

A close-up photograph of a horse's hoof, showing the hoof wall and the frog. Two overlapping white circles are superimposed on the image, with the text 'Leading in animal sciences' centered within them.

Leading in animal sciences



WAGENINGEN
UNIVERSITY & RESEARCH



Department of Animal Sciences, Wageningen University & Research:
Leading in animal sciences based on scientific excellence in biology, ecology and zootechnology

Introduction

The attention for animals has never been greater. On the one hand, that attention is focused on the role of animals in food production: from issues surrounding protein security to concerns about diligence and environmental pressures of livestock farming and infection risks for humans and animals. On the other hand, there is also a great interest in animals themselves, from pet animals to animals in nature. People love and experience pleasure from animals and feel obliged to offer good and responsible care to them. Animals are fascinating and appealing and they inspire us to achieve technical innovations based on forms and functions that have arisen in the animal kingdom.

The Department of Animal Sciences of Wageningen University & Research focuses on the development of knowledge of the functioning of animals on all levels of fundamental biological knowledge and integration in order to answer the growing need for knowledge about animals. From questions about realising healthy, safe and sustainable animal production and products to questions about the use of animals in research and about supporting the health and welfare of animals in domesticated settings as well as in a healthy, biodiverse environment.


This booklet presents a number of appealing examples of our research and shows the diversity and impact of the research of the Department of Animal Sciences.



The chickens in the innovative Kipster barn get food made from leftovers.

Towards a circular food system

Livestock can play a key role in feeding the growing world population in a sustainable way. A diet with a moderate amount of animal-source food could free up about one quarter of our global arable land. Animals in such a circular food system would not consume human-edible biomass, such as grains, but mainly convert leftovers from arable land, and grass resources into valuable food. Leftovers include crop residues, co-products from industrial food processing, and losses and waste in the food system. The quality and quantity of leftovers and grass resources available for livestock determine the amount of animal-source food that can be produced. To what extent grasslands can be used for ruminant production, however, is still questionable. A large proportion of available grassland was previously covered by forest and to reach biodiversity or carbon targets it is probable that grazing would need to cease on some of this grassland. Research within the Animal Production Systems group lays the scientific foundation under this so-called narrative of circular food systems. In the Netherlands, this circular food systems approach is increasingly acknowledged in industry and governmental policy.

A photograph of a large, light-colored sow pig lying on a bed of straw. Several small, pink piglets are huddled around her, some resting and others standing. The background is a wooden wall. A green text box is overlaid on the left side of the image.

Weaning gives stress. In pig farming, piglets are removed from the sow at weaning, and solid feed is presented to them. The young piglets miss their mother, their familiar pen and they also have to get used to the new feed. As a result, too many piglets in the first days after weaning do not eat, lose weight and get diarrhoea.

Monkey see monkey do - also for piglets

Researchers from the Adaptation Physiology group looked at the role of the sow when learning piglets, among other things, eating solid feed. Their main conclusion: piglets want the same food as the sow.

When the mother of the pig is nearby, piglets are willing to try new food faster and eat more of it. Another important factor in the feed intake of piglets was the environment in which the piglets grew up. Piglets from an enriched pen where straw, wood shavings and interesting objects such as branches are provided are also more likely to sample unknown food.

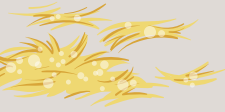
The results of this study are already used to facilitate the transition at weaning. Eating together with the sow is facilitated in a newly developed group housing system for lactating sows and their piglets. Animal feed companies are applying the results of the research by adding the same flavour to sow feed and piglet feed.



Straw is rigid and not easy to digest



We add fungi



The straw becomes less rigid and breaks down



We cover up the straw before mushrooms emerge



The cow absorbs much more nutrients from this straw

Wheat straw: + 50%
Wood chips: + 150%

Food security

Fungi turn straw into easily digestible animal feed

In many developing countries animals are fed with waste and by products that are poorly digestible, such as straw. Straw contains a lot of lignin that gives crops their stiff woody structure. Researchers from Animal Nutrition developed a ground-breaking method in collaboration with colleagues from Plant Breeding to break down lignin. In doing so, they use certain fungi, such as the oyster mushroom and shiitake, which can degrade lignin. After the fungi treatment low-grade biomass such as straw is much easier to digest by ruminants and therefore suitable as animal feed. After the fungi have done their work, the product can be stored anaerobically for a long time if it is properly covered. Good for the environment and economically very interesting. Also because low-value biomass is available in almost unlimited quantities.

