

# Cerealier

No. 04/2022

A magazine from  
Lantmännen  
Research Foundation



THEME

## PRECISION NUTRITION



RESEARCH

**Blood tests may  
replace samples  
from the gut**

NEW THESIS

**Iron absorption  
an important factor  
in the green shift**

OATS

**New foods  
developed  
at Nofima**



**Helena Fredriksson**  
**Season's greetings!**

**M**any people think about what they eat to feel good. My best days start with porridge, not just because I know it's a healthy choice, but also because it's a good start to the day. In this issue, the theme takes the link between food and health to a much higher level – precision nutrition. This is an incredibly complex and interesting research field. We have met researchers who regard precision nutrition as an important element for improving public health in the future.

We already know a great deal about what we should eat to feel good, such as more legumes. But further research is necessary – and you can read about Cecilia Mayer Labba's work in this area. For example, she has shown that iron from legumes may be difficult to absorb.

Salt intake is another issue that has clear links to health. The ReduSalt research project has just ended; at the final seminar the researchers showed ways to reduce the amount of salt used in foods like meat substitutes and bread.

We have reached the final part of our series about Active, a new oat variety. Read about our meeting with two Norwegian researchers who are investigating how this unique variety could be used in new ways.

And, finally, we have several colourful, Christmas-themed porridge recipes.

I hope you all enjoy reading this issue!

**Helena Fredriksson**

Lantmännen Research Foundation

**Cerealier**

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See our colourful  
Christmas por-  
ridge recipes on  
pages 20–21.



PHOTO: ISTOCK

# Precision nutrition

*In this issue, we interview researchers about the potential for bespoke preventive dietary treatments for improved public health.*

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PHOTO: ISTOCK

## More Swedish-grown legumes in schools

A new project, FoodJams, has been started to increase the share of more locally produced plant-based protein in Swedish school meals. It disseminates research-based facts about the benefits of Swedish-grown legumes, and groups of chefs and teachers test the recipes together. Klimatkommunerna, Hushållningssällskapet, the Swedish University of Agricultural Sciences and Azote communications agency are responsible for FoodJams, with funding from Formas. ●

Read more:

[www.klimatkommunerna.se](http://www.klimatkommunerna.se)  
(in Swedish only)

## Fibre conference in Leuven

“Towards Unlocking the Full Potential of Fibre for Food, Function and Global Health” was the title of the eighth international conference on dietary fibre, held in Leuven, Belgium, 16-18 October. The conference, which is held every four years, is a scientific platform where the latest research is presented and discussed by leading researchers and industry stakeholders from around the world.

This time the specific subjects included dietary fibre and gut health, method development for dietary fibre analysis and the commercialisation of side streams to utilise dietary fibre. ●



PHOTO: ISTOCK

↑ Swedes trust that their food is safe and does not contain hazardous substances.

## Consumer confidence in food safety

Out of all the EU member states' citizens, Swedes have the highest confidence in the information about food risks they receive from national authorities. This was the result of Eurobarometer, a regular survey of EU citizens' attitudes to food safety. In general,

Europeans have a high level of confidence in research when it comes to food safety. Eight in ten Europeans see researchers as reliable sources, whereas somewhat fewer trust national authorities and EU institutions. The survey also showed that pesticides and antibiotics

are what Europeans worry about most, as regards food. The survey was commissioned by EFSA, the European Food Safety Authority. ●

Read more: <https://www.efsa.europa.eu/en/corporate/pub/eurobarometer22>

## Developing computer games about food

SLU Holding has received funding from the Swedish Inheritance Fund to develop a computer game about the climate, biodiversity, plant nutrient economy, sustainable consumption and food production.

The game is primarily intended for secondary school teachers and students; it builds

on scientific data and available statistics for food production. The players will be able to experiment using different challenges, strategies and solutions, including reaching climate goals. Development will be completed in 2024. ●

Read more: [www.sluholding.se/en/](http://www.sluholding.se/en/)





ILLUSTRATION: LENE DUE JENSEN

# Reducing the amount of salt in food

There are various ways to reduce the amount of salt in foods. This is one of the conclusions of the ReduSalt research project, which ended recently and had been run by RISE, the Research Institute of Sweden.

**R**ISE conducted several sub-projects on reducing salt, along with stakeholders in the food chain. In one study, salt was gradually reduced in selected products, and these were then tested by a trained sensory panel and by consumers. Different foods were affected in different ways. In one bread, salt was reduced by 10 per cent with no impact on taste, texture, safety or processability, whereas a 20 per cent reduction had a significant effect on taste. In vegetarian soya mince, salt could be reduced by 25 per cent without affecting taste, texture or processability.

“If you want to reduce the amount of

salt in a food by more than 5 to 10 per cent, sodium chloride can be replaced by other salts for the taste, and its other functions can be replaced by emulsifiers and preservatives,” says Camilla Öhgren, product design researcher at RISE.

**HOW SALT IS** integrated in the product is important for its taste. If the concentration is high in some parts, the product may seem salty, even if the total amount of salt is not high.

## REDUSALT

The ReduSalt research project has been running since 2011. RISE has led the project with 22 partners from the food chain. Its background is that salt consumption in Sweden is twice as high as the recommended intake. High salt intake increases the risk of high blood pressure, cardiovascular disease and strokes. ReduSalt has received research funding from Vinnova.

“Evaluating how the salt moves in the product is important, so that it gets into the mouth easily when the product is eaten,” says Evelina Höglund, food and product design researcher at RISE.

**IN ONE STUDY**, white bread was baked with six different layers – three with salt and three without. The level of salt in these layers varied, and the taste and effect were evaluated after proving, baking, freezing and defrosting.

