project in 2019

New research project aims to help women with vulvar cancer

Vulvar cancer, which affects the outer surface of female genitalia, is a rare form of cancer that affects around 120 women in Denmark each year. The disease rate is on the rise, however, particularly in young women, which is why researchers from the DCRC have initiated a research project aimed at increasing women's survival rate and reducing late effects.

Vulvar cancer can either be due to an infection with the HPV virus or have other causes, such as the skin disease lichen sclerosus.

Learning why the disease arises can help lead the way to finding the best treatment. This is why the researchers will study whether two factors in the malignant tumour can predict these women's survival chances.

One is determined by measuring the amount of the p16 protein, which plays an important part in regulating cell division. The other is whether the cancer is caused by an HPV infection. Research into head and neck cancer, which can also be caused by HPV, indicates that cancer caused by an HPV infection might be more sensitive to radiotherapy. If this also turns out to be the case for vulvar cancer, this could be a pathway towards better treatment.

The research is led by Susanne Krüger Kjær, head of the unit 'Virus, Lifestyle and Genes' at the DCRC, and Professor at Rigshospitalet and the University of Copenhagen.

New project in 2019

From genes to new treatments: New research will examine malignant melanoma

A new research project targeting malignant melanoma will go all out to provide new information about the complex mechanisms inside cells and about new treatment options.

What takes place inside pigment-containing cells (melanocytes) when they develop into melanoma and which parts of the cell can be targeted by new therapies? Senior researcher Daniela De Zio of the DCRC hopes to find the answers to these questions in a new research project involving partners from Denmark and abroad over the next three years.

Daniela De Zio will study the *AMBRA1* gene. She and her team at the group 'Cell Stress and Survival' discovered that mice in which *AMBRA1* is inactive are more prone to develop malignant melanoma than normal mice. In these animals, the tumour grows bigger and more rapidly. Accordingly, Daniela De Zio hypothesizes that the changes taking place in cells when *AMBRA1* is

inactivated could be a target for future treatments against malignant melanoma.

The funding sources for this new research include one of the world's leading foundations in the area of malignant melanoma – The Melanoma Research Alliance – and this is the first time the foundation is supporting a researcher in Denmark.

When the research project is completed, Daniela De Zio hopes that its results will help shed new light on our understanding of malignant melanoma.

"I hope that we better understand how malignant melanoma develops and that we find many of the cancer cells' weaknesses which we can exploit in future treatments. Perhaps we will even have a few good suggestions for specific new treatments," Daniela De Zio says.



Daniela De Zio
Photo: Büro Jantzen

Collaborating researchers

The researchers from the DCRC are joined by researchers from the National Center for Cancer Immune Therapy (CCIT-DK) at Herlev Hospital and from the universities in Newcastle, Luxembourg and Leuven.



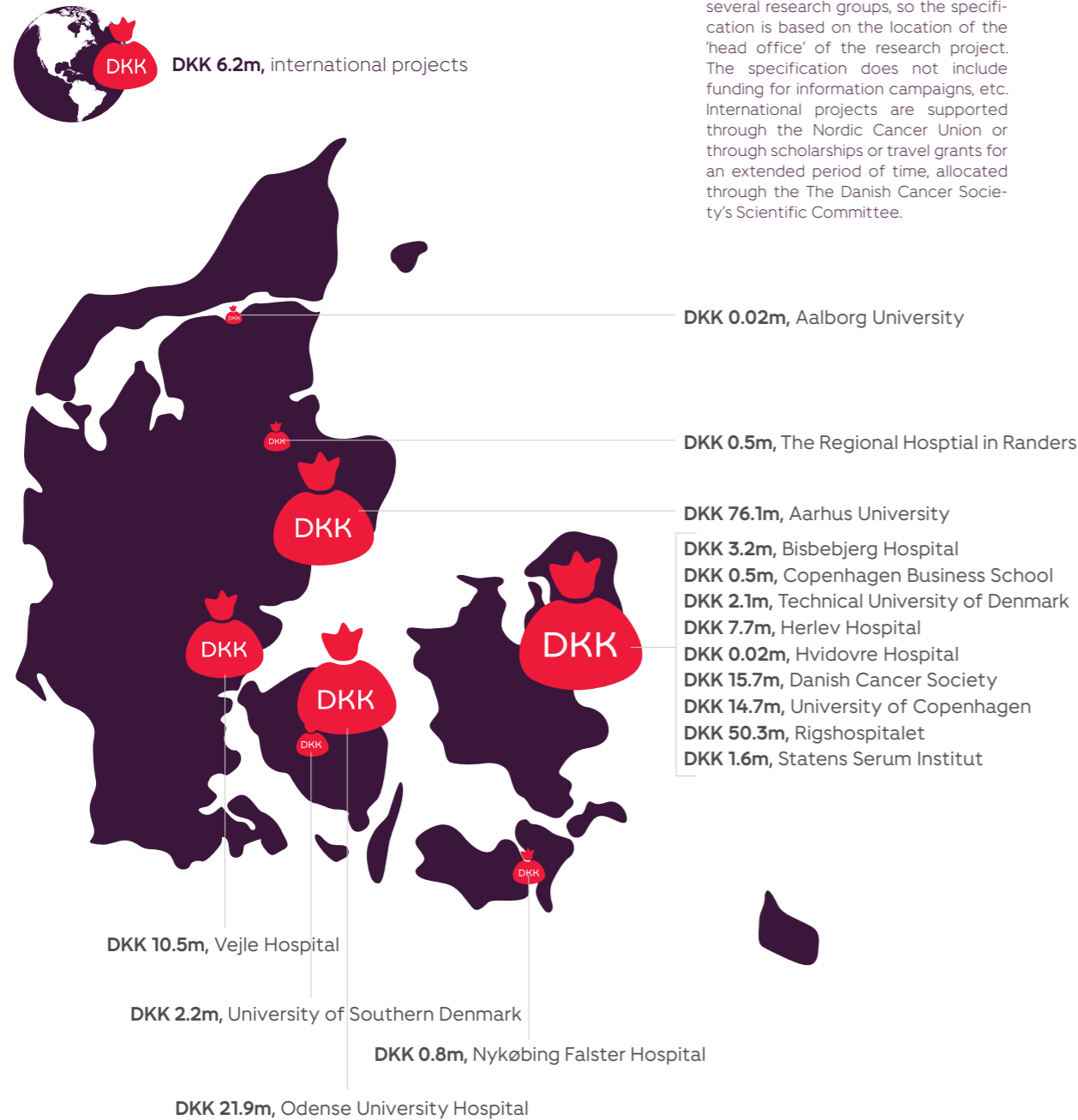


The Danish Cancer Society supports research throughout Denmark

In addition to supporting the DCRC, the Danish Cancer Society supports cancer research with funding in excess of DKK 200 million every year.

Funding granted by the Danish Cancer Society to research in 2019

The map below shows the geographical distribution of the funding granted by the Danish Cancer Society in 2019.



Specification of the distribution of funding granted through the Danish Cancer Society's Scientific Committee, Psychosocial Research Committee, the Nordic Cancer Union and Knæk Cancer.

