



The effect is very limited. It does not transfer to a structurally different task, and it diminishes if you stop training.

Cognitive fitness

CAN WE CURE CANCER? | TURKEY'S NEW DIRECTION BIG LOSS FOR DEMOCRACY
COGNITIVE FITNESS | "STILL NOT PARTICULARLY PLUMP" | FOOL'S GOLD



Female sexual desire may decrease more in long-term relationships

A longitudinal study conducted at the University of Turku and Åbo Akademi University, Finland, investigated the stability of female sexual functions over a period of seven years. Sexual desire diminished more among women who were in the same relationships throughout the study period.

The research results may be useful for the treatment of sexual dysfunction.

“Changes in relationship status influenced sexual desire in the sense that women who were in the same relationship for the entire seven-year period that the study spanned, displayed the greatest weakening of sexual desire,” says **Annika Gunst**, doctoral student at the University of Turku. The study was conducted in cooperation with researchers in psychology at Åbo Akademi.

Women who were in at least two relationships during the period studied, displayed a somewhat smaller decline in sexual desire at the latter testing time, while women who were not in a relationship

at that point did not show any decrease in their sexual desire. The length of the relationship was considered in the statistical analyses.

“The results indicate that aspects connected to a relationship have an impact on changes in sexual functions. The treatment of sexual dysfunction in women should therefore also focus on factors pertaining to the relationship they are in. We should, however, study the functions further during shorter intervals in order to gain more nuanced knowledge of the changeability of the functions,” says Gunst.

In their study, Gunst and her research colleagues explored changes in female sexual desire, arousal, orgasm function, sexual satisfaction and pain related to sex. A total of 2,173 adult women participated in the study, which was based on a national, population-based sample. The study has been published in the journal *Psychological Medicine*.

TEXT: MIA HENRIKSSON

intro

The way we experience reality and the world around us depends on several factors. Our childhood, culture, social context and education all play an important role. Our brain creates an image of all the things we see and the things we remember.

However, the possibilities provided by modern technology for reconstructing events and realities have added an entirely new dimension for us. We are able to enter virtual realities and experience a totally new world, or view a historical event from an entirely new perspective. Or enter the bloodstream and cells in the body in order to see how they function and interact.

IN THIS ISSUE of the *News Bulletin*, we make an exciting journey into virtual realities, learn how cells communicate and interact with their environment, and whether we can improve our memory by training. A common denominator for successful research is interdisciplinarity, as Lea Sistonen, Professor of Cell Biology, points out. What it takes is researchers from different disciplines who cooperate and contribute their experience.

In 2017, Finland will celebrate its centenary as an independent country – independence was declared on 6 December 1917. ‘Together’ is the chosen theme for the jubilee year, during which all Finnish people and friends of the country alike are offered a varied and international festive programme in Finland and abroad.

‘**TOGETHER**’ is also the motto for the organisation Universities Finland UNIFI, which in its recently published vision emphasises Finland’s role as a pioneer and driving force for open science. The universities of Finland believe in success through cooperation and interaction, and through increased recruitment of talented international students and researchers. Welcome to participating in celebrations and science *together!*

Thurid Eriksson
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news bulletin

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July 16, 2016, a tank moves into position as Turkish people clamber onto it, attempting to stop the military coup, in Ankara, Turkey. Photo: AP/Lehtikuva.



Cover photo: Bigstock.

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FISHING ERODES NATURAL SIZE VARIATION

FISHING TYPICALLY removes the large individuals from the population. Over time, this not only leads to evolutionary shrinking of fishes but also erodes natural trait variability in fish stocks. This was demonstrated by experimentally harvesting zebrafish. Loss of natural trait variability is alarming, as variability facilitates population viability in changing environments.

Intensive and selective removal of large individuals by fishers can act as a pronounced directional selection force, leading to evolution towards smaller body sizes. In addition to evolutionary downsizing, fishing can also reduce size and growth variation among individuals. Preserving variability is important: a population harbouring variation is less susceptible to changing environments and catastrophic disturbances.

For example, when food availability is low, individuals that grow slowly will survive while fast growing individuals will star-

ve. Therefore, populations that consist of individuals growing at different rates will be better off in fluctuating environments.

An experimental study conducted by an international team of researchers focused on the effect of size-selective harvesting on body size variation.

The experimental zebrafish populations were harvested size selectively for five generations after which the harvesting was halted for six generations. The researchers found consistent differences in body size variation among differentially harvested zebrafish populations.

Decreased size variation caused by fishing can have serious consequences for the resilience and recovery of exploited fish stocks. It can negatively affect population's ability to buffer environmental changes, decrease the rate of evolutionary rebound and, ultimately slow down recovery from overfishing.

The study was conducted in collaboration with the University of Turku (UTU), Åbo Akademi University (ÅAU), University of Helsinki (HY), and Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB). The title of the article is "Altered trait variability in response to size-selective mortality" and it was published in the journal *Biology Letters*. ♦

RESEARCHERS RECOMMEND COOPERATION TO IMPROVE THE HEALTH OF THE ELDERLY

SOCIAL INPUT improves the health of older persons. This was confirmed by a recently published study involving researchers in social policy at Åbo Akademi University.

The project analysed 36 randomised and controlled studies on the impact of social capital, or the social community, on health and well-being. The researchers compared the effect of social interventions on the health of elderly people. The interventions covered social measures, such as promoting friendship or increasing participation in various activities.

Social capital affected quality of life, well-being and self-evaluated health, but had less impact on objective health measures, such as mortality. Using a so-called logical model, the project also explored the way in which various social measures may impact health and, in the long term, lessen the use of health care, for example.

The results were formulated into a number of recommendations for policies, further research and practical application. The authors' recommendations include cooperation between social and health care services for health promotion among the elderly; social measures for furthering health equality among the elderly; and also that more research and evaluation is needed as to the consequences of various measures and interventions for the well-being and health of older persons.

The study was conducted by physician **Laura Coll-Planas**, doctoral student in public health at the Universitat Autònoma de Barcelona, Spain, **Fredrica Nyqvist**, Lec-



turer in Social Policy at Åbo Akademi, and others.

The article "Social capital interventions targeting older people and their impact on health: a systematic review" was published in the *Journal of Epidemiology and Community Health* (November 2016). ♦

Fool's gold

It is not all that commonly known that minerals may have active properties, which make them interact with their environment. Researchers at Åbo Akademi University and the University of Turku in Finland have developed a water purifying product based on the mineral vermiculite, which is popularly known as 'fool's gold'.

TEXT: MARCUS PREST



Vermiculite. Photo: Jens Johansson.

Olav Eklund, Professor of Geology at Åbo Akademi University, has for a long time nurtured the idea that he, as a researcher, should not only educate students, but also give something back directly to society, something to improve the environment.

“I began thinking along these lines while teaching field courses in geology on the Åland Islands in the Baltic Sea. I’ve been running these courses for many years and at the same time I’ve observed the continuously worsening state of the aquatic environment there,” Eklund explains.

“Of course, a lot of research has been conducted on these issues. But it’s a long way from research results to concrete action. Unfortunately there’s not a lot happening in that respect.”

Eklund had read about the fact that certain minerals are able to absorb ammonium nitrogen into their crystal lattice. Together with phosphorus, ammonium nitrogen is the key component in the eutrophication of the Baltic Sea – these two nutrients find their way into the sea from agricultural land.

“I asked a research assistant to find out which kind of clay mineral captures ammonium nitrogen. It turned out that vermiculite is the mineral that does that. Familiar to most people, vermiculite is one of the minerals that are popularly called ‘fool’s gold.’”

“Vermiculite proved to be really efficient in the task we had in mind for it. In good conditions it can absorb most of the ammonium nitrogen in less than five hours. As this process does not allow ammonia to form, there is no smell, either.”

The characteristics of vermiculite triggered a number of ideas. The main one is water purification; for instance, the mineral can be placed at points where smaller watercourses flow into larger ones. The fact that vermiculite also neutralises smells makes it a useful material for dry toilets, along with hen houses, biogas plants, landfills, and perhaps also in water treatment plants to take care of the slag.