“Having salt in the outside layer of a product was most important for the taste, because this is the layer you first come into contact with when you eat.”

Other lessons from ReduSalt include that if the acidity of a product is increased, it seems saltier. Sugar, however, lessens the sense of saltiness, which means that reducing the amount of sugar may be a good way to also reduce salt.

**Karin Janson**



ILLUSTRATION: LENE DUE JENSEN

## World Porridge Making Champion

This year's world championships in porridge making have been held in Carrbridge, Scotland. The title of World Porridge Making Champion is awarded to the contestant deemed to have made the best traditional porridge using just three ingredients – oats, water and salt. A jury assessed the appearance, texture, colour and taste. Lisa Williams, Trimley St Mary, England, won for the second year running. In addition to the main competition, the title of Speciality Porridge Champion is awarded to the creator of a sweet or savoury dish where oats can be combined with any other ingredient. This year's speciality winner was Chris Young, Crieff, Scotland, who wowed the judges with his porridge noodles two ways, with hand-dived seared scallops and caramelised figs. ●

Read more: [www.thegoldenspurtle.com](http://www.thegoldenspurtle.com)

# 2023

is the year in which Stockholm will be the European Capital of Gastronomy. ●



PHOTO: KATJA RAGNSTAM

↑ Barleyotto with rutabaga from Västergötland.

## New regional dishes

Following a call from various organisations, including the Swedish academies for gastronomy and mealtimes and the Royal Swedish Agricultural Academy, Sweden now has new regional dishes.

The dishes include several grain products, such as a barleyotto with rutabaga from Västergötland, baked rabbit with roasted rye from Dalsland and äggost (egg cheese) with roasted oats

from Bohuslän. The dishes are made using local ingredients and are rooted in each province's history and heritage. ●

Read more: [www.ksla.se](http://www.ksla.se) (in Swedish only)

## European investment in more varieties



ILLUSTRATION: LENE DUE JENSEN

The Re-cereal research project, being run in Italy and Austria, will establish more cultivation of oats, buckwheat and millet.

The aim is to generate greater

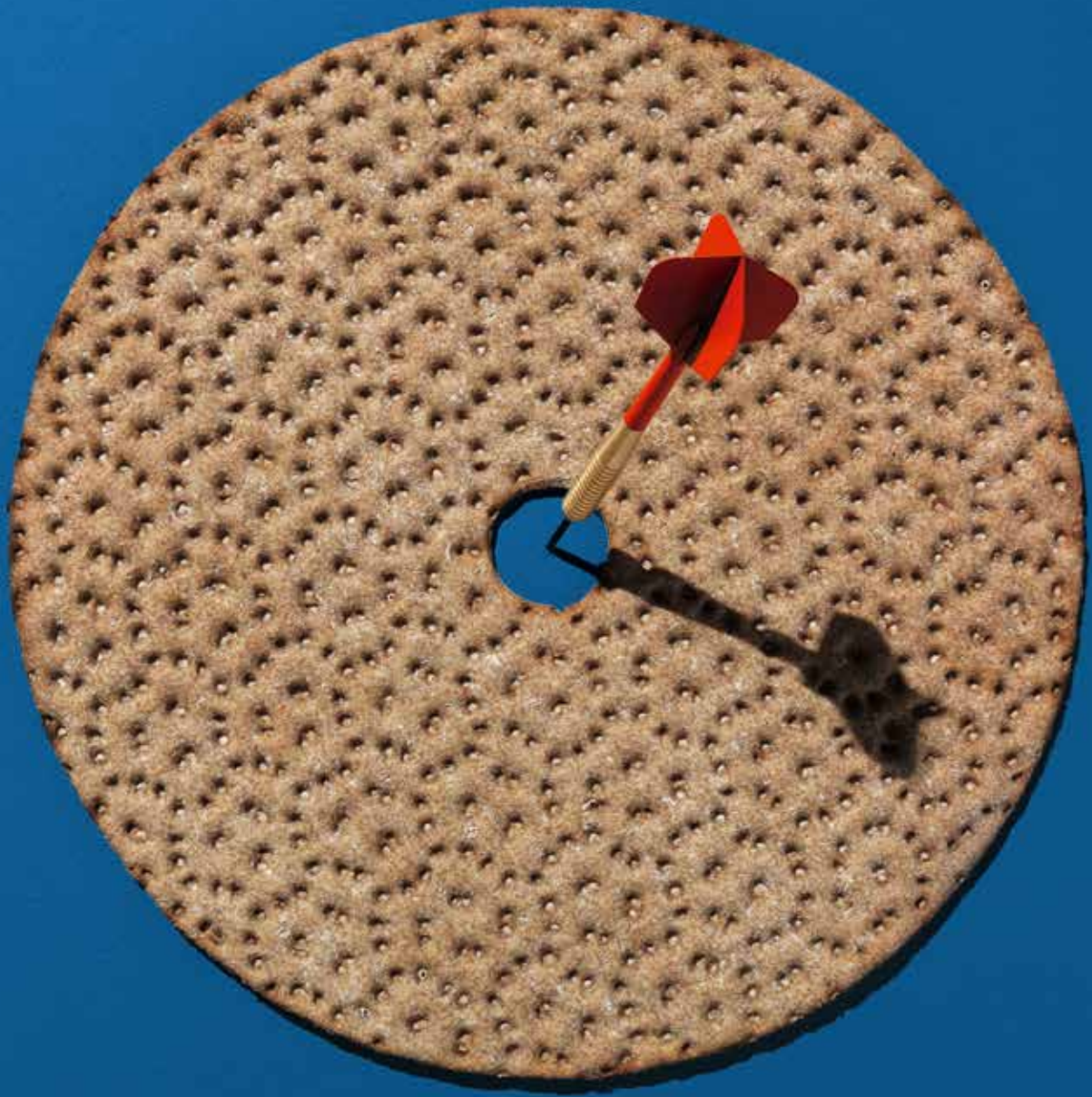
variation in the grains grown in these countries, as well as to increase production of naturally gluten-free grains.