This project was realised through the Wageningen University Fund thanks to donations from three philanthropic partners. Soon the first trials will take place on a semi-commercial scale in Indonesia and Vietnam. Interest has also been shown from China, Iran and Thailand.



Food security

Chickens for Africa

In Africa, chicken production is important in nearly all poor rural smallholder households. Families keep chickens to produce meat and eggs for home consumption and they are a source of income. But the productivity of those chickens is often low.

The Animal Breeding & Genomics group plays a prominent role in the large-scale African Chicken Genetic Gains (ACGG) program, which is coordinated by the International Livestock Research Institute (ILRI) and is funded from the Bill & Melinda Gates Foundation. The aim of ACGG is to improve the delivery of better adapted chickens to support poverty reduction, productivity growth, increased household animal protein intake, and the empowerment of women farmers in rural communities.

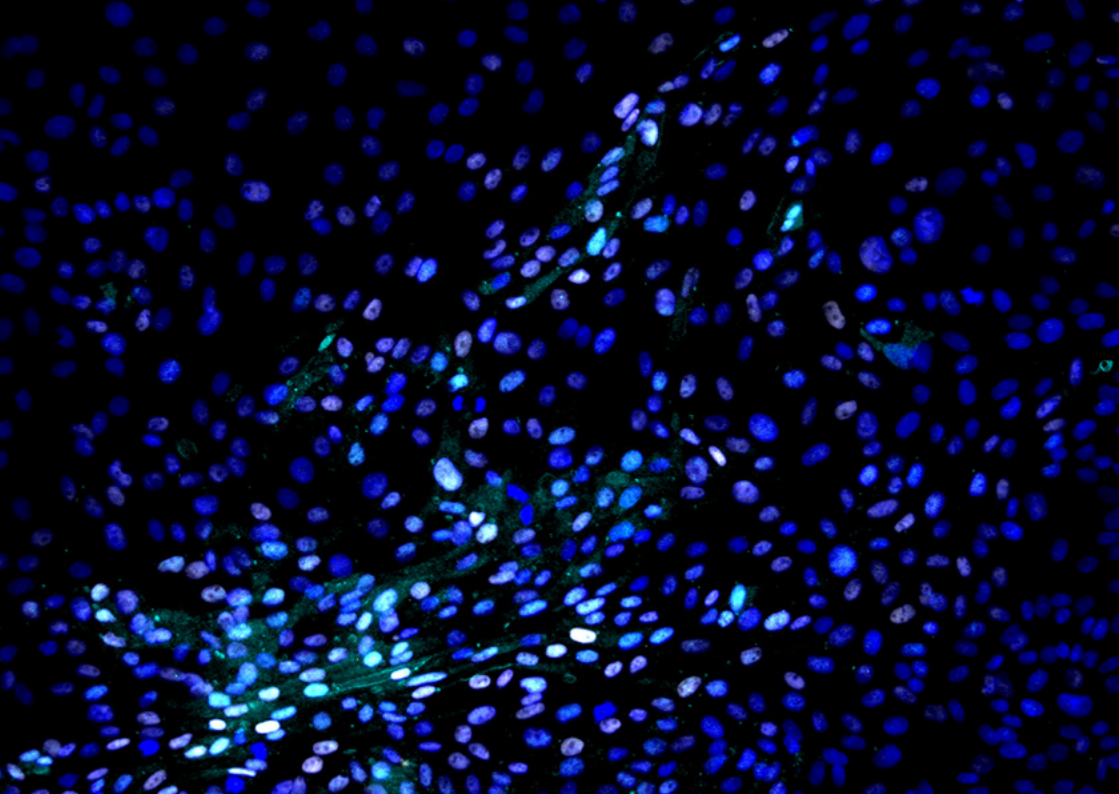
In the program, which will continue until 2019, several different breeds of chickens from India and Africa were tested for their high-production potential under low-input systems in three target countries – Ethiopia, Nigeria, Tanzania. On-farm testing was combined with community-level farmer innovation platforms that engage women to co-create solutions.