What makes vermiculite even smarter, however, is that it can be reused as fertiliser; as the mineral absorbs ammonium nitrogen into its crystal lattice, the nutrient assumes a form which is easy to handle, and the ammonium hydrogen can be spread back onto the fields to fertilise plants.

“The product works incredibly well as a fertiliser, as it is packed with ammonium nitrogen. The difference compared to reference products is almost as graphic as in cartoons. We see ten times stronger spruce plants and 22 times heavier cabbages in the same period of growth compared to those fertilised with reference substances.”

Risk capital for risk-free projects

Having observed the positive features of the mineral, Eklund and his group of researchers from Åbo Akademi, and the University of Turku, as well as entrepreneurs including Caius Kuhlefelt, Taina Laiho, Rasmus Blomqvist, Miradije Rama, Jens Johansson, Timo Forss and Stefan Sandbacka, conducted market analyses in order to find out where the right kind of vermiculite could be acquired. That is, vermiculite with the correct and best chemical composition for the process, and not contaminated by heavy metals.

For this purpose the group established the company NanoGeo Finland.

“The first thing we needed was risk capital. But we realised that there is hardly any risk capital available in Finland. And what little there is, is only invested in absolutely safe projects. We were told: ‘We only provide you with capital if you have three major customers that have committed to buying large volumes for three years ahead.’ What kind of risk capital is that? What risk is there in that?” Eklund asks.

“We learnt that you shouldn’t invent anything entirely new, it’s too complicated. Instead, you should achieve a small improvement in something that already exists. So, we decided to carry this through by ourselves. We started from scratch and do everything ourselves with support from Tekes, the Finnish Funding Agency for Innovation, and the private foundation K.H. Renlunds stiftelse.”

By-product from mining

Vermiculite is a by-product from phosphorus mines. It is found in the upper layer of soil sediment, which is removed before reaching the phosphorus. NanoGeo was first interested in vermiculite from the mine in Kovdor, Russia. The mine is up and running, but nobody on site knew who actually owns the mine, so it proved impossible to reach any agreements or business deals.

The company therefore had to explore the international market further to find the type of vermiculite needed for making the planned product elsewhere.

“At this stage, we don’t want to disclose where we buy our vermiculite. But at the moment we are getting the right kind of vermiculite at a reasonable price,” says Jens Johansson.

In 2016 NanoGeo launched its first product – GeoTrap. It is a vermiculite product which extracts ammonium nitrogen from human faeces and also removes the odour. The product replaces peat in these respects and can also be recycled as fertiliser for plants.

Caius Kuhlefelt, CEO of NanoGeo and an experienced entrepreneur, says that the company wanted to launch a product on the market as quickly as possible.

“We wanted to test the package and the product, and establish a retail network. All these initiatives have been successful. Furthermore, we wanted to make a product quickly in order to generate some resources that we can use for research and to make us independent of support and funding as soon as possible. Our aim is to be self-sufficient. A recycled fertiliser will be our next product, but the environment for loading GeoTrap in order to produce this fertiliser is not finished yet,” says Kuhlefelt.

“When it comes to other areas of application, we haven’t yet advanced sufficiently in our research. For example, using vermiculite in biogas plants for extracting ammonium nitrogen from slag products works well, but we don’t know exactly what all the substances in the vermiculite are when the mineral is removed from the plant. Until we know for certain that vermiculite can be safely put back into the cycle, it’s not worth it.”

The same applies to slag pools at water treatment works.

“The largest potential application area might be various cattle and chicken farms as well as fish farming, where there is better knowledge of all the substances present.”

GeoTrap has been well received. In Finland, modest summer cottages are very common, and there are 500,000 outside toilets in the country, many of them in the archipelago. GeoTrap is a means for fighting eutrophication and algal bloom. ♦

Vermiculite proved to be really efficient in the task we had in mind for it. In good conditions it can absorb most of the ammonium nitrogen in less than five hours. As this process does not allow ammonia to form, there is no smell, either.

Pictured, from left, are Jens Johansson, Taina Laiho, Caius Kuhlefelt, Olav Eklund and Miradije Rama. Photo: Marcus Prest.



Vermiculite

- There are large vermiculite deposits in Brazil, Russia and South Africa.
- When vermiculite comes into contact with ammonium nitrogen, the ammonium ions push out magnesium ions and other ions that are loosely attached in the vermiculite and take their place.
- If there is phosphorus in the environment, the magnesium ions and ammonium ions can react with it and create the mineral struvite, an ammonium magnesium phosphate. This is a positive side effect, as it is also a way of capturing phosphorus.
- Furthermore, the lattice is tightly closed when ammonium nitrogen takes the place of magnesium ions – this has been observed using x-ray diffraction. The ammonium nitrogen is extracted only when roots and sprouts soak it up.



Photo: Wikipedia Commons.



Can we cure cancer?



Photo: Jussi Vierimaa

According to Cancer Research UK, approximately 14.1 million new cases of cancer were reported worldwide in 2012. Cancer is a global issue that needs to be tackled on several different levels.

TEXT: NICKLAS HÄGEN

Cancer research in Turku, Finland, is being carried out at all levels ranging from fundamental biological research to the pharmaceutical research taking place both at the universities and in the city's pharmaceutical industry. Clinical research is also undertaken at Turku University Hospital. Åbo Akademi University and the University of Turku with their shared facility, the Turku Centre for Biotechnology, are major players in this field.

A little bit like unmasking the villain right at the start of a detective story, let us cut straight to the chase: **Lea Sistonen**, Professor of Cell and Molecular Biology at Åbo Akademi University, will we ever be able to cure cancer?

"We can do a lot to tackle it already. For example, leukaemia in children was usually fatal 20–30 years ago, but today there is often a cure for it. Against this background we may not be able to foresee how the situation will develop," says Sistonen.

"However, my personal belief is that we won't eradicate cancer. I think that in many cases it will become a condition that the patient will live with. And patients can have a good life, as is the case with a number of other chronic diseases. I therefore consider it hugely important to develop better medicines and there is a lot to do in this respect, but I don't think we will get rid of cancer completely."

Why not?

"Cancer is incredibly adaptable – we've already seen that. It adapts well to different conditions and obstacles we try to put in its way. But as I have said, the situation may be different in 20 years' time."

Many different diseases

Cancer research is continuously moving forward, but the major breakthrough that would solve the riddle of cancer once and for all has failed to materialise to date. For every new insight gained, it is notable that providing an answer as to why cancer develops and what processes lie behind it is an increasingly complex task.

Or "it" is actually the wrong word. We normally refer to cancer as one disease, but a more accurate description might be to call it a group of different diseases with certain common denominators.

Lymphoma and leukaemia are forms of blood cancer that differ in character from the forms of cancer which develop as stationary tumours, for example. But the differences between these, too, are huge, depending on where the cancer is located in the body.

In fact, the situation is even more confused. A specific form of cancer, such as breast cancer or prostate cancer, doesn't appear to consist of a single cell type. So it isn't just that there are many different types of breast cancer, for example, with some being hormone-related and some not, but the individual tumour consists of many different types of cells.

"I carried out cancer research as a postgraduate student in the 1980s. The belief then was that all cells in a certain type of cancer were the same – that there was one cell that became a cancer cell and then made copies," says Sistonen.

"Now we think differently, that actually different types of cells are involved. When we try to kill cancer cells, it is possible to kill maybe 95% of the cells, but there may be a few cancer stem cells that are not caught, and it is these cells that spread. The common factor in all forms of cancer is that they are malignant and – if they cannot be cured – fatal diseases. But cancer cannot be considered one disease."

The DNA sequence in our genes has its molecular building blocks, the nucleotides, organised in a certain order. When changes, so-called mutations, occur in this order, these can ultimately cause cancer.

"Mutations occur every day, so it is a miracle that we don't all have cancer all the time. We have many smart systems in the body that keep it under control," says Sistonen.

Each time a cell divides, there are two or three control points in the cell cycle that check whether all chromosomes are in the correct order and whether the cell is ready to divide. If any error exists, the division is aborted.

After cell division, too, there are control points in the cell that react if something has gone wrong and eliminate the processes. Apoptosis, programmed cell death, eliminates poor cells that should not exist in the body.