The project includes genetic

evaluation, developing cultivation technologies and flour analyses. ●

Read more: [www.re-cereal.com/en/](http://www.re-cereal.com/en/)





## THEME

# PRECISION NUTRITION

*In theory, food as a preventive treatment can lead to diseases developing later or not at all. Precision nutrition is an area of research that involves identifying the right diet for the right individual at the right time, to improve public health. We have interviewed four researchers about what is happening in the field of precision nutrition. ►*





↑ Rikard Landberg would like to see a major study on the beneficial health effects of a Nordic diet.



# A research field with huge potential

Precision nutrition could have a significant positive effect on public health as more targeted preventive measures can be implemented earlier. However, there is still a lack of large-scale research into how these measures should be targeted and the effects they could have, says Rikard Landberg, professor of food and health at Chalmers University of Technology.

Text Karin Janson

**T**he research world used to talk more about “personalised nutrition”, or individual nutrition. This autumn, Chalmers University of Technology hosted a conference that gathered leading international researchers in the field of precision nutrition. What is the difference between these terms?

“The terms are often considered to be the same thing, but we want to regard precision nutrition as widening the concept of individual nutrition. In addition to individuals getting the right food at the right time, precision nutrition also involves providing the right conditions for better nutritional studies to more precisely measure what people eat and their health status,” explains Landberg.

**MEASURING RISK FACTORS** for diseases in different groups of people before they have developed a disease allows the construction of algorithms that can

predict the risk of disease at an early stage, such as by analysing data from the gut microbiome.

“For some diseases that have established diagnostic values for healthy or sick, it’s actually a question of a gradual change that starts early. You don’t just go from healthy to sick overnight. One of the aims of precision nutrition is to define these groups at an early stage and then use the correct preventive measures, so the disease never occurs,” says Landberg.

**ONE AREA** in which precision nutrition could be of great importance is how individuals can maintain their weight in the long term, after weight loss. There is great individual variation in the factors that explain why people put on weight again after losing it.

“A large study, with perhaps 600 to 1,000 participants is needed. They would

lose weight and then there would be a detailed study of what happens when and if they put the weight back on. What is their microbiome like? Blood sugar control, appetite regulation, behaviour? We would need to gather information about the factors that may be significant for weight gain, and then build models that can predict what leads to weight gain in different individuals.”

Despite its enormous potential, in terms of research, precision nutrition is in the start-up phase. One problem is that there have not been enough large intervention studies to be able to build the mathematical models necessary to adequately predict how individuals will react to specific foods. Another challenge is that when large studies are conducted, the data is attractive for companies that build patented solutions for the private market, instead of sharing data and solutions with researchers and healthcare services.

**THE NORDIC COUNTRIES** have an incredible potential for high-quality research in precision nutrition, says Landberg.

“We have good registries, good biobanks, dietary data and an infrastructure that provides excellent opportunities for large-scale intervention studies. It would be interesting to conduct a large study that can guide how a bespoke Nordic diet could be given to individuals to increase the preventive effects. ●



PHOTO: ANNA-LENA LUNDOVIST

**“In addition to individuals getting the right food at the right time, precision nutrition also involves providing the right conditions for better nutritional studies...”**

**Rikard Landberg**

Professor, Chalmers University of Technology

Reference: Palmnäs *et al.*, *Nutrients*, 2020

# PRECISION NUTRITION

*A new research study has shown a link between metabolites in the blood and the gut microbiota. This could open up ways for blood tests to replace faecal samples which, in the long term, may lead to more accurate dietary advice.*

Text Åsa Eckerrot, Karin Janson

## Blood tests reflect the gut microbiota

**O**ur gut flora (microbiota) produces many different metabolites. Some are transported into the blood, where they can affect health. Diet and medications also affect which metabolites are formed. Investigating and describing these connections is an important step on the way to increasing understanding of how the gut microbiota can affect our health.

“**IN ITSELF, GUT FLORA** is a complicated community and we have only just started to understand how the human world and bacterial communities affect each other. Our results show that there is a strong link between some gut bacteria and metabolites in the blood,” says Marju

Orho-Melander, professor of genetic epidemiology at Lund University, and one of the study's authors.

**IN THE STUDY**, blood samples and the gut microbiota of 8,583 people were analysed in detail. All participants were aged 50–64 and are part of the Swedish cardiopulmonary bioimage Study, Scapsis.

When the researchers analysed the participants' blood samples, they found an association between the gut microbiota and each individual's unique metabolome. The metabolome, or the metabolite profile, is the variety of hormones, molecules and enzymes at a particular time or situation, and is unique to

“We are currently working on a project to examine whether gut flora can be measured using a blood test instead of a faecal sample.”

**Tove Fall**  
Professor,  
Uppsala University





↗ Blood tests open up opportunities for individual dietary advice, says Tove Fall, professor of molecular epidemiology.

PHOTO: MIKAEL WALLERSTEDT

every individual. The metabolome determines how adaptable an individual's metabolism is in differing conditions.

Researchers believe that more than half (up to 58 per cent) of the variation in metabolites in the blood can be explained by the gut's microbiota.

**"WE ARE CURRENTLY** working on a project to examine whether the gut flora can be measured using a blood test instead of a faecal sample. Our preliminary analyses give promising results, but we need to continue working on it," says Tove Fall, professor of molecular epidemiology at Uppsala University, who coordinated the study along with researchers from Lund University.