What are the best strategies to combat Avian influenza?

Avian influenza and especially highly pathogenic avian influenza (HPAI) is of great concern to society. Not only does HPAI cause large outbreaks in poultry with high mortality, thus having a major impact on economies and food security, it is also a zoonotic treat. Avian influenza is controlled in the economically better-off countries by killing all birds on infected premises. In other countries control is often attempted by vaccination.

The research of Quantitative Veterinary Epidemiology focuses on the quantification of transmission. The research showed that the strategy of killing all birds on infected premises fails when the local density of chicken farms is too high. Vaccination when tested in experiments does reduce transmission sufficiently to eradicate the infection. However, in the countries that are vaccinating it seems that vaccination does not work to stop transmission. QVE research has shown that the low vaccine response in the field causes the failure of the vaccine. Follow-up research focuses on the question whether it is possible to vaccinate in the field with sufficient response.




Animal and public health

Organoids: one of the most promising advances in life sciences

Organoids - laboratory-grown, functional organ-like structures derived from stem cells - provide us with an excellent system to improve our understanding of complex genotype-phenotype relationships. It provides a powerful tool to study complex phenotypes by dissecting them into better defined molecular phenotypes, amenable to high throughput, cost-effective, large- scale phenotyping.

Organoids derived from stem cells from individual animals or humans are considered one of the most promising recent advances in life science. Host-Microbe Interactomics is a leading group in this field. The group exploited novel developments in the area of stem cell research for mice and humans and developed methods for generating organoids from pigs, chicken and bovines that closely mimic the physiology of specific tissues.

These advanced stem-cell models are being used to generate biological data on intestinal functions relevant to resistance to infection, host-microbe interactions, homeostasis and feed efficiency.



Aquaculture provides about half of the fish for human consumption worldwide. The demand for fish is rising, but fisheries are not expected to grow due to fully or over-exploited fish stocks. Aquaculture production seeks to meet this increasing demand for fish.