"However, a number of errors can occur, for example if the control points are not as they should be. A mutation may take place in a gene that should code for a protein that is supposed to be in the control point, causing the protein to be absent or incorrectly structured. The errors accumulate and can ultimately lead to cancer," says Sistonen.

"We can demonstrate relatively simply how individual cells become cancer cells in the model system, so we know what happens or can happen. If the cancer exists in the form of tumours, it is relatively easy to cure by removing them, but the metastases are the problem and it is these that cause death. The cells in the tumour can vary considerably – they are not homogeneous, as we once thought and some people may still think even now. Individual cells escape and resort to various tricks to survive, even during treatment. Cancer cells are extremely cunning in the way they exploit the body's mechanisms and ingenious in the way they spread."

Inherent stress

Sistonen is not a cancer researcher by definition. In her research she studies cell stress. How the cells react to changes in temperature, acidity levels or pressure, for example, are questions that are much more fundamental in nature than more specific questions about how cancer develops or is cured. And yet it has turned out to be the case that cell reactions to stress factors appear to be closely linked to cancer.

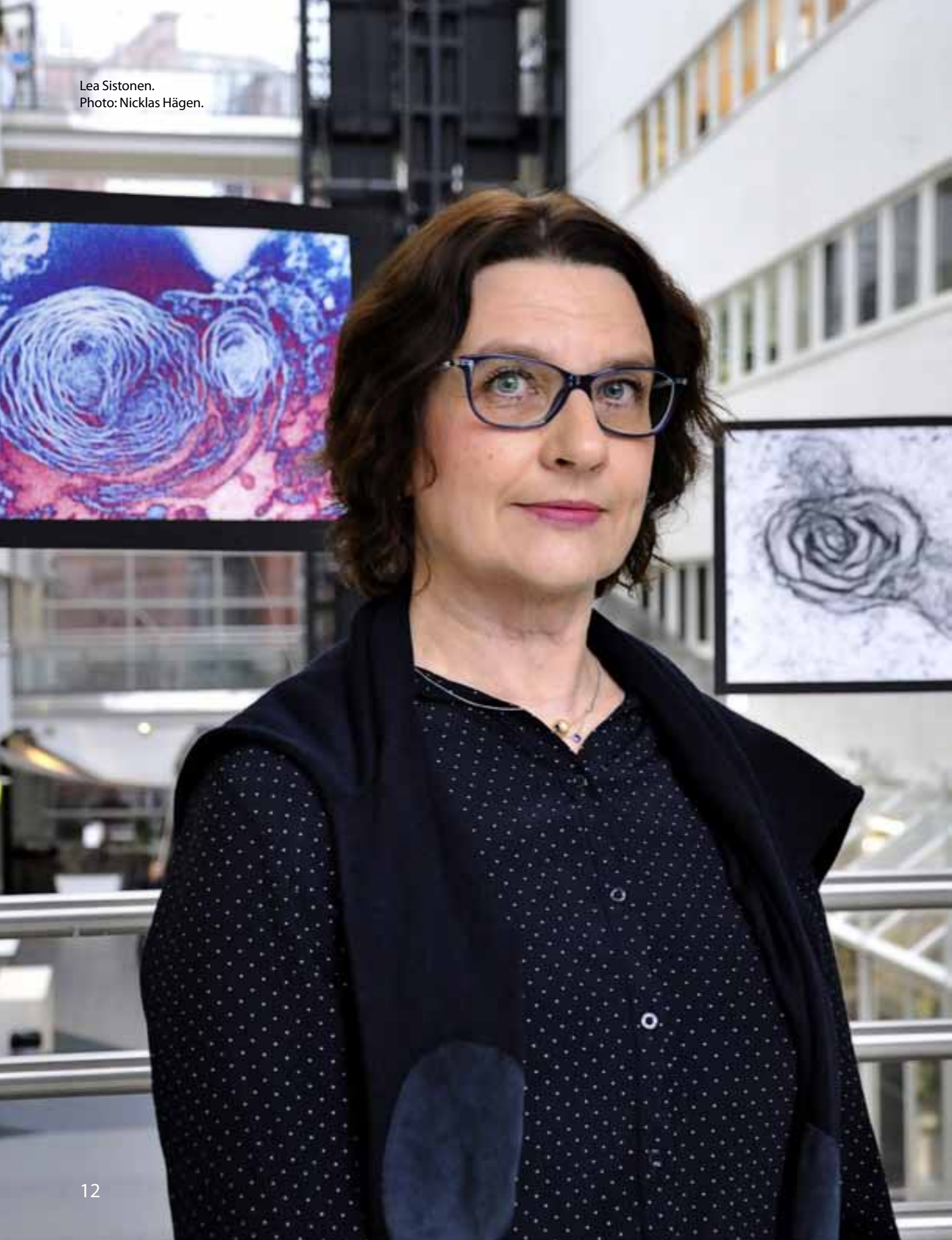
"We try to understand how the cells function normally and to see how the processes are changed in different disease conditions. We use cell stress as a model system. This means that we investigate what happens in the genetic make-up and genes in connection with acute and chronic stress. Which processes are activated and which are toned down?"

Different stress factors influence our bodies constantly. The cells cannot know if the changes are temporary or permanent, and immediately trigger a stress defence mechanism, often by ceasing all activity and just waiting.

"The stress defence reactions are really old in evolutionary terms, some of the oldest functions we have in our cells," says Sistonen.

"Even if the normal reaction to stress is that everything freezes and energy metabolism is minimised, there are certain genes that are active. Our job is to understand which genes are active when others are quiet and why this is."

It has been observed that cancer cells handle stress situations better than the body's healthy cells. Genes that are normally quiet or mode-



rately active can be hyperactive in cancer cells. The cancer cells are de facto dependent on stress; they have inherent stress factors that keep them alive.

“When stress occurs, certain genes are activated that produce proteins, which protect the cells’ other proteins. These are chaperones, which have the job of ensuring that the cell’s normal functions are protected when the conditions are abnormal. The intention is that these protective functions should be active for a brief period and that everything should return to normal when the stress has passed,” says Sistonen.

“The cancer cells can exploit these functions also when the external stress is absent. They use this protection to make themselves stronger.”

Cell stress and how it affects the quantity of protective proteins can be used as a clarification model for many other diseases also, for example Parkinson’s Disease and Alzheimer’s, even if the clinical picture is completely different. But as we have already indicated above, cancer is a very broad disease, and while Sistonen refuses to assert that it could underlie all forms of cancer, she won’t rule it out entirely either.

Cancer takes away the lives of those who develop it by knocking out the body’s own functions. Paradoxically, it can be described as an extremely vigorous form of life.

“In lower organisms the stress reaction system exists in a similar form. These mechanisms have made the existence of life possible. Cancer is a very primitive life form, and its cells have one function only, which is to divide,” says Sistonen.

“All forms of cancer can overcome many types of functions and obstacles. They are able to do this because they eliminate all sophisticated functions. Their mission is simply to survive and multiply, and in this they remind us of the foetal stage, in which growth is all and more mass needs to be gained.”

Start out from a system that can be controlled

Lea Sistonen is engaged in what is called fundamental research. This means that she seeks knowledge without the primary objective of applying it in a certain way, for example by developing a new drug.

“We work at the cell and molecular level in model systems that can be controlled. We can investigate phenomena that may have significance for medicine, since they can only be discovered in a controlled system. If we go directly to complex biological systems such as the human being, we have no idea what we should be looking at,” adds Sistonen.

“We must study grubs and flies and yeast cells and mice, simpler systems, and get to the roots of individual phenomena, because it is too complex to try and go directly to man.”

Bruce A. Beutler and Jules A. Hoffmann were awarded the Nobel Prize in Physiology or Medicine in 2011 for increasing our understanding of the immune system by studying fruit flies.

“We have a group in Turku also trying to understand the immunity of fruit flies. It’s not that anyone’s worried about whether fruit flies are sick or not, but what is interesting is that they have an immune response to certain bacteria and viruses,” says Sistonen.