The study also presents new correlations



PHOTO: PETER WESTRUP

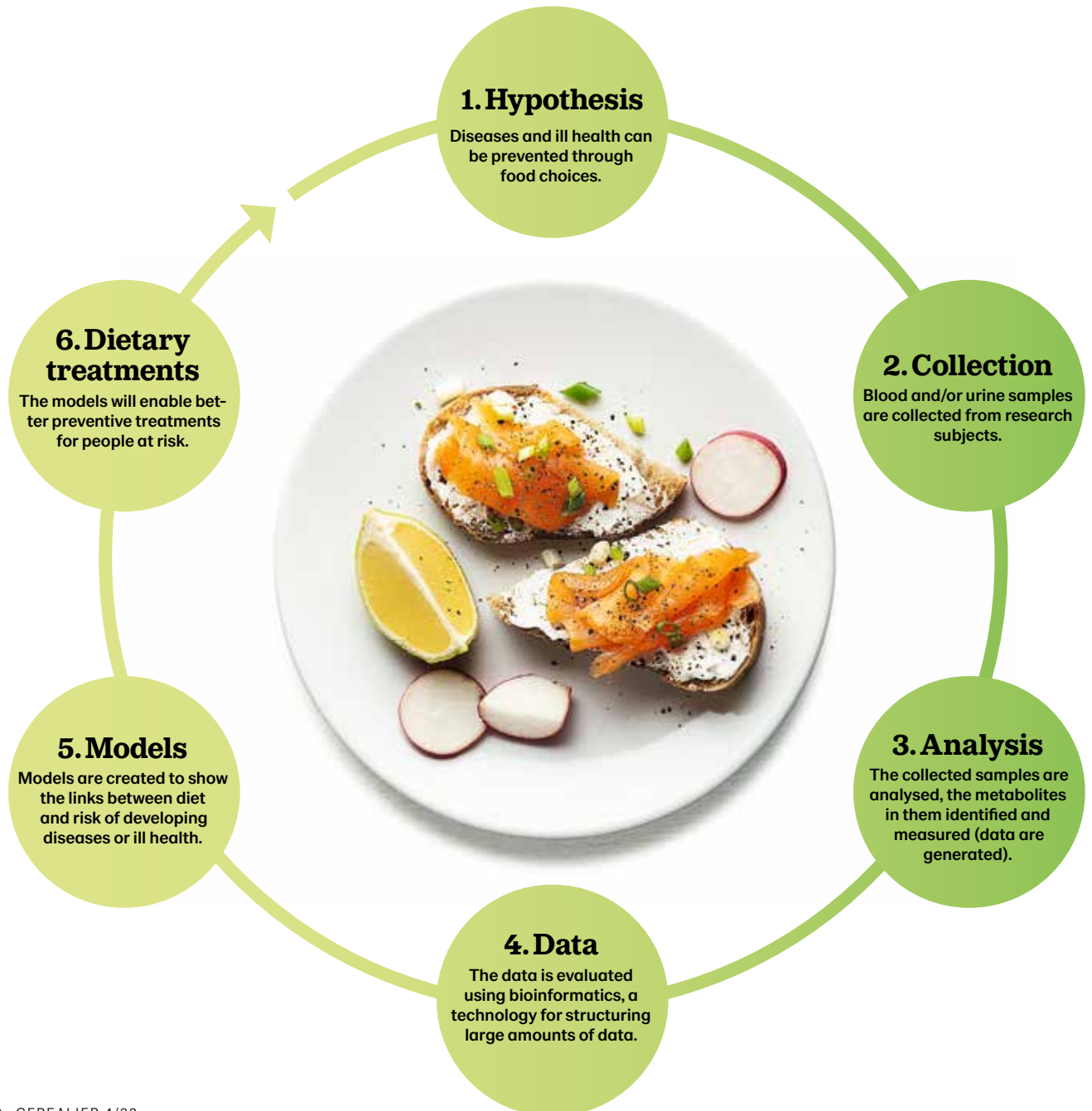
↑ Marju Orho-Melander, professor of genetic epidemiology at Lund University.

between different dietary types and medication, and the link to the gut microbiota and some microorganisms. The results may provide a basis for targeted studies of specific metabolites to identify biomarkers in blood plasma that influence the composition of gut flora. In turn, this could open up precision nutrition.

**"THERE ARE TWO** things we must understand first: which bacteria make us ill or healthy, and how we can affect these bacteria without causing damage. Once we know these things, there is exciting potential for treatments such as bespoke dietary advice," says Fall. ●

Reference: Dekkers *et al*, *Nature Communications*, 2022

# Metabolomics – a tool for





# bespoke dietary advice

*Predicting and preventing cardiovascular disease is one of the biggest challenges for healthcare – and for society. One factor is diet, and another is metabolism. Metabolomics can help make preventive dietary advice more accurate.* **Text Linda Swartz**

**T**raditional ways to measure what people have actually eaten are not always reliable, as they are often based on asking people about their eating habits, which has a risk of error. Metabolomics is thus a good complement and creates a more objective way of measuring food intake.

“Using metabolomics is like taking a snapshot of someone’s metabolic status. We can see whether they really have eaten a particular food by looking for specific metabolites in the blood or urine,” says nutritional researcher Clemens Wittenbecher.

**WITTENBECHER COMPLETED** a postdoc in Potsdam, at the German Institute of Human Nutrition, as well as at the Harvard School of Public Health, and is now working in the Division of Food and Nutrition Science at Chalmers University of Technology. His focus is examining how diet affects the risk of developing chronic disease, in particular type 2 diabetes and cardiovascular disease. The research includes observing how an individual’s metabolism adapts to different types of food – and the long-term health effects.