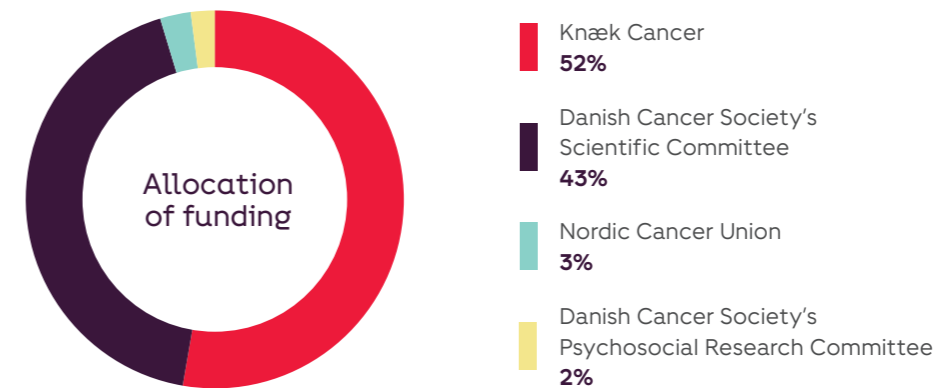
The figures show the total amount granted to research institutions for all the funding of research projects given to the institution. Projects are often implemented as a collaboration involving several research groups, so the specification is based on the location of the 'head office' of the research project. The specification does not include funding for information campaigns, etc. International projects are supported through the Nordic Cancer Union or through scholarships or travel grants for an extended period of time, allocated through the The Danish Cancer Society's Scientific Committee.

The Danish Cancer Society has two standing committees: the Scientific Committee and the Psychosocial Research Committee. Each year, they allocate funding to research projects in an open call for applications.

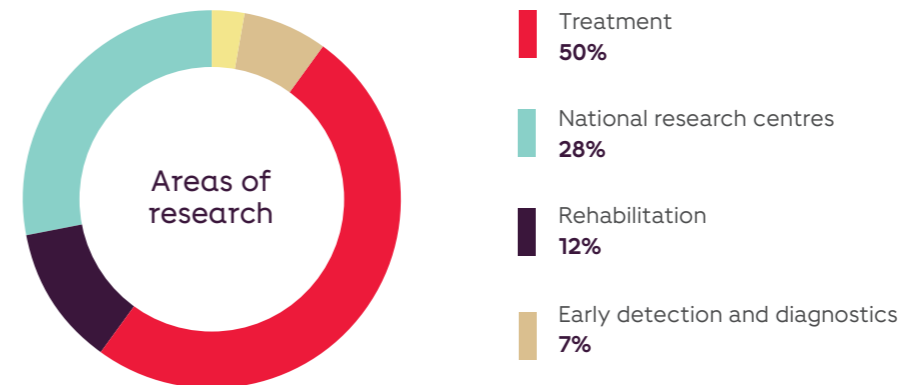
The Danish Cancer Society distributes both general and strategic research funding.

As the general funds are not earmarked for specific fields of research, they can be applied for across a broad spectrum.

The so-called strategic funds, such as the proceeds from Knæk Cancer, are allocated to research within areas selected and decided on by the Central Board. The funding is granted by committees with a relevant scientific background as well as patients and relatives.



The percentage breakdown of research funding granted by each of the committees under the Danish Cancer Society.



The percentage breakdown of the cancer stages targeted by research projects supported by the Danish Cancer Society in 2019.



The Danish Cancer Society's Scientific Committee

In 2019, the Danish Cancer Society's Scientific Committee gave DKK 80.8 million to 49 research projects in the main allocation round. This is fifteen more research projects than in 2018, and the extraordinarily large allocation was possible due to large sums bequeathed to cancer research. Approximately DKK 7.5 million was bequeathed to the Danish Cancer Society in 2019.

Each year, the Danish Cancer Society's Scientific Committee allocates funding to a wide range of basic, clinical and epidemiological cancer-research projects in the fields of medicine and science and to epidemiological cancer research projects within psycho-social research. The grants are possible thanks to money bequeathed by Danes to the Danish Cancer Society each year.

To be eligible to apply for these funds, you must be a cancer researcher at a Danish institution (such as a university or hospital), or a Danish researcher who is conducting research abroad and intends to bring the results back to Denmark. The DCRC's researchers are also eligible to apply. They do not have a preferential right, but apply on equal terms with other researchers.

The Danish Cancer Society's Scientific Committee has 15 members; they are active, experienced

researchers from either Denmark or abroad and are knowledgeable of oncology. In addition, two members of the committee are patient representatives. The members are selected by the Central Board of the Danish Cancer Society, and the composition of the committee ensures that it has experts within all the fields to which funding is granted.

The funding is allocated on the basis of an assessment of the applications submitted. Bequeathed donations that are earmarked for special types of cancer research are also allocated by the Danish Cancer Society's Scientific Committee.

The Danish Cancer Society's Scientific Committee can also submit opinions to the Danish Cancer Society's Executive Committee concerning technical issues within the Committee's sphere of expertise.

Circulating tumour DNA

It is predicted that analyses of 'circulating tumour DNA' (ctDNA), also known as cancer DNA in blood, will revolutionize cancer treatment in the future with effective new tests. The Danish Cancer Society supports this research, most recently with DKK 25 million from the 2019 Knæk Cancer fundraising campaign to establish a 'National Research Centre for Treatment Guided by ctDNA in the Bloodstream'.

Result from 2019

New test for colorectal cancer relapse

Researchers from Aarhus University Hospital and Aarhus University have studied whether blood samples could predict which patients were at risk of relapse after having undergone colorectal cancer surgery. The blood was examined for small DNA fragments deriving from cancer cells, because this means that the patient still has cancer cells somewhere in the body.

The results show that if a patient has ctDNA in the bloodstream after the operation, the risk of relapse is very high, almost 100 pct. This makes ctDNA in the bloodstream a much better indicator of the relapse risk than the procedure used today. The blood tests detect ctDNA roughly nine months earlier than a cancer relapse is detected via a CT scan.

The researchers are now working on new studies aimed at verifying the value of the blood tests which measure ctDNA in the blood.

The results are published here: Thomas Reinert et al: Analysis of Plasma Cell-Free DNA by Ultra-deep Sequencing in Patients With Stages I to III Colorectal Cancer. JAMA Oncology



Professor Claus Lindbjerg Andersen.
Photo: Anita Graversen

The Danish Cancer Society supports the research

The project 'Implementation of non-invasive ctDNA analysis to optimize post-operative treatment and follow-up for patients with colorectal cancer' received DKK 2 million from the Danish Cancer Society's Scientific Committee in 2016 and DKK 1 million from Knæk Cancer in 2015.

New project in 2019

Blood tests as follow-up

Researchers are conducting a new study to compare a novel blood-test-based follow-up programme for colorectal cancer with the current scan-based programme. The researchers are looking into whether it is possible, with the help of blood tests measuring ctDNA, to find more relapses earlier so more patients can receive curative treatment and whether this will increase the survival rate in the long term.

ctDNA in the blood is a sign of residual disease with an inherent high risk of relapse. The researchers hope that the blood-test-based follow-up programme will make it possible to divide patients into two groups: a group where patients with ctDNA in their bloodstream are offered scans more frequently to detect relapse, and a group of patients without ctDNA who can avoid unnecessary scans.