“Fruit flies are suitable for studying when attempting to understand genes, because they have fewer genes and they are mapped better than our own are. Without this knowledge we can’t move on to the complex system.”

From linear biology to systems

Research has now reached a point at which individual components of simplified systems have been investigated. A reasonable understanding has been gained of how the signals follow one another when the



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cell receives a stimulus, for example a growth factor or a heavy metal, and reacts to it.

The next major challenge is to combine what we know to form a picture of larger entities, but a problem with such system biology, as it is termed, is that the quantities of data involved are simply huge.

“Will a cell become active and divide when it receives a stimulus? Will it wait, forward the signal to another cell or perhaps die? We have taken a linear approach to this issue. Something external appears that passes through the membrane into the cell and is received by a signal molecule,” says Sistonen.

“But in reality a host of factors are involved, which are integrated into each other’s processes, come together and influence one another. All organs and all tissues consist of different types of cells. The cells are not isolated, but interact with one another.”

Sistonen says that cancer research needs to be linked better to metabolism.

“Cancer cells interact continuously with their environment, and they are not indifferent to it. They can ‘infect’ or influence their environment, just as the environment feeds the cancer cells and must therefore also be observed. They influence the metastasis properties; the tumours aren’t going anywhere without individual cells,” says Sistonen.

“Without the knowledge we already have we would not be able to investigate this. That is why interdisciplinary research is so important. We need people who can handle computers, because so much data is being generated and we can produce simulations and images in resolutions that we could only dream of a few years ago. So we need IT and technicians, but we also need doctors and people who do what we do.” ♦

Targeting cancer stem cells

Drugs that target the unique properties of cancer stem cells can be very effective in preventing the development and spread of cancer. There may be drugs on the market even now that can have an effect if used in the right way.

TEXT & PHOTO: NICKLAS HÄGEN

Stem cells are cells that have not matured into specific types of cell themselves, for example into blood cells or skin cells, but underlie the development of these cells. A fraction of the cells in the body are stem cells and they play a central role in foetal development, in the growth of children and young people and in how new cells are created when old ones have come to the end of their useful existence or are damaged.

Since the start of the new millennium it has become increasingly clear that so-called cancer stem cells exist. These are cells that drive the development of cancer cells and are a key factor in the formation of tumours. It is assumed that these cancer stem cells are responsible for the metastasis of cancer and for the recurrence of cancer, even when the tumours have been eliminated.

“The hypothesis is that the cancer stem cells have mutated from tissue stem cells or other, more specialised stem cells,” says **Daniel Abankwa**, a docent at Åbo Akademi University and group leader at the Turku Centre for Biotechnology.

“Where cancer cells with stem cell characteristics specifically come from or how they are created through mutation and so on are academic questions that are open to debate. But all the evidence I have seen points to the existence of special cancer stem cells that are resistant to the drugs we use to treat normal cancer cells.”

Abankwa is researching Ras, a protein in the ‘shell’ of a cell that is active when cells divide and mature into a specific type of cell. Ras is part of the signalling network existing between a cell and its environment and it is instrumental in setting the cell ‘machinery’ in motion when it is time for it to be activated.

Ras occurs in three forms – H-, K- and N-Ras. All three have been shown to mutate and be overactive in cancer, but K-Ras exhibits the highest mutation frequency and appears to be the form of Ras that influences or actually promotes the stem-cell-like properties of certain cancer cells.

“In many cases where the cancer involves mutations in K-Ras, the prognosis is very bleak, often tantamount to a death sentence,” says Abankwa.

“Now we are starting to amass data indicating that what makes cancer stem cell drugs effective is that they attack K-Ras and not H-Ras. This helps us to search for drugs that have the right effect.”

Properties from chemical compounds

Abankwa will receive funding from the Academy of Finland until autumn 2018 for his project “The development of drugs to treat breast cancer by targeting K-Ras”. By screening chemical compounds, his



Daniel Abankwa.

research group has already found certain classes of compounds that appear specifically to subdue the protein's activity in stem cells.

“We looked at 400 compounds in our second screening and found 14 that reacted specifically with K-Ras. We validated half a dozen of them and two were as potent as or more powerful than the best potential drug for cancer stem cells that we were previously aware of. Our research got off to a flying start,” adds Abankwa.

“A drug that inhibits K-Ras may be the ‘holy grail’ for cancer research. K-Ras is central to cancer stem cells and cancer stem cells are central to the tumour as such. What is being done to combat K-Ras can be a real game-changer.”

At the same time as examining different molecules that will hopefully be more effective than the drugs already on the market, there is also a reason for looking afresh at old drugs. Phenothiazines are a group of old antipsychotic drugs that were used – and are still used today to a certain extent – to treat schizophrenia.

“In our studies they specifically moderate K-Ras and not H-Ras and reduce the stem cell properties of stem cells in cell cultures, while other studies have shown that certain phenothiazines effectively counter metastasis and tumour growth.”

These drugs were being used to treat cancer back at the end of the 1980s, but without any great success. This might be because they were not tested on the right patients.

“With the aid of gene profiling, it would be possible to select patients who would probably respond to the drug. I hope to find a clinician who would be willing to test these on people, because the drug is already approved for use on humans and it could save lives.” ♦

in brief...

YOUR PLACE IN THE SIBLING “PECKING ORDER” MATTERS

SEVERAL STUDIES have shown a strong link between a person's place in the family and aspects such as education, income level and cognitive and non-cognitive skills. Children born later into a family tend to perform less well than children born earlier into the same family.

Rigorous studies on the connection of birth order to health and mortality have previously been based only on data from Sweden and Norway. These have shown that there is a link also to mortality, and in particular to suicide. Being a younger child in a family is connected to a higher risk of suicide.

Research carried out by **Jan Saarela**, Professor of Demography and Statistics at Åbo Akademi University, now shows for the first time that this is the case also in Finland. The results obtained from quantifying the connections are more or less identical with ear-

lier results from Sweden. Compared to first-borns, persons who are the second child in a family run a 27% higher risk of committing suicide; third children run a 35% higher risk; and fourth or younger children run a 72% higher risk.

The mechanisms underlying this connection have not been established. There are several potential explanations, and one such is the social interaction within families, which may place younger children at a disadvantage. A remarkable aspect of the Finnish results is that there is no clear connection between birth order and suicide risk among the Finland-Swedish population. This might be explained by cultural reasons, and also have a link to the fact that the risk of separation is considerably lower in Finland-Swedish families, as compared to both Finnish-speaking families and families in Sweden.



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The results have been published in *Social Science & Medicine*, which is considered the leading journal within social medicine. The study was carried out in cooperation with two Swedish universities: the Centre for Health Equity Studies at the Karolinska Institutet and Stockholm University. ♦

VISUAL BIOCENTRE IN TURKU

EURO-BIOIMAGING, a European research cooperation project for bioimaging technologies, opened its first service centres in 2016. This means that researchers working on bioimaging can use the 36 different imaging technologies available at the 29 service points in various parts of Europe.

The idea is to facilitate researchers' access to available technology, regardless of which university or organisation it is linked to. Contacts with researchers will provide Euro-BioImaging with a better overview of current research issues, which will make it possible to map the requirement for new technological solutions and to advance technological development. And the circle will be closed as technological development may give rise in turn to new research questions.

“We have experienced a technological revolution in the last few decades, but access to the new technology has been limited. Through Euro-BioImaging we want to give researchers free access to the best services in Europe and bring developers and users closer to each other,” says **John Eriksson**, Director of the Turku Centre for Biotechnology and one of the initiators of Euro-BioImaging.

The organisation is based in Turku, Finland. Euro-BioImaging is linked to the existing local organisations through Turku BioImaging, which coordinates the different imaging technologies, and the Turku Centre for Biotechnology, which implements the practical activities and maintains the equipment. Members of Turku BioImaging include the Hospital District of Southwest Finland, Turku University Hospital, Åbo Akademi University, Turku University, Turku University of Applied Sciences, the Regional Council of Southwest Finland, the City of Turku and Turku Science Park.