“It’s not just about what you eat, but how your diet interacts with you as a biological being,” says Wittenbecher. This is where metabolomics has come

to be a useful tool. It can be simply described as the identification and measurement of a broad spectrum of small molecules, metabolites, in blood or urine samples. The large amount of data obtained is analysed using advanced bioinformatics. The results can then provide clues to how diet can be linked to the long-term risk of disease. For example, there are biomarkers associated with the risk of developing cardiovascular disease.

**PRECISION NUTRITION** examines dietary biomarkers and risk markers for diseases that can be affected by diet. The markers can be used to design and evaluate dietary studies.

Wittenbecher says there is evidence that risk markers found using



PHOTO: MARTINA BUTORAC

**“It’s not just about what you eat, but how your diet interacts with you as a biological being.”**

**Clemens Wittenbecher**  
Assistant professor,  
Chalmers University of Technology

metabolomics may be better than the traditional markers, such as measuring LDL or HDL cholesterol and triglycerides. Researchers have used metabolomics to identify lipid molecules that may improve knowledge about the risk of cardiovascular disease.

“When we combine several metabolites, these are often stronger risk indicators, and more clearly linked to diet, than the traditional markers. This allows us to make more exact measurements of diet and targeted dietary interventions. However, I want to emphasise that metabolomics cannot replace traditional forms of assessment, but is an important supplement.”

**IN ONE CURRENT** research project, Wittenbecher and his colleagues analysed around 1,000 lipid metabolites and selected 45 biomarkers. These show the distribution of saturated and unsaturated fats people ate in a dietary intervention. The preliminary results show that the selected biomarkers have a strong correlation with the future risk of developing cardiovascular disease and type 2 diabetes, which could form a basis for more targeted dietary and lifestyle advice. Wittenbecher emphasises that this is not individually designed dietary advice, but that this advice can be given to large population groups.

“One of the main advantages of metabolomics is that it is possible to find objective biomarkers that indicate the risk of disease, and that the technology can be used to check the results of a dietary intervention. Biomarkers based on metabolomics can therefore be a valuable tool for preventing chronic disease through targeted dietary advice.” ●

# An entirely new arena for precision nutrition

To have new foods that are better adapted to individual digestive systems – this is the aim of Precision Nutrition Innovation Arena, PNI, at Örebro University.

“We are developing two technologies,” says Robert Brummer, professor of gastroenterology and clinical nutrition.

Text Karin Janson

**T**he new technologies will help industry develop new foods, ingredients and supplements that are tailor-made for different gut functions.

“The gut flora primarily differs in how it processes carbohydrates and proteins, depending on how your flora, the microbiota, is composed. This makes it impossible to draw general conclusions about what effect a food has,” says Brummer.

HE ALSO LEADS the PAN Sweden centre, which is working on producing new and healthy plant-based and protein-rich foods. The uptake of plant-based proteins in the small intestine is poorer than for animal proteins, so the plant proteins risk being fermented in the large intestine, possibly with negative health effects.

“Our aim is that these new technologies can also be used in the production of new plant-based product concepts within PAN Sweden, to see how the

proteins are absorbed in the small intestine and processed by the large intestine.

“Current methods for measuring what happens to gut microbiota are not very informative. The standard is a faecal sample, but what does that tell us? It most likely tells us something about what happened one and a half metres further up in the bowels, one to two days ago,” Brummer says.

PNI IS DEVELOPING a biosensor the size of a medicine capsule, that can be ingested. When it is swallowed, it can measure the digestion of proteins and carbohydrates as they travel through the gut. Brummer cannot reveal exactly how this is done due to a patent application.

“Imagine taking a measurement, changing your diet, and then measuring again to see whether there is any difference. This is an expensive method that is suitable for small-scale studies. We believe that companies can use the biosensor for food development and that it will also benefit patients.

## PNI

The Precision Nutrition Innovation Arena is run from Örebro University, in partnership with Chalmers University of Technology, Örebro healthcare region and industry (Lantmännen, Biogaia and Nutrileads). The project runs from 2021 to 2024 and has funding from Vinnova. The long-term aim is to permanently establish an innovation arena that focuses on precision nutrition.

The other device is a bespoke exhaled breath meter. This has more large-scale potential,” believes Brummer.

“Exhaled breath analysis has already been used in many studies, such as for measuring some inflammatory processes. Many of the metabolites produced by gut bacteria are volatile, in the form of gas. Very small amounts of them are found in exhaled breath. We can get a picture of activity in the large intestine by using various methods to measure them. Once we have the technology sorted, and more experience, we may be able to produce it more cheaply.”

ONE AREA IN WHICH the exhaled breath meter could be used is studying the effect of probiotics (beneficial bacteria).

“There are many different types of probiotics and it is difficult to know what type someone needs, and to measure their effect. But this could be possible with an exhaled breath analysis – taking a probiotic and conducting a new analysis a few weeks later,” says Brummer.

The plan is for the two prototypes to be ready for testing in about twelve months. Another important area within PNI is building mathematical models to interpret the results.

“Artificial intelligence, AI, has an important role to play. Both in the sensor technology, and in evaluating and aggregating the data we obtain from exhaled breath analyses to improve our methods,” he says. ●





Professor Robert Brummer leads the new arena for precision nutrition, PNI, at Örebro University.

*Plant-based meat substitutes often contain high levels of phytic acid which reduces iron absorption, according to a recent thesis by Cecilia Mayer Labba, who recently received a doctorate in food and nutrition science from Chalmers University of Technology. It also showed that plant-based products can contain high levels of salt and saturated fat. The solution may be plant breeding, using the right processing methods and targeted product development.* Text Karin Janson

**Bean meal**  
Per cent absorbed:



## Iron absorption an important

**F**ood contains two types of iron: haem iron and non-haem iron. Haem iron, which comprises about half the iron in meat, is more easily absorbed by the body. Non-haem iron, which is mainly found in vegetables, is often less readily available.