The researchers will also study how the two different follow-up programmes affect patients' quality of life.

Result from 2019

Bladder cancer relapse is detectable in the blood

Another group of researchers from Aarhus have studied ctDNA in blood taken from patients with bladder cancer. The researchers found ctDNA in the blood of all patients in the project who suffered a relapse after treatment for bladder cancer. And they found it about three months earlier on average than it was detected via standard follow-up programmes. No ctDNA was found in patients without relapse.

The researchers hope that measuring ctDNA in the blood can help identify patients with relapse of bladder cancer at an earlier stage and thereby improve survival rates in the future.

The results are published here: Christensen E. et al.: Early Detection of Metastatic Relapse and Monitoring of Therapeutic Efficacy by Ultra-Deep Sequencing of Plasma Cell-Free DNA in Patients With Urothelial Bladder Carcinoma. Journal of Clinical Oncology

New project in 2019

Knæk Cancer supports a 'research centre without walls' for cancer DNA in the blood

One of the biggest grants from the 2019 Knæk Cancer campaign, DKK 25 million, went to the creation of a new national research centre for treatment guided by ctDNA in the blood. The centre will pave the way for research projects which can document how measuring ctDNA can become part of routine cancer treatment.

The centre is led by several of Denmark's leading researchers, including Professor Claus Lindbjerg Andersen and Professor Lars Dyrskjødt Andersen, both of Aarhus University and Aarhus University Hospital. The research centre gathers all researchers and experts in the field. More than sixty doctors and researchers from four universities and seventeen hospitals covering all five regions of Denmark are involved in the establishment of the centre.

ctDNA

- » Cells in the body release small fragments of genetic material, DNA, into the bloodstream. This also applies to cancer cells. This means that cancer patients have DNA with cancer mutations in their bloodstream.
- » The blood-sample test is designed for each individual patient by analyzing tissue from the cancerous tumour that was surgically removed.
- » This is referred to as 'circulating tumour DNA' (ctDNA) and in spite of the keen focus on blood testing, ctDNA can also be detected in other bodily fluids, such as urine, in connection with bladder cancer.

The Danish Cancer Society supports the research

The project 'Individualized cancer monitoring by means of ultra-deep sequencing of ctDNA in advanced bladder cancer' received a grant of DKK 1.8 million from the Danish Cancer Society's Scientific Committee in 2015.

The project 'IMPROVE IT2: IMPROVE interventions studie 2' received a grant of DKK 3,9 million from The Danish Cancer Society's Scientific Committee in 2019.

Result from 2019

Acute pancreatitis can be a sign of cancer

Many patients who are hospitalized with acute pancreatitis should probably be examined for pancreatic cancer. This is the message from the lead author of a new study, supported by the Danish Cancer Society's Scientific Committee, which points out a possible tool for early diagnosis of a very serious type of cancer.

The new study shows that patients who get pancreatitis within 90 days before being diagnosed with pancreatic cancer are generally diagnosed earlier and thus have a better survival rate than cancer patients who did not have pancreatitis first.

Because the cancer is detected earlier, several of the patients are eligible for surgery, which is the most effective way to treat pancreatic cancer, explains the study's lead author, Jakob Winther Kirkegård, PhD, who is a resident doctor at the Department of Surgery (section for upper gastrointestinal and hepato-pancreato-biliary surgery) at Aarhus University Hospital.

"Our results verify that patients cope better, because in many instances the cancer is detected earlier in patients who get acute pancreatitis. Therefore, a greater number of these patients should probably be scanned for cancer on a routine basis," Jakob Winther Kirkegård says.

"Yet we don't know exactly when the scan should be done, or whether there are any special groups of patients who don't need to be scanned. We would like to study this in a new experiment in which we scan all patients who are hospitalized with acute pancreatitis, and preferably include patients from several countries," he adds.

Both Danish and American patients

The new study builds on registry-based data for almost 50,000 Danish and American patients with pancreatic cancer. Among them, 1.4 pct. of the Danish patients and 5.9 pct. of the American pa-

tients had had acute pancreatitis within 90 days before being diagnosed with cancer.

Among the Danish patients, 6.1 pct. more of the patients who had had acute pancreatitis were alive five years later, compared to the rest of the patients with pancreatic cancer.

In 43 pct. of the Danish patients with acute pancreatitis, the cancer had metastasized by the time of diagnosis, compared to 49 pct. of the rest of the patients with pancreatic patients.

This meant that 20 pct. of the Danish patients with acute pancreatitis could undergo surgery for pancreatic cancer, compared to only 12 pct. of the patients who had not had an acute condition first.

The researchers found the same tendency among the American patients, but to a lesser extent. This could be due to the fact that the American patients were older and had several other diseases than cancer, the researchers write.

An insidious disease

Pancreatic cancer is a very serious disease affecting about 1,000 people in Denmark each year. The disease has frequently metastasized before the patient shows any symptoms.

"Pancreatic cancer sneaks up on you, and today we frequently detect the disease so late that it is advanced and difficult to treat. This tool enables us to detect the disease earlier in some patients, which is why it can make a difference," Jakob Winther Kirkegård says.

One percent of patients with acute pancreatitis have pancreatic cancer.

It is uncertain whether cancer actually causes the acute pancreatitis. But previous research seems to indicate a biological explanation whereby the malignant tumour can block a duct leading from the pancreas into the duodenum, which can induce acute inflammation.

The results are published here: Kirkegård et al: Acute Pancreatitis as an Early Marker of Pancreatic Cancer and Cancer Stage, Treatment, and Prognosis. Cancer Epidemiology, 2019

Comment
from the Danish
Pancreatic Cancer
Group

Doctors must be aware

Professor Michael Bau Mortensen is a member of the board of the Danish Pancreatic Cancer Group, which is the medical society for the treatment of pancreatic cancer. In his view, the study emphasizes that acute pancreatitis requires a heightened awareness.

"The most important message of the study is that all doctors must be aware of the possibility that acute pancreatitis can be the first sign of a serious pancreatic disease. This is particularly true if none of the usual causes are present, such as gallstones or a high level of alcohol consumption," Michael Bau Mortensen says.

He takes a positive view of the new study that Jakob Winther Kirkegård wants to launch.

"No matter how sensitive the follow-up scans are, quite a lot of patients would have to be scanned to find a few cases of cancer, because pancreatic cancer is a rare disease, fortunately. That said, however, I'm still positive about any scientific advance that can improve the treatment of pancreatic cancer," Michael Bau Mortensen says.

Result from 2019

Repurposed medicines showed no effect on pancreatic cancer risk

A study disproves a theory that drugs used to treat diabetes, hypertension and to lower cholesterol levels also have an effect on cancer.

While he was a PhD student, Dr Jakob Winther Kirkegård was employed on the basis of a grant given by the Danish Cancer Society's Scientific Committee in 2015. Since then, he has published ten scientific articles; he is lead author of nine of them.