The additional two main sites of Euro-BioImaging are located in Italy and at the European Molecular Biology Laboratory, EMBL, based in Germany. The project's service points are found in eleven European countries. ♦

Jan Ellenberg, Head of the Cell Biology and Biophysics Unit and Coordinator of the Center for Molecular and Cellular Imaging at the EMBL, Germany, visited the opening of the service centre in Turku. Ellenberg was also one of 14 honorary doctors at ÅAU's doctoral conferral ceremony in May 2016. Photo: Nicklas Hägen.



Turkey's new direction big loss for democracy

The Turkish president Erdoğan seems to be leading his country towards autocracy while realising the visions he had in his own, banned party.

TEXT & PHOTO: MARCUS PREST

Military coups or “military inventions” have been frequent in the history of modern Turkey. The military has openly intervened in 1960, 1971, 1980, 1993, 1997 and most recently in the summer of 2016.

The measures taken by the Turkish regime, led by president **Recep Erdoğan**, following the 2016 coup have given rise to worried and condemnatory reactions, at least in the press, but also politically by the EU and USA. Turkey seems to be sliding towards increasingly authoritarian rule, while president Erdoğan is enormously popular at home.

“This is what a majority of the Turks want,” says **Markku Suksi**, Professor of Public Law at Åbo Akademi University.

“It might be difficult to understand, as Erdoğan wants to change the state ideology that has prevailed since **Kemal Atatürk**.”

Kemal Atatürk is regarded as the founder of the Turkish state after World War I and the collapse of the Ottoman Empire. Atatürk's ambition was to modernise Turkey by introducing secular rule and not giving religion any role in official contexts – he wanted to steer the country away from sultan rule. He also pursued a strong Turkish nationalistic programme while trying to carry through modern reforms.

The instigators of last summer's coup had a list of measures that they wanted to have implemented in Turkey. The first point on their list was to guarantee the continuation of secular rule, which has prevailed for almost a century in an almost exclusively Muslim country.

“Formally almost all Turks are Muslims – but in practice this covers people of various degrees of profanity and religiosity. On the whole, however, it is obvious that Turkey is a markedly Muslim country,” Suksi says.

“After the military coups in the 1970s and 1980s, and after a military invention in the 1990s, Turkey developed in a more democratic direction, which allowed parties with a religious agenda to form and participate in politics. Until then, the Turkish state had actively hindered such parties from public participation.”

There is a well-known case from the European Court of Human Rights, called The Welfare Party Case, from 2003. This unique case concerned the party of which Erdoğan was then leader. What made it special was that the European Court of Human Rights allowed the state to ban a political party.

“Usually the verdict is the opposite when political parties are involved. But this Islamist party was wholly anti-democratic and advocated discrimination against non-Muslims and women. The party was forbidden by Turkey, something that the European Court of Human Rights approved, and Erdoğan as its leader was given a prison sentence by the Turkish court system,” Suksi explains.

“When he was released he founded the Justice and Development Party, the AKP, which opposes the most fanatical Muslim extremism, but is nevertheless a strongly religiously oriented party. And since then it seems as if the agenda of Erdoğan and the AKP coincides with that of most Turks.”

Suksi underlines that a military coup is always the worst alternative, and that it was good that the latest one in Turkey was unsuccessful. However, Turkey is currently creating a regime which, according to Suksi, seems as unpleasant as the military alternative.

“For me personally this is a great moral problem. But my opinion is that successful military coups are always the worse alternative. So what we have now is a Turkey that is developing into an autocracy while donning a democratic façade. A ruler similar to a tsar or a sultan has been allowed to establish himself. Erdoğan will continue strengthening his own position and forcing through new constitutional regulations in parliament,” Suksi predicts.

“When these laws come into force, Turkey will be transformed from a state with official parliamentary rule to a state where the president and parliament are separate entities, and where the president has the power to rule and also to overrule parliament. This means that the entire state administration totally changes character. And this entails a fundamental difference from the way countries within the EU are governed. Erdoğan is going to realise the Welfare Party's vision, but under another name.”

A lost opportunity

Suksi himself earlier thought that Turkey's negotiations for EU membership could have potentially been successful. Much effort would have been needed for the country to fulfil the EU requirements, major changes would have had to be made, but the same has applied to some current EU member states too.

“The first serious discussions on the conditions for Turkish EU membership took place at the EU meeting in Helsinki in 1999. But with the development we are currently witnessing, this opportunity has now been lost for a long time. And it also means that a considerable part of Turkey's educated labour force is packing their bags. Turkey is facing an expensive brain drain.”

How do you think the autocracy will influence the future of Turkey in more detail?

“Turkey will become a country similar to the Central Asian states and Russia. This means, among other things, that we should constantly be aware of who Erdoğan's successor might be. That is, I don't think Erdoğan will let his position be subject to entirely free and fair elections. Unfortunately I expect a more dynastic development, but I hope I'll be proved wrong.”

“Erdoğan is now 62 years old, which is young for a dictator. But in 10–15 years he must have a successor whom he has trained for the position. The successor will be hand-picked and probably somebody from within his family. Naturally, all this is speculation – but these kinds of patterns tend to recur in the world of one-man rule.”

What are your thoughts on Turkey's role as a NATO country?

“I'm not all that familiar with NATO as an organisation. But NATO is a military alliance and the objectives of military alliances are totally different from those of governmental organisations that cooperate internationally on other than military issues.”

“NATO consists of democracies and expressly acknowledges the principle of democracy. And it's uncertain whether it can even be pretended that Turkey is a democracy, although the country would try to maintain a democratic façade. It will be a major issue for NATO if Turkey turns into a pure autocracy. One aspect of that is, for instance, that autocracies are unpredictable. If another country enters into dispute with Turkey, it's equal to entering into dispute with Erdoğan, and vice versa.”

How do you think autocracy will influence Turkey's possible power ambitions in Central Asia?

“Imagine something happening in, say, Azerbaijan or Uzbekistan, which creates a threat to the Turkish population there. I don't think Erdoğan would shun any means if he could gain something by interfering. Considering NATO, of course, this is not a good scenario. And if Turkey provokes an attack on its own territory – how will NATO react in accordance with its treaty article 5 pertaining to collective security?”

“A consequence of the state considering itself to be Muslim is that there is no room for other groups. Apart from certain so-called treaty minorities, mainly Christian and Jewish, there would officially be no other minorities. This would make the situation for Kurds even more difficult. It seems that the possibilities of Kurds to start to act politically in a cautious manner through the parliament during the past 15 years will now be constrained to the level that preceded the 1990s.”

A radicalisation

Suksi is concerned about the current radicalisation of Europe and the rest of the world. Countries such as Hungary and Poland are ruled by right-wing nationalists and populists with authoritarian leaders. Not to mention the general situation in the Middle East. **Le Pen** is strong in France, but there the political culture is still of a different kind.

“Turkey's present development is such a big loss for democracy. Turkey has been the model for democracy in the region, but now the country has, in turn, modelled its development on the neighbouring countries in the Middle East. This is a horrible development.” ♦



Markku Suksi.

“It's uncertain whether it can even be pretended that Turkey is a democracy, although the country would try to maintain a democratic façade. It will be a major issue for NATO if Turkey turns into a pure autocracy.”

Hitting the resonance frequency

Breaking a glass using your voice is not as easy in reality as on film. It takes a strong singer, a suitable glass and the right circumstances.

TEXT: NICKLAS HÄGEN

The scene is classic: a singer holds a high tone for a long time and somewhere in the room a glass breaks, often a crystal wine glass or in a cut-glass chandelier. But is this actually possible to do outside the world of film, and in that case, how does it happen? We asked **Torbjörn Björkman**, lecturer in physics at Åbo Akademi University to tell us what is required.

“Yes, it is possible to break a glass using sound. What it takes is to hit the resonance frequency of the glass. But I dare not promise that it’s possible to do it the way it is done in films,” says Björkman.

Each material has its natural frequency, a frequency at which the material tends to oscillate. For a glass, it is the tone the glass makes when you tap it with your finger, for example. The mechanical tap causes oscillations that make a sound at a certain frequency.