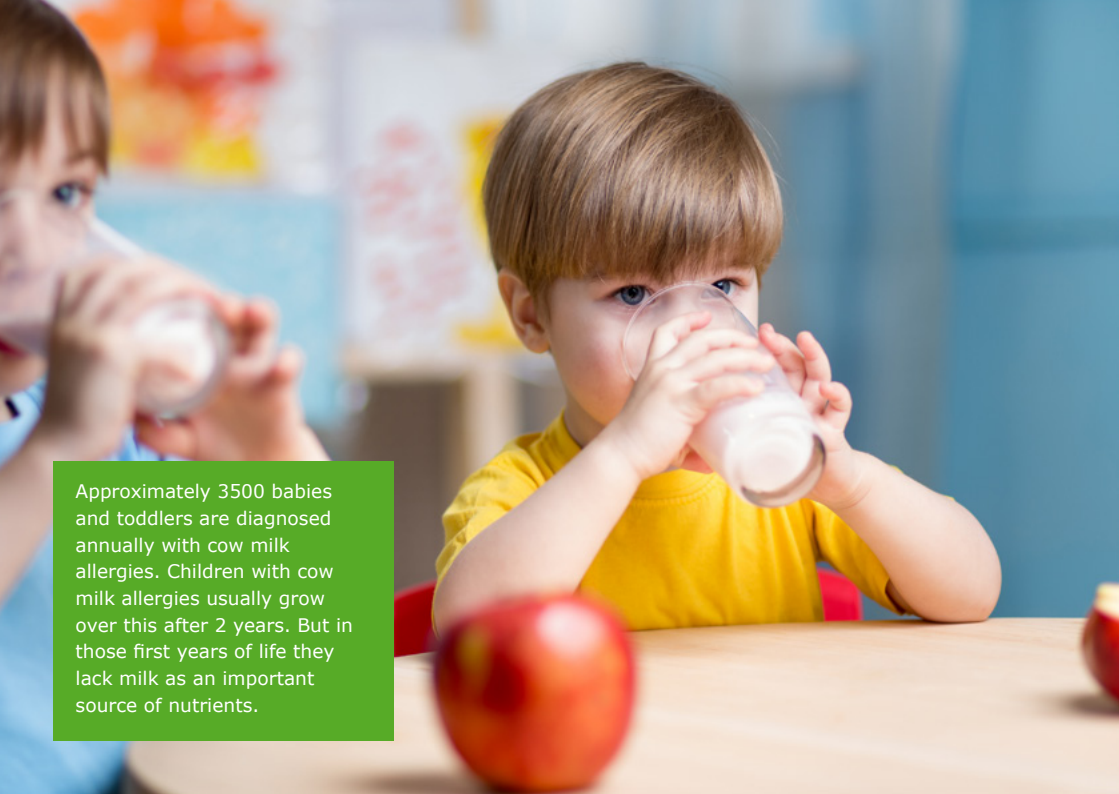
Sustainable food production

A boost for collaboration within the European aquaculture research sector

European aquaculture is a knowledge intensive sector facing challenges in many areas among which sustainable feed production, animal health and welfare, integration with environment, technology and systems, biological lifecycle, product quality and human safety.

This knowledge is being developed in many places in Europe, but was fragmented. The Aquaculture & Fisheries group plays a prominent role in the large EU-funded project AQUAEXCEL (Aquaculture infrastructures for excellence in European fish research). Within this project, major steps have been taken to integrate, on a European scale, key aquaculture research infrastructures.

The AQUAEXCEL consortium developed, analysed and disseminated best practices on a variety of pertinent issues for the aquaculture industry, for example guidelines for sanitary issues linked to fish transport between infrastructures, for measuring and accurately defining traits and phenotypes, and for developing traits and environmental conditions ontologies.


A photograph of two young children sitting at a light-colored wooden table. The child in the foreground, a toddler with short brown hair and blue eyes, is wearing a yellow t-shirt and is drinking from a clear glass filled with white milk. Another child, partially visible on the left, is also drinking from a similar glass. In the foreground, slightly out of focus, are two red apples on the table. The background is a blurred indoor setting with colorful elements, possibly a play area or classroom.

Approximately 3500 babies and toddlers are diagnosed annually with cow milk allergies. Children with cow milk allergies usually grow over this after 2 years. But in those first years of life they lack milk as an important source of nutrients.

Combating cow's milk allergy

The Cell Biology & Immunology group (CBI) plays a prominent role in a major collaborative project in which scientists, doctors and a producer of dairy products have jointly developed a product that allows children to grow faster over a cow's milk allergy. It is a powder with cow's milk proteins that have been heated in a protocol-like manner so that they do not cause a noticeable allergic reaction. These heated proteins can allow the immune system to become accustomed to cow's milk protein unnoticed, as a result of which the child will tolerate cow's milk earlier.

In this project CBI unravels the mechanism of action how modification of so called CM proteins through processing affects immunogenicity and allergenicity. The results of this research are of great interest for patients, food companies and companies that produce therapeutic or diagnostics products.



The adhesive pads on the fingers of tree frogs form inspiration for soft grippers used in operations in the human body.

Bio-inspired design solutions for human health

Female parasitic wasps lay their eggs in larvae of other insects that are often hidden in plants, trees or underground. In order to reach these larvae, wasps have a long flexible needle-like tube (the ovipositor) that they can direct in various materials with the muscles in their abdomen.

Researchers from the Experimental Zoology group recorded how the wasps lay their eggs in various transparent gels using high-speed cameras. They published their findings in 2017 in the journal Proceedings of the National Academy of Sciences (PNAS). The results are used to design advanced controllable needles for medical applications together with TU Delft.