The original focus of the grant from the Danish Cancer Society's Scientific Committee was chronic pancreatitis and pancreatic cancer. It is known that patients with chronic pancreatitis have a six-fold greater risk of subsequently developing pancreatic cancer, and Jakob Winther Kirkegård and his colleagues were tasked with studying whether the cancer was preventable using ordinary prescription drugs administered to combat diabetes and hypertension and to lower cholesterol levels.

Jakob Winter Kirkegård's studies cannot verify this hypothesis, however. The results are published in three articles in scientific journals.

"Unfortunately, none of the medications we studied seems to be able to reduce the risk of pancreatic cancer," Jakob Winther Kirkegård says.

Comparing data from registries

The studies comprise 8,311 patients with chronic pancreatitis, i.e. all patients in Denmark who have had the disease from 1996 to 2012. During the follow-up period, 153 of them developed pancreatic cancer. Assisted by data from the Danish National Prescription Registry, the researchers could com-

pare data on patients' consumption of medicine used against high blood pressure, statins which are used to treat high levels of cholesterol, and the diabetes drug metformin.

"Previous studies have indicated that these drugs could have an effect on pancreatic cancer, but we have been unable to verify this. More research is needed before the association can be totally disproved, however," Jakob Winther Kirkegård says.

Sometimes new ideas just don't work

Mef Nilbert, Head of Research at the Danish Cancer Society, emphasizes that Jakob Winther Kirkegård's results are important even if it would have been better if the study had showed that the familiar drugs have an effect against cancer.

"Sometimes new ideas don't work. But disproving theories and determining what we shouldn't use to treat cancer are also important aspects of our research", Mef Nilbert says.

In addition to studies of acute and chronic pancreatitis and pancreatic cancer, Jakob Winther Kirkegård has published three scientific articles about the treatment of pancreatic cancer both in Denmark and in a European context.

The research results are published here, among other places: Kirkegård et al.: Statins and pancreatic cancer risk in patients with chronic pancreatitis: A Danish nationwide population-based cohort study. International Journal of Cancer 2019



Scientific articles

- » Scientific articles are crucial in the world of research because publication in a scientific journal is a seal of approval of the quality and importance of the results. And it is also a way for researchers to share knowledge with each other
- » To ensure the articles' high scientific quality, the scientific journals use peer review, which means that the article's manuscript is reviewed by a number of professional peers and then edited, if necessary, by the authors

The Danish Cancer Society supports the research

The project 'Prescription medicine and chronic pancreatitis vis-à-vis risk and prognosis' received a grant of DKK 1.5 million from the Danish Cancer Society's Scientific Committee in 2015.



Some of the team behind the new research: (left to right) Amanda B. Abildgaard, Kresten Lindorff-Larsen, Rasmus Hartmann-Petersen, Sofie V. Nielsen and Amelie Stein. Photo: Leif Bolding.

Result from 2019

Large-scale protein atlas add knowledge on hereditary cancer

By combining computer models and laboratory experiments, researchers from the University of Copenhagen have taken a huge step towards understanding the genetic mutations responsible for the hereditary condition Lynch syndrome.

Lynch syndrome is a genetic condition caused by variants in the DNA-repair genes MSH2 or MLH1. These two proteins are important to cells due to their ability to repair cellular DNA damage. When MSH2 or MLH1 mutates, the cell's ability to repair DNA damage is inhibited, which is why Lynch syn-

drome increases the risk of cancer, particularly colorectal cancer. Lynch syndrome is the cause of about 3 pct. of all cases of colorectal cancer.

When patients are genetically tested for Lynch syndrome, it is a big help to be able to predict which variants can heighten the risk of cancer. If the genetic test shows that the patient has variants of MSH2 or MLH1 (which increases their disease risk) this will make it easier to be alert for early signs of colorectal cancer, for example, and treat the disease early.

There are many different types of MSH2 and MLH1 variants, however, only a few of which are definitely known to result in Lynch syndrome. This often makes it difficult for a doctor to advise a patient after a genetic test.

Therefore, researchers from the Linderstrøm-Lang Centre for Protein Science, at the Department of Biology, University of Copenhagen, are working to compile a library of the disease risk for all conceivable variants of MSH2 and MLH1. Their compiled results will constitute an atlas over variants of MSH2 and MLH1, which doctors can use to make diagnoses in the future.

Computer models and laboratory experiments

The process combines computer analyses and laboratory experiments and is well under way. In 2017, researchers showed how they could use computer models to predict whether various mutations of MSH2 would result in Lynch syndrome. And in 2019, they have now completed corresponding analyses for MLH1.

Proteins fold into a three-dimensional structure and proper folding is essential to a protein's function and stability. Therefore, an important part of the researchers' charting is to describe the proteins' three-dimensional structure.

"In the laboratory, we see how even relatively minor changes to a protein's native structure cause the misfolded protein to destabilize and break down. Therefore, the cell will lack the protein, and the cell's DNA damage will not be repaired as effectively, which is often why patients have a higher risk of cancer," says Professor Rasmus Hartmann-Petersen, who is behind the research – together with Professor Kresten Lindorff-Larsen, Associate Professor Amelie Stein, Postdoc Sofie V. Nielsen and PhD student Amanda B. Abildgaard.

Based on the correlation between the protein's structure and cell degeneration, the researchers can use computer calculations to predict whether a given mutation of MSH2 or MLH1 will result in

Lynch syndrome. Up to now, the researchers have studied about 100 mutations of cells in the laboratory, and the computer's predictions by and large seem to prove accurate.

"One strength of this task is that it gives us a better understanding of the inherent problem of pathogenic protein mutations. This might be able to pave the way for new treatments sometime in the future," Rasmus Hartmann-Petersen says. For example, it is conceivable that future treatments will either remedy the protein misfolding problem or prevent protein degeneration. The results of such an approach have already been seen in the treatment of a few other genetic diseases, including cystic fibrosis.

The results are published here: Abildgaard AB. et al.: Computational and cellular studies reveal structural destabilization and degradation of MLH1 variants in Lynch syndrome. Elife. 2019. Nov. 8 e49138.

Niels Lauritzen et al. Predicting the impact of Lynch syndrome-causing missense mutations from structural calculations. PLoS Genet. 2017 Apr 19;13(4): e1006739

The Danish Cancer Society supports the research

The project 'Predictions of unstable DNA-repair components in a hereditary cancer syndrome' received a grant of DKK 1.86 million from the Danish Cancer Society's Scientific Committee in 2015.

New project in 2019

New knowledge about neuralgia during chemotherapy

Neuralgia in hands and feet, for example, can be a very discomforting side effect of chemotherapy. The pain is called peripheral neuropathy and knowledge about it is dramatically insufficient, as are treatments to relieve it.

In 2019, Tore Bjerregaard Stage, associate professor and pharmacist, University of Southern Denmark, received a grant from the Danish Cancer Society's Scientific Committee for a new project which will use stem cells to further understand neuralgia as a side effect of chemotherapy and thus hopefully show the way to new methods for preventing and treating the pain.

In the project, researchers will develop pain-receptor cells based on stem cells, to study the underlying mechanism of this side effect. When pain receptor cells are not functioning adequately, it is possible to experience neuralgia, which resembles the pain suffered by chemotherapy patients.