Some examples from popular culture of breaking glass by using voice:

- **Victor/Victoria** (1982): Victoria Grant, played by Julie Andrews, breaks a wine glass by singing.
- **Who Framed Roger Rabbit** (1988): The animation rabbit is given so strong a drink that it makes him sound like a steam whistle and the sound breaks all glasses in the room.
- **Shrek the Third** (2007): Prince Charming breaks glasses at the opera with his squeaky voice.

The effect is the same when you touch a guitar string: a basic frequency arises as well as several overtones, which are all natural frequencies.

“If you sing the same tone as the string makes, the string starts to oscillate, resonance is created. You can drive the oscillation of the string with your voice. The link between them is weak, but sufficient. What happens is that your voice makes the air oscillate and the air particles reach the string in waves, which in turn make it also oscillate,” Björkman explains.

“Cars, too, have their natural frequencies, which make them vibrate when they reach a certain rotational speed. This mainly pertains to older cars. In modern cars, this has been prevented, so if it occurs, there is a fault in the construction.”

Brittleness of glass crucial

What is needed to break a glass using your voice is a strong frequency, which matches the natural frequency of the glass, and which continues for long enough with sufficient intensity.

“The sound wave pumps in energy, seen in the form of vibrations in the glass. If you can sustain the tone for long enough, the oscillations become larger and larger. Glass is a brittle material and will eventually break. Other materials, such as plastic, also vibrate, but since it is flexible rather than brittle, it will not break.”

However, what makes Björkman hesitant as to whether it is actually possible to break a glass with one’s voice as on film, are the circumstances required. It’s partly a case of the pitch being right and the glass being of the right thickness; but also the effect of the sound waves weakens as they travel through the room.

“The singer must have a fairly strong voice. But more crucial is how fragile the glass is and what inherent tensions there are. These make it brittle. You must be lucky with your glass,” says Björkman.

“In films, it is usually high tones that break glasses. But those are more likely to break prisms in cut-glass chandeliers, which have a very high natural frequency since their circumference is smaller than that of drinking glasses. I have no trustworthy statistics on how many glasses are broken by singing, but it should be possible, even if it is not as common an occurrence as in films.” ♦



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ÅBO AKADEMI UNIVERSITY

Cognitive fitness

With work putting a bigger strain on the mind than on the body, the demand for cognitive fitness has increased. Meanwhile, the population is rapidly ageing and memory disorders are becoming more common. A new digital market promises easy solutions to reduce our worries, but does not seem to live up to the expectations.

TEXT: NICKLAS HÄGEN



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had a memory training app in my mobile some time ago. Ironically enough, I can't remember what kind of tasks it involved, but probably they weren't interesting or rewarding enough, as I stopped using it after some time.

Just as well, according to **Matti Laine**, Professor of Psychology, and researcher **Anna Soveri** at Åbo Akademi University. Memory training is not likely to cure my absent-mindedness or improve my memory to any considerable degree.

"Training does not seem to offer any promising results. The meta-analysis we have done shows that there is a big difference between the groups that train and those who don't train when it comes to the specific training tasks. Moreover, the training groups improve on untrained tasks that are very similar to the ones they trained on. But when looking at other assignments different from the training task, the effect is minuscule," Soveri explains.

"If you perform the same tasks, but with other stimuli, there is an impact. For example, if you practise using numbers, you're able to perform the same task using letters. But the effect is very limited. It does not transfer to a structurally different task, and it diminishes if you stop training."

Laine refers to the expression 'the curse of specificity'.

"Whichever skill you work at, you become better at that specific task, but not much more. If I practise playing the piano, I become better at playing the piano, but I don't improve my skills in playing the violin," Laine exemplifies.

Fast growth

Although there is no proof that memory training does improve one's memory, the industry is growing fast. According to SharpBrains, a

company specialising in market research of the so-called cognitive fitness market, the turnover of the industry has already reached over one billion dollars. The number of enterprises and apps within the field has increased explosively in the last years and the turnover is estimated to grow to six billion dollars within a few years.

The growing market has caused a larger need for consumer protection. In early 2016, the creator and marketer of the Lumosity memory training app, Lumos Labs, agreed with the US government authorities to pay two million dollars in compensation for false marketing. Their advertising claimed that the app would improve daily performance at work and school, and reduce or postpone a weakening of the cognitive functions caused by old age or serious illness.

"You can claim that your program is efficient and that you have a new way of implementing it. This might even be true. But the burden of proof is on you, and there are strict methodological requirements on the testing. They are similar to the principles of testing new medicines. Having just one group that uses your program for a few weeks, and interviewing them before and after doing so, does not suffice as proof that the program works," says Laine.

Better effect on persons with memory disorders

The impact of memory training can be said to be negligible, but there are, nevertheless, exceptions. Patients diagnosed with various memory disorders seem to gain a more generalisable advantage from training than persons with an intact memory.

One reason for this might be that the efficiency of the executive functions, including working memory and concentration ability, follows a curve which peaks at around the age of twenty. And since test persons in the studies are usually university students, they are close to

their highest potential; thus there is not much room for improvement, and the training might prove useless. However, when test persons are at a lower point on the curve and unable to use their full capacity, they might be able to compensate through training.

Another reason why patient groups might achieve better results through training can be that the training has a diffuse, generally positive effect, which is reflected in how they perform in tests.

"The tasks train many things other than just working memory. Therefore you might start performing better in a task, although it's not your working memory capacity that has improved," Soveri explains.

Laine adds that the various functions are not isolated entities. Working memory cannot be tested without the involvement of social (like the motivation to participate) or linguistic aspects.

"If the task is to repeat a sequence of numbers, you must concentrate on it. But if you're doing it on a computer, you must also keep the test instructions in mind. After a while, you become faster at using the computer, more used to number sequences and start creating strategies for remembering," says Laine.

"So perhaps it's not the case that training of working memory influences the actual working memory, but rather that it's mediated by other aspects – by taking your time, focussing on something and improving your computer skills."

Effects, mechanisms and strategies

BrainTrain is a Centre of Excellence research project at Åbo Akademi, funded by the Åbo Akademi University Foundation since the beginning of 2015. The project will continue until the end of 2018.

The object is to explore working memory very extensively, for example using a web-based test platform, which makes it possible to

test a significantly larger number of people and without geographical limitations.

"We will look at whether a link exists between several factors – health, hobbies, nutrition, sleep quality, stress level and linguistic background – and how well or badly the test persons do in the tasks. Do you have a better working memory if your level of education is higher, if you are not depressed, if you eat dark chocolate, drink red wine, eat nuts or exercise? Is there a connection?" asks Soveri.

So far the project has managed to find out how working memory is influenced by training; they have begun to be able to foresee how a certain kind of training might give results (although weak) and at what point the effect dwindles.

The strategies people use, for example, to divide long number sequences into groups, or to make up words of letter sequences have proved to be an important issue. When you have to keep things in mind for a short time, you can do it in various ways, and some are better for the purpose than others.

"People tend to make associations with a wide range of things, and these probably play an important role. There isn't much written on this in literature, and this is one of the things we are going to study during the next two years," says Laine.

The way in which the strategies work might explain why the effects of memory training are so limited.

"The test persons perhaps develop good strategies for performing tasks that they train three times a week for five weeks, but the strategy only works for a certain kind of assignments and not for others," he continues.

"Usually when we give training tasks to test persons, we don't provide them with instructions as to the best way of remembering things.

Working memory

The question as to what happens when we remember things makes researchers sigh deeply. There is no easy answer to how memory should be described.

"Something happens in the brain, there's no doubt about that. Working memory seems to be about an increased level of activity in the brain's network, that is why it is temporary. When moving to long-term memory, we're talking about a different system, structural changes based on the activity in certain loops and networks. Over time, these create structural changes in your synapses, which are the contacts between nerve cells. This lays the foundation for long-term memory. Even if you focus on other things in between, you can return to these things," says Matti Laine, Professor of Psychology at Åbo Akademi University.

Working memory was called short-term memory until the 1970s. The new term reflected a wish to emphasize the active part of working memory, the fact that it's something happening here and now.

"Working memory can be regarded as a part separate from long-term memory. But there is also another view, which considers them to be one system where working memory constitutes the active part of long-term memory," Laine explains.