“Phytic acid, which is found in grains and legumes, forms insoluble bonds with non-haem iron and zinc, which means that iron and zinc can pass through the digestive system without being absorbed,” says Mayer Labba.

A STUDY OF the absorption of non-haem iron from one meal with meat, one with fish and one with fava beans showed that the bean meal led to the lowest absorption of iron, despite it containing

the most iron of the three. Absorption was measured using a whole-body counter – a chamber with a detector that senses radioactivity. A radioactive iron isotope was added to each meal in the study.

“We also took blood samples and could use these to calculate how much of the iron isotope was found in the body,” says Mayer Labba.

Only four per cent of the iron from the bean meal was absorbed according to the study (see illustration). Mayer Labba thus sees a need for stricter legal interpretations in nutritional declarations on foods.

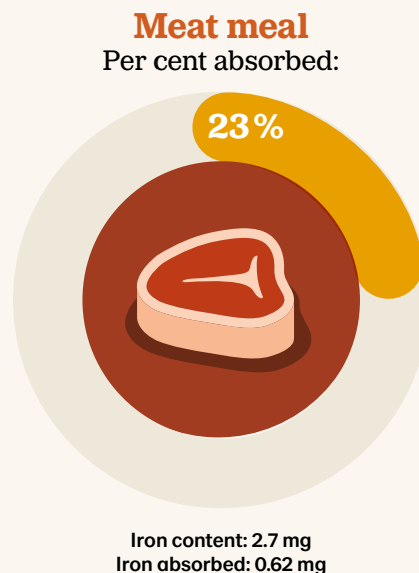
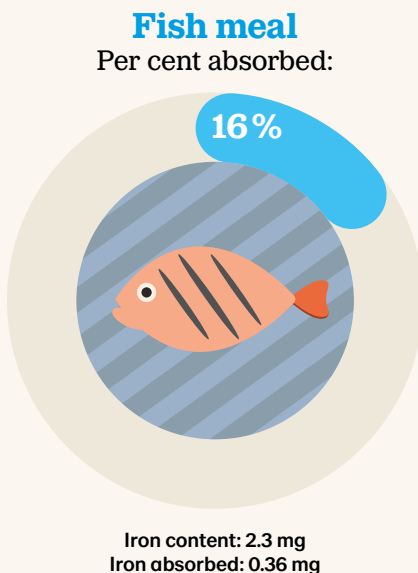
“Regulations state that a listed nutrient must be in a bioavailable form. If we were to interpret this more strictly and state how much of the iron is in a form that can be absorbed, it would be an

**“Around one in four women of childbearing age in Sweden has an iron deficiency.”**

**Cecilia Mayer Labba**  
PhD in food and nutrition science,  
Chalmers University  
of Technology

## IRON ABSORPTION

The study compared iron absorption in healthy women from meals containing textured fava beans, protein from fresh cod and meat protein. Two randomised human studies were completed during work on the thesis.



THE RECOMMENDED DAILY IRON INTAKE FOR WOMEN OF CHILDBEARING AGE IS 15MG, ACCORDING TO THE NORDIC NUTRITION RECOMMENDATIONS. PICTURE: ISTOCK

# factor in the green shift

incentive for the food industry to create products that not only have a high iron content, but in which the iron is also available.

**IN ANOTHER STUDY**, Mayer Labba showed that some plant-based products on the market can not only have high levels of phytic acid, but also high levels of salt and saturated fat.

“Salt and saturated fat are parameters that are fairly easy to change, while the absorption of zinc and iron is trickier. For example, fermentation under the right conditions could be considered, because the enzymes in grains and legumes can break down phytic acid during fermentation.

Another solution to increase the bioavailability of nutrients may be found in plant breeding. Mayer Labba analysed 15 varieties of fava bean and



PHOTO: MARTINA BUIORAC

↑ Cecilia Mayer Labba

found varying levels of phytic acid. Two varieties, Sunrise and Lynx, had a low level of phytic acid combined with a high iron content.

“Around one in four women of childbearing age in Sweden has an iron deficiency. Among girls in school year 8 and year 2 of upper secondary school, one in three shows signs of an iron deficiency, according to the Riksmaten Ungdom 2016–17 survey. Somewhat generalised, we can say that the groups that most need iron tend to mostly eat vegetarian food. To avoid iron deficiency becoming more widespread, we need better processing methods combined with plant breeding to promote varieties with good bioavailability,” says Mayer Labba. ●

Reference: Labba *et al.*, *Nutrients*, 2022





Supercritical CO<sub>2</sub> extraction is used to remove most of the fat from the oats before they are milled.

#### ACTIVE PART 4:

# Active evaluated as an ingredient and in meat substitutes

*This year we have followed the development of Active, a new oat variety, in Cerealier. We started with a look at the work of plant breeding and are ending the series with Active's use in foods. A Norwegian research institute, Nofima, is currently studying Active as a protein-rich ingredient for use in meat substitutes.*

Text Karin Janson

**N**ofima is the project owner for GreenPlantFood, a Norwegian research project that aims to promote the development of new plant-based and protein-rich foods from Nordic crops. Two important elements of this work are the implementation of new technologies for manufacturing plant-based ingredients and producing prototype foods.

Within GreenPlantFood, researchers Stefan Sahlstrøm and Svein Halvor Knutsen are conducting small-scale testing of Active.

"We have begun by dehulling the oats and making them into groats. We haven't heat-treated them, as this can destroy the protein. They were lovely large oat groats, and Active behaved as other oat varieties do, there was no difference," says Sahlstrøm.