The researchers will also study how chemotherapy penetrates the cells and how it leaves them again. It is hoped that this knowledge will make it possible to reduce the amount of chemotherapy that penetrates the cells and thus prevent the damage.

The project aims to provide insight into why some patients experience many side-effects while others do not, and it is hoped that the project can assist in giving cancer patients a more individualized treatment with chemotherapy.

The Danish Cancer Society supports the research

The project 'Molecular mechanisms and conveyance of medication in chemotherapy-induced peripheral neuropathy' received a grant of DKK 1.5 million from the Danish Cancer Society's Scientific Committee in 2019.

The Danish Cancer Society supports young talents

Each year, the Danish Cancer Society presents up to two Junior Researcher Awards to support young scientists who have made a special contribution to Danish cancer research. The award is primarily given to young scientists who have made an extraordinary effort and/or obtained an international breakthrough and attention with their results. One award is given for basic biological or epidemiological cancer research and the other for clinical cancer research. In 2019 there was one recipient: Nicolai Juul Birkbak of Aarhus University and Aarhus University Hospital.

In his research, Nicolai Juul Birkbak translates copious amounts of data from genetic analyses into patterns and probabilities for how cancer develops in patients with cancer. In so doing he analyses the genetic mutations, using both samples of cancer cells in the laboratory and samples from patients. This is because the transformation from a normal cell to a malignant cell involves a wide range of genetic changes, which initially appear to have occurred randomly. But Nicolai Juul Birkbak's research shows that the genetic changes which lead to the development of cancer follow specific patterns. This makes it possible to stay a step ahead of the cancer cells and predict how they will develop and, in the long term, provide scope for both better diagnostics and better treatments for patients.



Nicolai Juul Birkbak, Associate Professor, recipient of the Junior Researcher Award. Photo: the Danish Cancer Society

The Danish Cancer Society's Psychosocial Research Committee

In 2019, the Danish Cancer Society's Psychosocial Research Committee allocated DKK 4.1 million to nine research projects.

Each year, the Danish Cancer Society's Psychosocial Research Committee grants funding to research into the psychosocial aspects of cancer. Examples of this are patient or treatment-provider relationships, behavioural research, palliative efforts and care (pain relief) or ethical issues. This could also include research affiliated with the healthcare system's structure and function, which is particularly relevant to cancer. The committee is made up of experts in the field to which funding is granted, and the committee members are appointed as personal members. This means that they do not represent the interests of any organization or association.

Those eligible to apply for funding through the Danish Cancer Society's Psychosocial Research Committee are researchers at Danish institutions, such as universities or hospitals. Other eligible applicants include Danish cancer researchers conducting research abroad and who intend to bring the results back to Denmark. The DCRC's researchers are also eligible on equal terms with other researchers.

The Danish Cancer Society's Psychosocial Research Committee can also submit opinions to the Danish Cancer Society's Executive Committee concerning technical issues within the Committee's sphere of expertise.

Result from 2019

Children with cancer attend school via a robot

Researchers at Rigshospitalet's Department of Paediatrics and Adolescent Medicine have received funding from the Danish Cancer Society's Psychosocial Research Committee for a project in which children with cancer can maintain contact with their school class by means of a robot.

Children who develop cancer are not only concerned about the disease. If they are schoolchildren, they can also be concerned about being forgotten by their schoolmates and falling behind in their homework.

Their concern is genuine. Schoolchildren who develop cancer have a high rate of absenteeism, not only during the cancer treatment itself, but also afterwards when they have to cope with the treatment's side effects.

But robots may be able to come to the rescue. During 2020, schoolchildren hospitalized at Rigshospitalet for treatment of their cancer will be given an opportunity to take part in a research project whereby they can be present in their classroom via a so-called 'telepresence' robot.

"The robot is placed in the classroom, and the child can sit at home or in the hospital and log on via an app on his/her tablet. Then, the child can keep up with what's going on in the class and also talk with the teacher and his/her classmates," explains Mette Weibel, who leads the school robot project. Mette Weibel is a qualified schoolteacher, has an MA in psychology and is a PhD student.

Will develop a new robot

The researchers involved in the project will compare two types of differently designed robots with different functional capabilities. A total of fourteen robots will be used on site in the classrooms, and during the project, the researchers will conduct interviews with the children who have cancer, with their classmates and with the teachers about what works and what doesn't.

"The purpose is to develop the best possible school robot which can hopefully become a permanent offer to children with cancer and eventually to other sick children and adolescents," Mette Weibel says.

"At the same time, we want to study how to use the robot in the best possible way, both to maintain the child's academic level and social relationships with classmates when he or she is sick and to enhance classmates' resources for dealing with serious illness," she says.

Good experiences

Mette Weibel and her colleagues have already tested a robot in a pilot project.

"We discovered that these robots really do have genuine potential, both for maintaining contact with the class and as a learning tool, not least because the child benefits from the flexibility of being able to log in whenever he or she has the energy for it," she says.

The initial experiences have also shown that the robot requires everyone – children, teachers, parents and hospital staff – to work together, and that the teachers receive training in how to use it," Mette Weibel explains.



Researcher Mette Weibel and the robot AV1, which has been tested among a small group of schoolchildren with cancer. The researchers involved in this new project will develop the best school robot possible to be used by children suffering from long-term illness. Photo: Rigshospitalet

Back to school with robotics technology

Fifty children and young people will be participating in the new study 'Back to school with robotics technology'. These children and young people are being treated for cancer or cancer-like diseases at Rigshospitalet in the period 2019–2021.

All participants are between the ages of 6 and 18, attend either school or a youth education programme and all are absent from school more than one day a week.

The children are assigned a robot which can represent them among their classmates and during lessons.

The research project is divided into three sub-studies:

- 1) sociality;
- 2) learning; and
- 3) development of new technology

The Danish Cancer Society supports the research

The project 'Back to school with robotics technology' received a grant of DKK 500,000 from the Danish Cancer Society's Psychosocial Research Committee in 2018 and again in 2019.

Knæk Cancer

2019 marked the eighth time that the Danish Cancer Society and TV2 organized Knæk Cancer and jointly earmarked a whole week to inform about cancer and raise funds. This year, a total of DKK 145.4 million was raised. A total of 25 projects were supported in the areas of research, patient support and prevention.

DKK 50 million went to two new national research centres, one of which conducts research into childhood cancer and the other into treatment guided by blood tests analyzing circulating tumour DNA. These are now the ninth and tenth research centres established by the Danish Cancer Society using proceeds from the Knæk Cancer fundraising campaigns.

Børnecancerfonden (childhood cancer foundation) received DKK 6 million out of the proceeds raised, which the foundation has granted to seven projects.

Each year, the Central Board of the Danish Cancer Society selects a number of topics for research that will be funded by the year's Knæk Cancer

fundraising campaign. The grants are the result of a thorough process in which input is received from experts and other stakeholders in the area of cancer.

Scientific committees with experts from the relevant scientific areas are tasked with assessing and selecting the research projects to receive support from Knæk Cancer. The assessment process is led by the Danish Cancer Society's Scientific Committee. The national research centres are assessed by an international evaluation committee.