"In that case your working memory could be described as a large library where you go with a torch and see different things at diffe-

rent times. Working memory can be seen as a mental platform moving according to what you're doing at the moment, and its contents can originate partly in long-term memory, partly in external factors."

A typical working memory test consists of repeating number sequences, perhaps also manipulating them by repeating them backwards. In functional magnetic resonance imaging (fMRI) this mainly shows response at the front of the brain.

"Repeating number sequences is a verbal task, which activates the left hemisphere, mainly the left frontal lobe, the left parietal lobe and the auditory cerebral cortex. If you're given visual input through the computer screen, the visual cortex is also activated, and possibly other areas related to language," Laine says.

The difficulty is that fMRI measures on a very broad scale.

"With fMRI we measure widely, and then have to relate the specific objective of the measurement to other things happening, in this case working memory in relation to social and linguistic factors. It's difficult to tell whether the response is created by working memory specifically. Perhaps the working memory operations take place in the cortical columns? They are extremely small and most likely to display interesting patterns, but we cannot make non-invasive measurements at sub-millimetre level." ♦



Pictured, from left, are Karolina Lukasik, Matti Laine and Anna Soveri. Photo: Nicklas Hägen.



We must bear in mind that working memory is not an empty theoretical concept without any significance. It's obvious that the tests that we criticise do quite strongly correlate with other things in real life, such as academic performance or, in the case of children, how well they learn foreign languages or how well they can control their emotions.

People find out themselves, either consciously or unconsciously, how they can best manage their tasks. We have tried to interview people about how they do that, but their descriptions are not all that detailed. This is something we want to explore in more depth.”

What does the test test?

When the BrainTrain researchers started digging into literature in the field, they found that there was surprisingly little methodological research into whether working memory tests and other executive measures actually measure what they are believed to measure. Nor is there a consensus as to the best way of using tests; different studies use different tests and combine them in different ways.

BrainTrain is conducting a meta-analysis in order to explore what popular executive tests measure, by analysing how the various ways of

measuring the executive functions correlate to each other. The long-term goal is to develop a tests that are closer to everyday life.

“Researchers and clinicians look at what happens in the brain when a person performs a task that is supposed to measure working memory. They can see that certain areas are activated, but if the task doesn't specifically measure working memory, the entire description is incorrect. In that case, the way in which the tasks are used must be changed,” says Soveri.

“Perhaps the tasks are chosen without any further reflection. They are simply chosen since they are assumed to measure working memory, but the test has never been monitored as to its actual function. We're going back to the roots here.”

That sounds as if it might have a dramatic impact on the research results?

“We must bear in mind that working memory is not an empty theoretical concept without any significance. It's obvious that the tests that we criticise do quite strongly correlate with other things in real life, such as academic performance or, in the case of children, how well they learn foreign languages or how well they can control their emotions,” Laine says.

“Working memory is not just about cold data processing, it's also affected by emotions and motivation. It's important that it is linked to real life and therefore we need to learn more about the building blocks of working memory. We don't know what the natural components of the brain and the mind are, how they function and do various things. It's a matter of, to quote Plato, ‘carve nature at its joints.’”

Is there any hope for those with a poor memory?

“Perhaps to use better strategies in various contexts. But there is no patent solution in sight,” Laine says.

“It is more a matter of a healthy lifestyle,” Soveri adds.

“Go out jogging, eat relatively well, sleep enough and be social. That's quite a good recipe. The advice we have for a healthy lifestyle also supports your memory,” Laine concludes. ♦



tDCS

Transcranial Direct Current Stimulation, tDCS, is a form of non-invasive brain stimulation. Two electrodes are placed on top of a person's head and a weak electric voltage is created between them.

In theory, tDCS is supposed to create better conditions for learning and improved cognitive performance. This is because activity in the brain is based on nerve signals consisting of electric impulses. By increasing their effect, the aim is to create structural changes in the brain, which will result in the rebuilding of synapses, that is, the contact points between nerve cells.

“Brain cells communicate with each other through electrochemical signals that transmit information, but do so only if the tension exceeds a certain threshold. With this gadget, the threshold can be somewhat lower, which makes it easier for the cells to create communication channels between them,” says **Karolina Lukasik**, post-graduate student in psychology at Åbo Akademi.

“We have placed the electrodes on parts of the brain that are particularly active with regard to verbal working memory. The participants perform a working memory task and we hope that they will perform better when receiving stimulation. So far, we have only done pilot testing, so we cannot say very much about the results yet.”

This technique is new, so it is still unclear how great an impact it actually has and what the best way to use it is. The advantage is that tDCS is very easy to use and does not require a large lab.

“The technique is also safe, there are no reports of negative long-term effects. Users say that they get red marks on their skin from the heat emanating from the electrodes, occasionally they get headaches or experience a tickling sensation. On the other hand, test participants cannot say whether they have received actual stimulation or placebo, so it's obvious that the expectations of something happening are great,” says Lukasik.

There are inexpensive tDCS devices available for ordinary consumers. But, as with all technology for memory training, it is recommended not to expect too much in the way of results.

“People want easy fixes, an easy way to improve. However, research indicates that there is no easy way of improving memory, apart from a healthy diet, lifestyle and hobbies. You can buy all the tDCS devices in the world, but if that is the only thing you do, it is unlikely to work.” ♦



Karolina Lukasik is trying to discover if tDCS really has an effect. Daniel Fellman, doctoral student at Åbo Akademi, volunteers as a guinea pig. Photo: Nicklas Hägen.

Virtual reality for (almost) everything and everybody

Virtual reality, VR, is a mixture of computers, multimedia and hypermedia, 3D technology, the web, robot technology, instrumentation, sensors and optics. VR is high tech and an increasingly popular user interface in an increasing number of applications. Åbo Akademi's new Experience Lab in Vasa is equipped with the latest VR technology.

TEXT & PHOTO: ARI NYKVIST

Virtual Reality consists of a number of different technologies, which function together to give us an illusion of physically entering another world. And when VR technology is combined with meaningful and educational content, we can acquire new knowledge in a new, but also age-old, way of learning – that is, by experiencing the subject physically, through our senses and our brain.

Åbo Akademi's new Experience Lab at MediaCity in Vasa, Finland, opened in the autumn of 2016. The lab's equipment includes the latest VR technology, which provides stunning 3D experiences of, for example, moving around in the human bloodstream while learning how it functions.

"Using VR in learning is a rapidly growing trend. But the world of business is also increasingly using VR for communication and marketing. Socio-cultural learning generally is growing in importance," says **Annika Wiklund-Engblom**, a lecturer in education at Åbo Akademi. She has used the present Experience Lab frequently in her work.

VR no longer just a 'cool thing'

VR can be used for visualising information and knowledge and, what is more, in direct interaction with the user. It is therefore expected to assume an important and dominant position in tomorrow's educational and experience industry. In the 2010s VR has advanced from mainly military environments and elite university laboratories to being one of the key elements in all professional development. For example, researchers and teachers, managers, instructors, trainers and therapists implement interactive, engrossing experiences in an increasingly realistic 3D environment.

One example of the socio-cultural dimension of VR, which has grown in importance in the 2010s, is the use of VR to increase the understanding of others and bridge cultural differences. For instance, Finnish pupils can visit and explore a village school in India and meet the pupils there online, and vice-versa.

"Particularly in the countryside, outside of larger urban areas, there is a growing need to use VR for visiting and studying the surrounding world in an easy, inexpensive and quick way. So this is a hugely useful aspect also for distance learning," says **Joachim Majors**, one of three certified testers at the Experience Lab.

In order for VR to provide as authentic an experience as possible and be truly useful, VR as a digital instrument must become even more transparent and invisible than it is today, according to **Joachim Högväg**, another of the Experience Lab's certified testers. And technology is advancing in that direction.

"Even now some users seem to totally forget the user interface when they move in a well-designed VR application. The interface, the fact that you are actually standing in our small VR room with a funny kind of diving mask on your head and a joystick in each hand, simply disappears, and you feel, register and respond to the virtual environment and what you see there in an entirely different way than when you watch a screen or read a book."

According to **Annika Wiklund-Engblom**, VR is now much more than just a cool thing for the quickly growing game and entertainment industry.