**MOST OF THE FAT** in the oats needs to be removed to produce a protein concentrate, and this was done using supercritical CO<sub>2</sub> extraction. The oats were ground to a fine flour and wind sifted (air classified) to concentrate the proteins, as the starch and fibres are blown away. In trials, the protein level in the Active concentrate was 55 per cent, compared to around 40 per cent

for ordinary oat varieties. The size of the fraction was the same for Active as for the other varieties.

"We were surprised that the results were so good and that Active produced a concentrate with such a high level of protein," says Sahlstrøm.

**THE NEXT STAGE** is to combine the oat protein with pea and bean protein, and extrude the mixture to produce ingredients for meat substitutes. The aim is to develop a product prototype that will be analysed and evaluated by a sensory panel.

"Combining the protein from oats and legumes provides a good mix of amino acids, which is an important reason for combining plant proteins. However, we have not reached as far as deciding what type of product it will be," says Knutsen.

Detailed analyses of Active's beta-glucan content have not yet been performed. This fibre occurs naturally in

oats and, after air classification, most of the fibre is in the coarsest fraction, while the proteins are in the fine fraction.

"The coarse fraction, which contains starch, fibre and some protein can be used for other food products," says Knutsen.

Sahlstrøm emphasises that one aim of GreenPlantFood is to increase the use of domestic oats.

"Norway produces 300,000 tons of oats every year, but just ten per cent goes to food. Sweden produces more, but the food use is about the same. Oats have huge potential, so we are trying to create new oat products. There is currently a lot of research into how oats can be used in more foods, which is very positive.

**WHEN COULD FOOD** products containing Active be on the market? Christian Malmberg, project manager at Lantmännen R&D, predicts this will be 2024 or 2025 at the earliest.

"If we scale up cultivation, we can have greater volumes next year, so products in one or two product groups could be launched the following year. We also need time to build up the concepts for different products, develop them, do taste testing, and test how they are prepared. ●

#### ACTIVE

Active is a new variety of oats, developed by Lantmännen. It has high levels of beta-glucan fibre and high protein levels, so Active may have potential for producing ingredients rich in protein and beta-glucan.

## RECIPES

# Colourful Christmas porridges!

Many of us eat porridge all year round, but porridge has a special place in Swedish Christmas celebrations. Here are three recipes for when you want to give it that little extra.



PHOTO: ULRIKA EKBLÖM / SUNDKURS

## Porridge with banana and peanut butter

Serves: 4 Time: 5–10 minutes

A hearty porridge that can also be served as a light lunch. Combining classic oat porridge with rye flakes is both tasty and healthy.

- 200 ml rolled oats, preferably high fibre
- 200 ml rye flakes
- 800 ml water
- 1 tsp cardamom seeds, crushed
- ½ tsp salt
- 2 bananas, peeled and sliced
- 2 tbsp unsweetened good-quality peanut butter
- 200 ml blueberries

### To serve

Skimmed milk or plant-based alternative

### INSTRUCTIONS

1. Combine oats, rye, water, cardamom seeds and salt in a saucepan.
2. Add the sliced banana and simmer for 5–6 minutes on a low heat, stirring continuously.
3. Serve with a dollop of peanut butter and lots of blueberries, as well as milk or a plant-based alternative. ●

## Beetroot porridge

Serves: 4 Time: 10 minutes

Beetroot makes this porridge beautifully sweet and red. Add matching dark berries for a real antioxidant boost.

- 300 ml high-fibre rolled oats
- 600 ml water
- 1 pinch of salt
- 2 fresh dates, pitted and cut into small pieces
- 2 fresh beetroots, peeled and coarsely grated

### To serve

- 200 ml frozen blackberries
- 200 ml frozen blackcurrants
- Flaked almonds

### INSTRUCTIONS

1. Combine oats, water, and salt in a saucepan.
2. Add the dates. Simmer for about three minutes, stirring constantly.
3. Stir in the grated beetroots. Simmer for another minute.
4. Serve with berries and flaked almonds, and your choice of milk if you wish. ●

**Tips!** You can use other berries if you want, such as blueberries and raspberries. They can be frozen, as they defrost in the porridge and add that little extra to your breakfast.

## Overnight oats with saffron

Serves: 1 Time: 5 minutes + overnight

A seasonal recipe for overnight oats, just as tasty for breakfast as for dessert!

- 100 ml rolled oats
- 100 ml oat drink
- 100 ml yoghurt
- 0.1 packet of saffron

### Suggested toppings

- Raisins
- Coconut flakes or fresh raspberries

### INSTRUCTIONS

1. Combine all the ingredients and place in a bowl. Leave to soak in the fridge overnight.
2. Top with raisins and coconut flakes or raspberries, and serve! ●



PHOTO: SANDRA GUNNARSSON / AXA





➤ Beetroot porridge.  
The recipe for this porridge  
and the banana and peanut  
butter porridge come from  
[www.sundkurs.se](http://www.sundkurs.se).

PHOTO: ULRICA EKBLÖM / SUNDKURS

# Research funding for the development of new foods

*Two recently started Danish research projects, PROFERMENT and SEEDFOOD, funded by the Novo Nordisk fund, aim to develop methods for producing new plant-based foods.*

Text Åsa Eckerrot

**A**ccording to a report from the UN's Food and Agriculture Organisation, the world will need around 50 per cent more food by 2050 to feed everyone. Around one-third of farmable land is now being used to grow animal feed. Increasing the amount of food we eat and reducing meat consumption would, theoretically, make it possible to feed another 4 billion people, while also fighting climate change.