Detgårpengenetil.dk (what the money goes to)

A total of 298 projects have been launched with the support of Knæk Cancer since the fundraising campaign began in 2012. The vast majority are research projects. Read about all the projects on detgårpengenetil.dk.



The touching ceremony of light is a recurring feature of the Knæk Cancer campaign. Pictured here is the "Light a Candle" event in Vordingborg. Photo: Per Rasmussen.

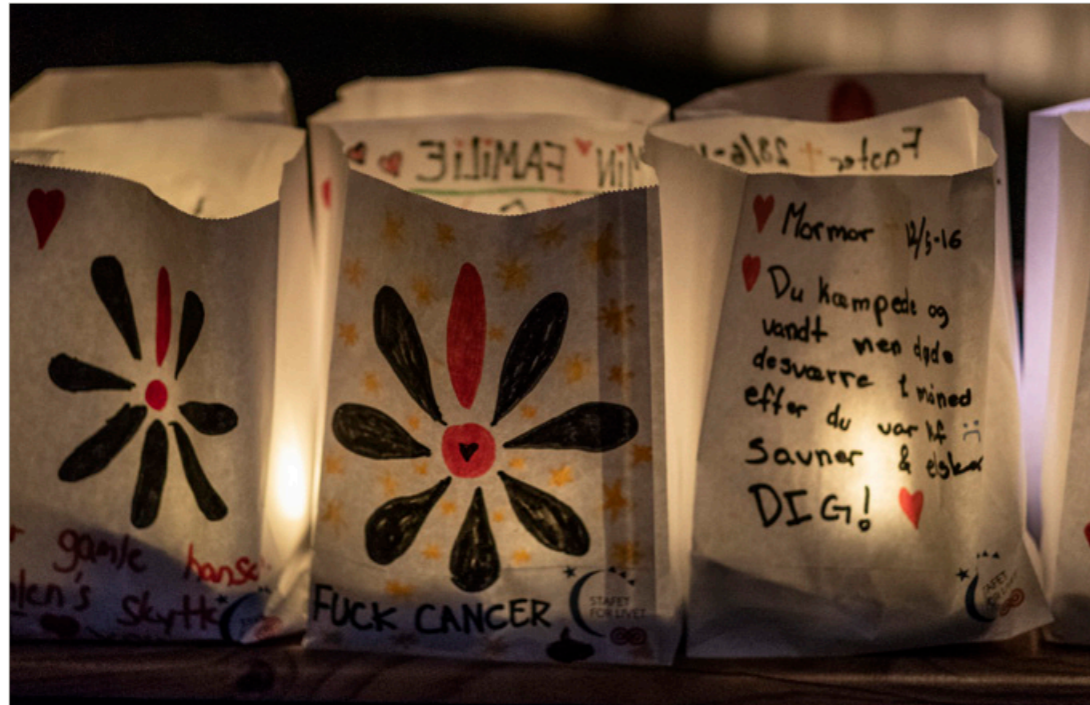


Photo: Per Rasmussen

Ten national research centres

Ten national research centres have been established in Denmark using Knæk Cancer proceeds since 2016. The national research centres are organized under the Danish Comprehensive Cancer Center and aim to strengthen Danish cancer research and gather lessons learnt from the development and application of new knowledge.

Another important task for the national research centres is to communicate new knowledge and new treatment methods faster and more systematically throughout Denmark, so that patients at all relevant hospitals nationwide are offered the latest treatment and an opportunity to take part in clinical trials or receive experimental therapies.

The national research centres are organized across Denmark and fields of specialization for the benefit of all patients in Denmark. On page 56 you can read about one of the centres – the Danish Research Centre for Equity in Cancer.

Ten national research centres based on funding from Knæk Cancer



A total of ten national research centres have been established in Denmark since 2016, thanks to the Danish population's support for Knæk Cancer.

1. **National Center for Cancer Immune Therapy**
Herlev Hospital
2. **Danish National Research Centre for Radiotherapy**
Aarhus University Hospital
3. **National Centre for Cancer Survivorship and General Late Effects – CASTLE**
Rigshospitalet
4. **National Center for Breast Cancer Survivorship**
Aarhus University Hospital
5. **National Centre for Research on Survivorship and Late Adverse Effects after Cancer in the Pelvic Organs**
Aarhus University Hospital in close collaboration with Aalborg University Hospital
6. **Danish Research Center for Precision Medicine in Blood Cancer**
Biotech Research & Innovation Centre (BRIC), University of Copenhagen
7. **Danish Research Centre for Equity in Cancer (COMPAS)**
Zealand University Hospital, Næstved
8. **National Centre for Lung Cancer Research**
Lillebælt Hospital, University of Southern Denmark, Vejle Hospital
9. **National Research Center for ctDNA Guided Cancer Treatment**
Aarhus University Hospital
10. **National Research Centre for Childhood Cancer**
Rigshospitalet

Result from 2019

First Danish centre for equity in cancer

With support from the Knæk Cancer campaign, the Danish Research Center for Equity in Cancer (COMPAS) opened in October 2019. The centre will work to develop solutions to inequity-based problems in cancer. It is headed by Professor Susanne Oksbjerg Dalton, who is a group leader at the DCRC. The COMPAS centre has launched a number of projects to develop new tools and ways of organizing the healthcare system so that all patients fit in, receive the optimal treatment and have their support needs met during their cancer pathway.

“Although no one wants to provide discriminatory treatment to patients, our system is not designed to address the particular needs of vulnerable patients. This is why we need to look at how we plan and organize our procedures and systems to make our healthcare system more accommodating to everyone. Although we are all doing our best, the heart of the matter is low quality of life and years lost, so it is important that we ensure that everyone has the best possibilities for surviving cancer,” Susanne Oksbjerg Dalton explains.

She mentions the Danish Cancer Society’s Navigator Project as an example of helping the weakest patients without a network by assigning a support person – a navigator – to them throughout their cancer trajectory. But many more solutions are needed.

“To some people, an app is a good solution, whereas an app is useless to others and something different must be available to them, too. Some may need a few extra home visits,” says Susanne Oksbjerg Dalton, who continues,

“The small steps help everyone get the best possible cancer trajectory, while in the long term, we obviously hope to level off the social differences in terms of cancer survival rates,” Susanne Oksbjerg Dalton says.

About the Danish Research Center for Equity in Cancer

In 2018, the Danish Cancer Society granted DKK 20 million from the Knæk Cancer fundraising campaign for the founding of the Danish Research Center for Equity in Cancer. COMPAS is a collaboration involving leading researchers from the National Institute of Public Health (SDU), the Danish Knowledge Centre for Rehabilitation and Palliative Care (REHPA), Aarhus University Hospital, Bispebjerg Hospital, Region Zealand and the DCRC. These institutions have contributed an additional DKK 11 million of co-funding.

Although COMPAS is based in Region Zealand, its research is conducted throughout Denmark. The centre has appointed a team of various experts: oncologists, anthropologists, psychologists, and specialists in the fields of rehabilitation, palliative care and epidemiology. They are tasked with developing solutions that counteract inequity in cancer, in a collaborative effort with patients, oncology departments and municipalities.