"The gaming world's way of interacting with users, both as individuals and as a cooperative group, is entering learning and educational development as a whole at a fast pace," says Wiklund-Engblom.

Extensive interest in new digital research methods

The great interest in the new, experimental analysis methods offered by the Experience Lab has taken its staff by surprise. **Sören Andersson**, engineer, certified tester and technology manager at the Experience Lab, has worked on developing more reliable and sophisticated methods and software for experimental measurement, data collection, analysis and evaluation since the early 2000s.

"Previously, we usually turned to researchers asking whether they would find experimental methods useful as a supplement to more traditional measuring methods. Now, researchers themselves are increasingly contacting us in order to use EEG, eye movements, psycho-physiological measurements and VR in their research projects, for instance. Interest in our methods has grown considerably," says Andersson.

With a team of staff that has worked for more than a decade with experimental methods and user experiences in particular, the Experience Lab is more advanced than most similar laboratories in Europe. Using skin conductance and eye movements for analysing how what is seen on a screen influences the viewer's attention and interest is a



Pictured, from left, are Joachim Majors, Joachim Högväg and Annika Wiklund-Engblom.

new approach even for many commercial laboratories elsewhere in Europe, while the lab and its predecessor at Åbo Akademi have already been using such measuring methods for about ten years.

These are objective ways of collecting data on how a person actually experiences a digital product, which increase our understanding of what the user thinks of the product.

The alternative is to observe persons using a product and to interview them afterwards. However, users do not always answer truthfully as to what they think of a product. Biometric measuring also provides more data on whether a person is frustrated, for example, and does not have a positive experience of the digital product at all.

"We're particularly good at subjective user experiences and at how these can be influenced and improved. This is our current competitive advantage. Focussing on the user is now more important than ever, as more and more services and devices are digitalised," Andersson says.

He finds the services offered by the new lab to be perfectly timed – they match current trends and have great potential for further development, not least pertaining to the use of VR within a growing number of areas and disciplines.

VR and AR (Augmented Reality) are being used in a large number of applications. For example, the Experience Lab is currently experimenting with VR in various classroom situations. One highly prioritised application is to test various stories from a historical perspec-

tive, so that the user may experience a historical event in an entirely new way.

"VR in teaching can also be used to learn about a certain substance in biology or to move around inside the body and see how the blood circulation or cells in the body function. Or to communicate using a virtual classroom, with the teacher and pupils actually sitting in entirely different locations.

According to Sören Andersson, biometric analysis is currently advancing at a dynamic rate. Developing new measuring methods, improving user experiences, designing new innovative products and marketing both services and products in cooperation with technical experts and users are becoming the natural point of departure.

With over ten years of experience in the field, the Experience Lab has a close relationship with the main developers of eye movement measurement. Today, test subjects can wear special lightweight glasses with small wireless cameras attached, and afterwards it is possible to see how their gaze has moved or focussed on certain things in a classroom situation, for example. Andersson says that methods and services are developed in dialogue with scientists and research groups both within and outside of Åbo Akademi University.

"We are developing constantly and acquiring new, increasingly user friendly technology for the lab all the time. We're planning several new things for 2017." ♦



Photo: AFP/Lehtikuva.

“Still not particularly plump”

TEXT: NICKLAS HÄGEN

Manufactured by the company Mattel, the Barbie doll has been controversial ever since it was launched on the market in March 1956. The main point of criticism is that it represents a distorted, idealised body image. For example, according to a study conducted at Helsinki University Hospital in Finland, Barbie would – were she human – lack the 17–22 per cent of body fat needed for a woman to become pregnant.

In 2016, three new shapes of the Barbie doll were introduced; a petite, a tall and a curvy.

“It was high time to make some other versions of Barbie after 57 years. But the curvy one is still not particularly plump. A more important point is that Mattel makes the dolls in various colours, so that not all are white,” says **Harriet Silius**, Professor Emerita of Women’s Studies at Åbo Akademi.

“At the same time, it’s important to point out that it’s not Barbie that’s causing eating disorders. The ideal of slimness is present in films, fashion, music, on YouTube – virtually everywhere. There is a connection between this ideal and the fact that so many people want to be thinner than they are. This affects girls more often than boys, although there are also boys who suffer from the ideal of slimness. Boys aren’t allowed to be fat, either.”

But boys may be big?

“They may be tall and are preferred to be ... normal. That’s the difference; girls are explicitly expected to be thin.”

Is there a symbolic value in Barbie having been given new forms?

“Mattel has been heavily criticised for decades, possibly from the very launch of the Barbie doll, and finally they have listened to the critical voices. It is a toy depicting an adult woman and at last they have reali-

sed that not everybody looks like that. Probably the company wants to reach out to the grown-ups who have previously refused to buy Barbie dolls.”

“On the other hand, Barbie is so exaggerated that the children, and today we’re talking about quite small children, who play with the dolls hardly regard them as representations of real people.”

It is obvious that we have a problematic view of bodies. Is there any positive progress taking place in this area?

“No, I don’t think there is. Or at least very little. *Vogue Magazine* has stopped using models with eating disorders and Italy, Spain and France have introduced a minimum weight for models. So in some respects some small things are happening, but this is just one magazine of many, and just a few countries out of many.”

“New movements have also emerged that advocate a round and happy body form. People’s body weight in rich, western countries is continually on the increase; this is the trend we see. But relatively little is actually happening as a response. Eating disorders are treated as individual illnesses, where the reason for the illness is not necessary individual, but can depend on the environment. We are surrounded by a slimness ideal and not only that; we are expected not only to have a perfect body, but to be perfect also in all other respects. This can prove too much for people of a certain age.”

This is not only a question of the relationship between child and parent?

“No, we mustn’t assume that eating disorders are caused by parents or others close to the person. External factors are much more significant.”

Having been Professor of Women’s Studies, currently Gender Studies, since the chair was established at Åbo Akademi University in 1996, Harriet Silius retired in 2016. Her retirement lecture attracted an audience twice as big as had been expected, so the event quickly had to be relocated to another auditorium. ♦

in brief...

THREE PROFILE AREAS WITHIN RESEARCH

IN MAY 2015 Åbo Akademi University was awarded three million euros by the Academy of Finland as so-called strategic research funding. The university was given an additional 2.87 million euros in March 2016 for the purpose of specifying and further developing its research profiles.

Åbo Akademi’s identified profile areas within research are:

- **Minority Research**, focussing on minority culture and identity, bi- and multilingualism and language learning; and discrimination, equal rights and democracy. In addition, the profile includes the area of gender equality.

- **Molecular Process and Material Technology**, focussing on the use of biomass, particularly wood-based biomass, as raw material for degradable chemicals and materials.

- **Drug Development and Diagnostics** (in cooperation with the University of Turku), focussing on, for example, bioactive substances, drug introduction and diagnostics.

The implementation has begun in all three profiling areas. Initially investments are mainly directed towards tenure-track recruitments. At the same time, ÅAU invests its own funds to recruit annually approx-

imately 10 experienced adjunct professors to support the specific profile areas with a 20% commitment to the activities at our university.

These adjunct professors are international top-level researchers who directly support the profile areas, and are involved in activities at ÅAU through postgraduate teaching, supervision and grant writing.

The Academy of Finland’s aim with this funding instrument is to support Finnish universities in profiling their research into distinct areas of strength. The funding decisions were based on the review reports drafted by international panels. ♦

Åbo Akademi University



Åbo Akademi University (ÅAU) is a multidisciplinary and an internationally acknowledged research university in Finland. Åbo Akademi University, with two main campuses in Turku/Åbo and Vaasa/Vasa, offers high quality education in Swedish and English for approximately 7 000 students and has a very low student teacher ratio – class size is often small and teachers have time to assist students individually. Around 1 000 international students study and conduct research at ÅAU.

Internationalization is an important part of all activities at the university and ÅAU offers International master’s programmes taught in English. In a national comparison graduates of ÅAU generally have excellent employment prospects. ÅAU provides a unique, inspiring and international environment for research and education.

For more information, please visit www.abo.fi/en and www.abo.fi/master. ♦

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