## PROFERMENT

The project uses the solid-state fermentation method to develop new foods. In brief, this process allows selected microorganisms to grow on and between a substrate, such as oats or yellow peas. The fermentation process increases the proteins' digestibility and quality, while legumes and grains both gain improved structure and flavour.

Combining *Bacillus* bacteria with different types of moulds in this fermentation process provides the researchers with information about the proteins' digestibility, the quality of various plant-based foods and how to create varied structures.

"Depending on the ingredients that are used, and how the fermented product is then processed, it is not unrealistic that digestibility could increase by at least 10 per cent," says Professor Dennis Sandris Nielsen from the University of Copenhagen, who is leading the project.

## SEEDFOOD

In Europe, huge amounts of rapeseed are grown and processed into rapeseed oil. When the rapeseed is pressed to extract the oil, it leaves a protein-rich cake that is currently used as animal feed. If the protein in the press cake were used to feed humans, it



▶ Rapeseed is the basis for the rapeseed press cake that could be a future food.

**"If the protein in the cake were used to feed humans, it could provide enough protein for 700 million people."**

could provide enough protein for 700 million people.

However, before this protein can be used in food, the press cake needs to be processed so that any unwanted flavours disappear," says Professor Marianne Nissen Lund from the University of Copenhagen, who is leading the project.

"The protein-rich press cake contains phenols and other substances that can have a bitter taste, but by using methods such as gentle filtering and enzyme treatment, we hope we can remove these unwanted tastes."

The researchers also hope they can use knowledge about how proteins and other molecules interact to tailor make other desirable properties for products. The project's results will be presented on an ongoing basis and also shared with industry, so they can benefit from the research. ●

Read more: [www.food.ku.dk/english/](http://www.food.ku.dk/english/)





PHOTO: HELENA HOLMKRANTZ / HK BILD&TEXT

↑ A current research project is trying to extract lignocellulose from straw.

## Agricultural materials in future bioplastics

Future green materials is one of Lantmännen Research Foundation's focus areas. One example of a large initiative is the FibRe competence centre, where Lantmännen is a primary stakeholder.

**Annelie Moldin** Lantmännen R&D

**T**he FibRe competence centre brings together a large number of research projects with the shared goal of finding ways to replace fossil-based plastic with bioplastic. The competence centre, which is funded by Vinnova, is a cooperation between Chalmers and KTH Royal Institute of Technology. Its vision is to create mouldable, thermoplastic biobased plastics that can replace fossil-based plastics. Research is built around two groups of materials from agriculture and forestry, and a special fibre, lignocellulose, which can be extracted from materials in both groups.

FibRe integrates the entire value chain, from research via material

suppliers and industry to the final user. Some of the industry partners are Lantmännen, Tetra Pak and Stora Enso. While Stora Enso focuses on forest materials, the focus from Lantmännen is materials from agriculture, such as straw.

**THE RESEARCH PROJECT** covers a broad area and is divided into three themes – molecular modification, characterisation and processing. Materials from forestry and agriculture have somewhat different qualities. Forestry already has a stream with lignin while, for example, lignin from straw is not currently available. One aim is thus to find a process that can extract lignocellulose from agricultural materials and then develop a bioplastic with as little modification of the raw

### LIGNOCELLULOSE

Lignocellulose is a collective name for a mixture of the dietary fibre components, lignin and cellulose. Woody plants and grasses largely consist of lignocellulose.

material as possible. A doctoral student at KTH will try to use their research to develop an efficient process for isolating lignocellulose from straw and comparing it with the equivalent process in wood.

**LANTMÄNNEN IS A** major consumer of plastic, with everything from agricultural stretch wrap to food packaging. Compiling knowledge and expertise about lignocellulose and its potential uses is thus an investment in the future. Lantmännen is an agricultural supplier, with a plastic strategy and a commitment to replace virgin fossil-based plastic with recycled and renewable materials by 2030.

Being able to replace all fossil-based plastics with bioplastics is still the subject of lively discussion. The most challenging factor is producing bioplastic that fulfils the hygiene requirements for food packaging.

The project has two years to go before the research is evaluated and the areas that will continue to a second iteration (providing funding is available) are decided. ●



## NEWS FROM LANTMÄNNEN RESEARCH FOUNDATION



PHOTO: PETER VAHLERSVIK / ISTOCK

# Recently granted projects



### Carbon storage

Generally, knowledge about carbon storage in agricultural land is low.

Finnish researchers will now study the carbon and greenhouse gas balance in cultivated soil and evaluate the effects of different farming methods.

Work will be conducted in both theory and practice. ●



### Unlocking bran

Wheat bran has many valuable components, but they are often strongly bound.

Researchers at KTH Royal Institute of Technology, Sweden, recently started a project to study structures and chemical interactions between components in wheat bran, aiming to extract selected ones more efficiently. ●



### Managing rancidity

Oats have a high level of unsaturated fat, so the fat easily turns rancid when making food or ingredients.

Researchers at Lund University, Sweden, will now study where oxidation and lipolysis occur, and then evaluate how processes can be developed to control the quality of end products. ●

## About the research foundation

Lantmännen Research Foundation supports research in the entire chain, from field to fork. It grants up to SEK 25 million to research annually, focusing on three areas:

- Agriculture and machinery
- Bioenergy and green materials
- Food and health

The goals of this research funding include increased agricultural production with minimised

environmental impact, and establishing how agriculture can contribute to the development of a biobased society. In the area of food, we want to increase knowledge of grains and legumes as a natural element of sustainable future food.

The foundation holds an open call every autumn, starting in September. See: [www.lantmannen.com/researchfoundation](http://www.lantmannen.com/researchfoundation)  
Applications are assessed on their newsworthiness, scientific

quality and business potential. Decisions are announced in December. ●

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