Ten themes for Knæk Cancer 2019

The Danish Cancer Society selected ten themes for the 2019 Knæk Cancer fundraising campaign.

1. Børnecancerfonden

(the Danish Child Cancer Foundation)

Each year, some 200 children below the age of 19 are diagnosed with cancer. Børnecancerfonden – the Danish Child Cancer Foundation – receives support for its work to ensure that as many children as possible can survive a cancer diagnosis and lead a good life.

2. National Research Center for ctDNA Guided Cancer Management

Measuring circulating tumour DNA in the bloodstream is a very promising area of research and the funding is used to support a national research centre in the field.

3. The elderly and cancer

About half of all cancer patients are over 70 years old, a ratio that will increase in the years ahead. Funding is earmarked to study how to improve the treatment of elderly cancer patients and how the healthcare system can improve the care it provides them.

4. Multimorbidity and cancer

Many cancer patients have other conditions when they are diagnosed with cancer. We need more knowledge of how to best treat these patients and the inherent risks when a patient is receiving multiple types of medicine at the same time.

5. Young talented researchers

The funding goes to support young Danish cancer researchers with great potential as future leaders of research.

6. Personal prevention

The funding is used for research that can show the way to more individualized prevention processes, based on knowledge of individuals’ genetic risks of cancer and the complex interplay of genes, lifestyle and environmental effects.

7. Individualized treatment

Some of the funding from Knæk Cancer must be used for research projects which develop offers of more individualized treatment.

8. Treatment results from the patients’ point of view

Patient-reported information must be incorporated into daily routines in order to use patients’ responses to adapt treatment to the individual patient, to counsel other patients and to improve cancer treatment.

9. HPV vaccine for both boys and girls

Knæk Cancer funding is used to further develop the Stop HPV campaign and widen the target group to include girls, boys and their parents.

10. National Research Centre for Childhood Cancer

We will set up a national research centre aimed at strikingly improving the survival rate of children with cancer, reduce treatment side-effects and improve the children’s quality of life.

Result from 2019

Antibiotics can suppress skin lymphoma

Antibiotics inhibit cancer cells in patients with the rare skin disease cutaneous T-cell lymphoma, according to research supported by Knæk Cancer, and this could perhaps pave the way for better treatment.

For most patients, cutaneous T-cell lymphoma is a rather mild disease resembling harmless eczema. But one-third of the patients develop a more aggressive form which causes severe inflammation of the skin. Up to now, this group of patients has lacked satisfactory treatment.

In 2019, however, researchers proved that antibiotic treatment could suppress both the staphylococcus bacteria which cause the infections and the cancer cells. The treatment reduces the number of cancer cells and strikingly suppress the lymphoma for a while in patients with skin inflammation.

Cytokines can promote the growth of cancer cells

In a staphylococcus infection, the healthy cells of the immune system are working hard to fight the infection. They are forming growth regulators called cytokines which activate the immune response system. Cancer cells can form a parasitic relationship with these growth regulators and use them to grow faster. It is this process which can be inhibited by antibiotic treatment.

"When we inhibit the staphylococcal bacteria with antibiotics, we simultaneously remove the activation of the immune cells. This means that they no longer produce cytokines, which removes additional sustenance for cancer cells at the same time. As a result, cancer cells are inhibited from growing as fast as they did during the bacterial attack. This is a trail-blazing discovery because it is the very first time we see a con-

nection between bacteria and cancer," according to Professor Niels Ødum, LEO Foundation, Skin Immunology Research Center, University of Copenhagen, who led the research.

Appetite whetted for new treatments

Up to now, doctors have been reluctant to give antibiotics to patients with cutaneous T-cell lymphoma and skin infections due to their prevailing fear that the infection would return as antibiotic-resistant staphylococci after the treatment. But these new results will presumably change this, according to the researchers behind the project.

"We've previously seen a positive effect of antibiotics on individual patients. But the actual effect of the antibiotics on the cancer itself has never been studied before. Our findings show that it can actually be a good idea to administer this treatment to patients with staphylococci on the skin because it both inhibits the cancer cells and possibly reduces the risk of new infections," Niels Ødum says.

It is still difficult to say whether the new knowledge can be transferred to other types of cancer. To researchers, the next step is initially to examine the link between cancer and bacteria.

"We don't know whether this finding applies to lymphoma alone. We see it particularly manifested in this type of cancer because it is within the immune system. The cancer cells already understand the signals being sent by the immune system's cells. When these cells are put to work, so are the cancer cells. At any rate, it will be interesting and relevant to take a closer look at the interplay between bacteria and cancer cells we're seeing here," Niels Ødum says.



"The next step will be to develop new treatments that only affect the 'bad' bacteria without harming the 'good' ones protecting the skin," he says.

Skin lymphoma affects about fifty people in Denmark every year. One-third of them develop an aggressive form of the disease.

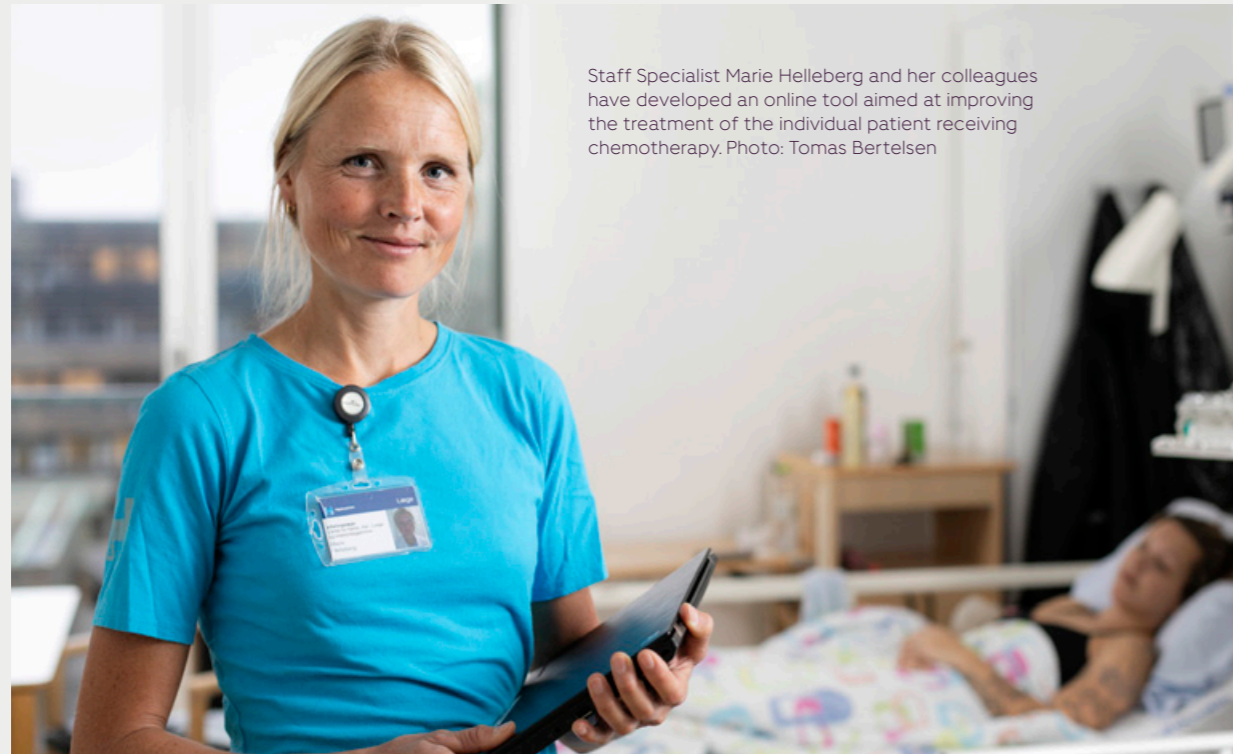
The results are published here: Lindahl L.M. et al.: Antibiotics inhibit tumor and disease activity in cutaneous T cell lymphoma. Blood (published by the American Society of Hematology), 26 September 2019;134(13):1072–1083.