The research group Experimental Zoology studies through reverse engineering these smart mechanisms and strategies in animals to then translate them into designs of new surgical instruments. For example, the soft adhesive pads on the fingers of tree frogs with which they can attach themselves to wet surfaces form inspiration for soft grippers that can be used in operations in the human body.



Fit aging

Getting older often involves increasing muscle weakness, loss of muscle mass and fatigue. At the same time, we also see a reduction in the amount of carnitine in the muscles. Carnitine plays an important role in the transport of fatty acids to the mitochondria, the energy factories of the cell. Our body can produce carnitine itself, but we also obtain carnitine through our diet, especially via meat and dairy.

Why elderly people have a lower carnitine status and how aging of muscles takes place is still unknown. This is being investigated in the Fitaal study that researchers from the Human and Animal Physiology group play an important role in.

A group of over-75s in Leeuwarden has been studied to gain insight into the differences between vital and vulnerable elderly people. Among other things the carnitine level in the muscle was determined via a biopsy. In addition, measurements were taken in young adults who serve as the healthy reference. The study gives us more insight into the aging process and helps to find biomarkers to detect at an early stage when older people become more vulnerable.



Nature restoration

Restoring coral reefs in Kenya

Coral reefs are under pressure throughout the world due to climate change, overexploitation and other causes such as dynamite fishing.

The Marine Animal Ecology group is building and restoring coral reefs off the coast of Kenya together with the REEFolution foundation and local communities. After the Great Barrier Reef in Australia, the coastal reefs of Kenya are part of the second longest barrier reef in the world, stretching along the East African coast from Somalia to northern Mozambique.

At various locations in the sea, various types of coral are cultivated by a team of scientists, students and local fishermen. In addition to optimizing the coral breeding process, they are also working on new ways to structurally improve coral reef productivity in developing countries. This is how a revolutionary bridge is created between the fishermen on the one hand and nature conservationists and diving tourism on the other. The aim is not only to restore the reefs, but also to secure the most important income sources of coastal inhabitants in coral reef areas - fishing and tourism - in the longer term, in Kenya and elsewhere in the world.



Just like humans, animals of the same species often form a society in which individuals have specific relations to each other. And just like humans, animals are sending signals to others, attracting or rejecting them.

Understanding animal societies

The Behavioural Ecology group shows how animal societies function by mapping social and communication networks. This provides fundamental understanding on how animals with different personalities are connected to each other, on how they affect their social environment and are in turn affected by their social environment. The research also provides examples of how disturbance of social signals, via signal degradation or environmental noise, affects the information that is available in a communication network.

The understanding of direct and indirect relationships between animals can be profitably applied by wildlife managers and conservationists. For example, to preserve natural social groups of animals, to ensure that protected habitats are sufficiently large and non-fragmented and to make good decisions when re-introducing species into habitats from which they have disappeared.

These insights also can be applied to husbandry systems where animals are kept in large groups and where social interactions need to be determined to understand and improve animal welfare and prevent spread of unwanted behaviour.



Research Facility Carus

Carus (Latin for 'caring') is the name of the research facility of the Department of Animal Sciences. The primary focus of Carus is to assist researchers and students in conducting animal research in accordance with the highest scientific, humane, and ethical principles.

The objectives of Carus are upheld through the development and maintenance of a comprehensive, high quality animal care and housing facility, where the welfare of animals is the main priority. Carus is suitable for fundamental research, is small-scaled and high-tech, operates within a specialized research-orientated segment of the market and is thus unique. The facility provides high-tech research equipment such as climate respiration chambers, high speed cameras and adaptable rooms, as well as providing accommodation for a wide range of animals (from fish to companion animals to cows).

Research at Carus is conducted in the fields of sustainable animal husbandry, behaviour and welfare, biology and aquaculture. At Carus students get acquainted with different animal species within themes such as reproduction, adaptation, nutrition and mindful husbandry.

Photo's

Shutterstock: 6, 10, 12, 16, 18, 20, 22, 24, 26

Marte Hofsteenge: 2

Hilko Ellen: 4

Host-Microbe Interactomics: 14

Carus: 28



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To explore
the potential
of nature to
improve the
quality of **life**