The Danish Cancer Society supports the research

The research project "Staphylococcal toxins promote cancer and are new points of attack for treating cutaneous T-cell lymphoma" received support from the Knæk Cancer fundraising campaign in the amount of DKK 3 million in 2015.

Further details about the research

Besides Knæk Cancer, the project is supported by the LEO Foundation, the Novo Nordisk Foundation, Independent Research Fund Denmark and the Lundbeck Foundation. The research is conducted by researchers from the LEO Foundation Skin Immunology Research Center at the University of Copenhagen, in collaboration with Aarhus University, Aarhus University Hospital and Zealand University Hospital, as well as partners in the USA and Germany.



Staff Specialist Marie Helleberg and her colleagues have developed an online tool aimed at improving the treatment of the individual patient receiving chemotherapy. Photo: Tomas Bertelsen

Result from 2019

New online tool aims to improve chemotherapy

Researchers from Rigshospitalet have developed a tool to predict which patients in high-risk of infection during chemotherapy, are eligible for preventive treatment.

Each year, thousands of cancer patients undergo chemotherapy. The treatment can be difficult and suppresses the immune system, which gives some patients a higher risk of developing infections (febrile neutropenia).

According to international guidelines, if the risk exceeds 20%, the patient should be given preventive treatment. But predicting the risk for the individual patient can be difficult.

A solution to this has now been found. A research group led by Marie Helleberg, Staff Specialist, PhD,

Rigshospitalet, have developed a tool which is ready for use online.

The tool enables doctors at hospitals to quickly and easily assess whether a patient should be given preventive medicine to strengthen the immune system and thus avoid life-threatening side effects. This will ensure better preventive treatment for those who need it and avoid giving medicine to those who don't," Marie Helleberg says.

10,000 patients

The tool's underlying model is based on a study involving 10,000 patients who received chemotherapy at Rigshospitalet from 2010 to 2016. The model was developed using data from 6,294 patients and then tested on the remaining 3,163 patients.

Specifically, the researchers collected the results of routine blood samples taken from each individual patient and collated them with other disease-related data, such as previous illnesses and use of medication, to arrive at an algorithm which calculates the individual patient's risk of developing an infection.

All the doctors have to do is enter a few pieces of information about the patient, after which they learn which risk group the patient belongs to and the estimated level of risk.

"It takes about a minute to enter the data required and get the program to calculate the risk for the individual patient," Marie Helleberg explains.

Ready to benefit patients

The next step is to spread the word about the tool, and more doctors must start using it so that more patients can benefit from the research. And the path is short, because the tool is ready and accessible.

"An infection during chemotherapy is a severe condition itself. And if an infection arises, the treatment has to be either temporarily suspended or postponed. This means that too much time may transpire between treatments, giving the patient a less than ideal cancer treatment. We expect that the tool will improve the prospects of patients receiving chemotherapy. Because if it is possible to prevent the infections, it is also possible to improve the treatment of the cancer," Marie Helleberg says.

Today, only a few patients receive this preventive medicine when they start chemotherapy. This is in part because the medicine is expensive and in part because this type of medicine has possible

side effects, which is just one more reason that Marie Helleberg recommends using the tool's more precise risk assessment.

Find the tool here:

<https://chip.dk/Tools-Standards/Clinical-risk-scores>

The results are published here: Aagaard et al.: Development and validation of a cycle-specific risk score for febrile neutropenia during chemotherapy cycles 2–6 in patients with solid cancers: The CSRFENCE score. International Journal of Cancer 2019

Aagaard et al.: Development and Validation of a Risk Score for Febrile Neutropenia After Chemotherapy in Patients With Cancer: The FENCE Score. JNCI Cancer Spectr.

The Danish Cancer Society supports the research

The project 'Better risk assessment and treatment of patients receiving chemotherapy' received support from Knæk Cancer in the amount of DKK 1.5 million in 2015.

New project in 2019

Better radiotherapy for children and adolescents

Dr Maja Maraldo, PhD, Rigshospitalet, conducts research into radiotherapy for children and young people and she received funding from Knæk Cancer in 2019 for a project aimed at improving treatment and follow-up after lymphoma. This will be achieved by refining the selection criteria for radiotherapy, reducing the radiation of healthy tissue and developing strategies for better, more individualized follow-up.

Maja Maraldo and her colleagues will develop a method to identify the most likely parts of the body where a relapse of lymphoma will occur so that doctors can better select which patients will benefit the most from radiotherapy.

They also intend to study whether it is possible to reduce radiation of healthy tissue by having the children hold their breath (and move less) during radiotherapy and by improving the accuracy of the radiation.

Finally, they will chart the late effects after radiotherapy to improve follow-up and document the need for late-effect clinics. They will do this by, among other initiatives, studying 222 patients treated at Rigshospitalet from 2005 to 2014.

The Danish Cancer Society supports the research

The project 'Better radiotherapy and follow-up after lymphoma in children and young people' received DKK 1.7 million from Knæk Cancer in 2019.

New project in 2019

Knæk Cancer will contribute to increased survival rates and quality of life for elderly cancer patients

One of the themes for 2019 Knæk Cancer was the treatment of elderly cancer patients, and one of the projects it funded is led by Henrik Ditzel, Consultant and Professor, Odense University Hospital.

The project is divided into two parts, the first of which involves testing a new method for determining whether a cancer patient can withstand the cancer treatment. This requires them to fill in a questionnaire and perform a simple physical exercise to see how many times an elderly patient can stand up and sit down in a chair in 30 seconds. This will indicate the patient's general state of health, Henrik Ditzel explains.

The second part involves a randomized clinical study in which doctors study whether frail elderly cancer patients can benefit even more from a geriatric assessment by a geriatrician (doctor specializing in the care of the elderly). The geriatrician conducts a more thorough examination of the patient's general state of health and assesses whether his/her medication needs to be adjusted, and whether additional support measures are needed to help the patient cope with a treatment process.

The Danish Cancer Society supports the research

The project 'Geriatric assessment of patients over 70 with cancer' received DKK 3.6 million from Knæk Cancer in 2019.

On behalf of The Danish Cancer Society we wish to thank everyone whose contribution has made the research possible

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