University of Zurich[UZH]

vetsuisse-faculty

ACCREDITED BY EAEVE/FVE

Vetsuisse Report

2020

A multiwell plate containing substances that can facilitate the spread of pathogens, and that are used to determine the health of animals, humans, and the environment.
From left to right and top to bottom:
air, soil with sprout
urine, water
manure, blood

The Vetsuisse Faculty

Cover Story

Digital Teaching

One Health – Research Highlights

Our Services

Investments in the Future

Prof. Dr. Dr. h.c.
Roger Stephan

Dean & Head of the Institute for
Food Safety and Hygiene

Dean’s Welcome

I am delighted to introduce this first edition of our Vetsuisse Faculty Report, which, going forward, will be published every two years. The report is replete with inspiring stories of animal patients and staff, teachers and students, the challenges we all faced, and the goals we will strive for in the future.

What does good teaching look like in the face of the SARS-CoV-2-virus pandemic? What is the ‘One Health’ approach, one of the three core research areas of the faculty, and why is it so important (page 12)? How do our collaborative research activities in the ‘One Health’ field help to address zoonotic diseases (page 22), and other pressing health issues like antimicrobial resistance (page 28), the prevention and treatment of cancer (page 30), and many all-too-common metabolic diseases (page 24) — in animal and human patients alike? And not least, how can veterinarians, physicians and researchers further intensify their joint efforts to improve the health of humans, animals and our living environment?

Here, we share our approaches to these pressing questions with highlights of our endeavours in veterinary care, research, academic career development, teaching, and more.

Have a look and enjoy reading!

After a challenging year in 2020, I would like to extend my gratitude to the faculty, staff and students for all the efforts!

I am looking forward to the new challenges in 2021.

Very best wishes,

Roger Stephan

Dean & Head of the Institute for Food Safety and Hygiene

Our Organisation

Department for Small Animals

- Clinic for Small Animal Internal Medicine
- Clinic for Small Animal Surgery
- Clinic for Zoo Animals, Exotic Pets and Wildlife
- Division of Radiation Therapy and Oncology
- Division of Emergency Medicine and Intensive Care

Department for Farm Animals

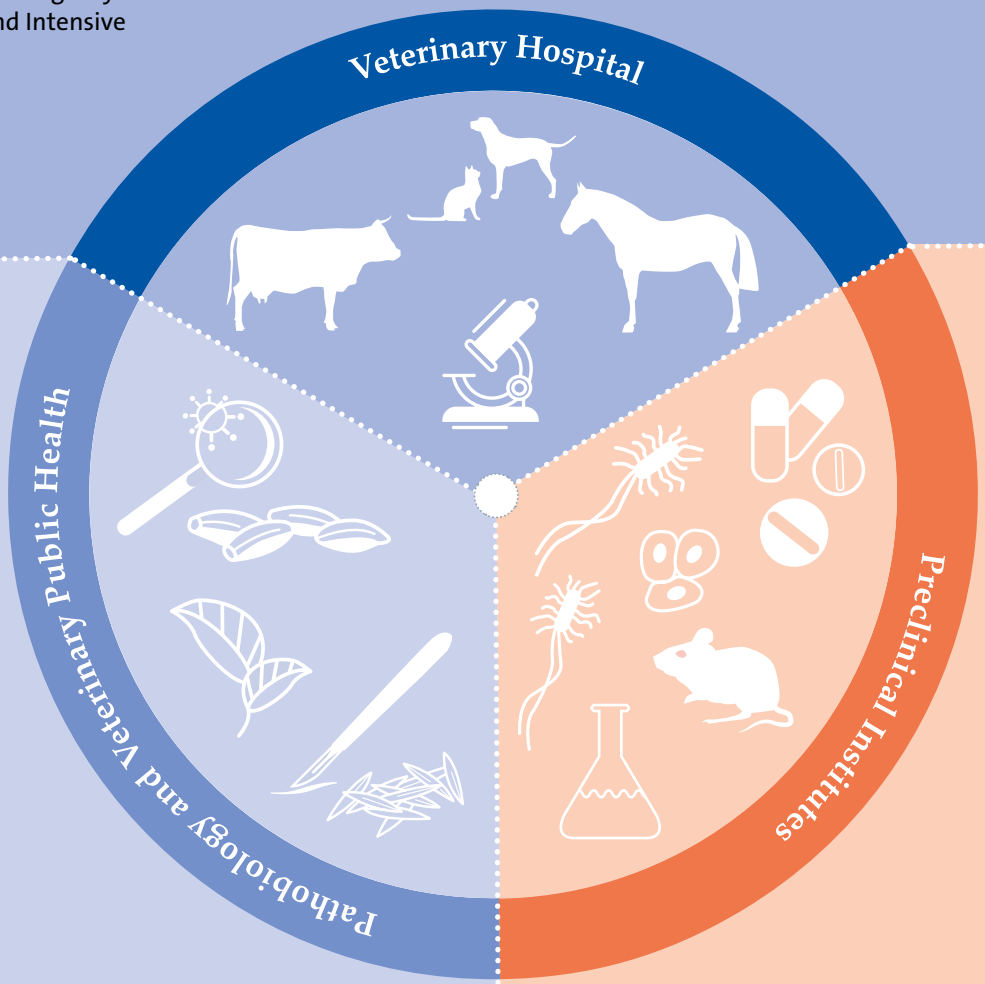
- Clinic for Farm Animals
- Clinic of Reproductive Medicine
- Division of Ambulatory Service and Herd Health
- Division of Pig Medicine

Equine Department

- Clinic for Equine Surgery
- Clinic for Equine Medicine
- Division of Opthalmology
- Division of Equine Performance

Department of Clinical Diagnostics & Services

- Pharmacy
- Laboratory Medicine
- Devision of Anaesthesiology
- Clinic for Diagnostic Imaging

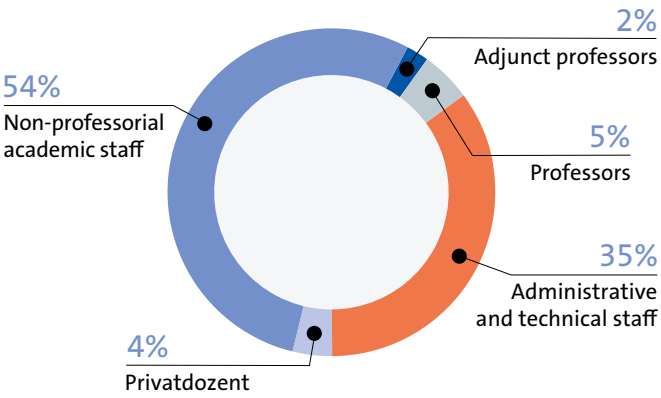


- Intitute for Food Safety and Hygiene
  - Section of Poultry and Rabbit Diseases
  - Section of Veterinary Bacteriology
- Institute of Parasitology
- Institute of Veterinary Pathology
- Institute of Virology
- Institute of Animal Nutrition
- Section of Veterinary Epidemiology

- Intitute of Veterinary Anatomy
- Department of Molecular Mechanisms of Disease
  - Muscular Skelletal Research Unit
  - Center for Applied Biotechnology and Molecular Medicine
- Institute of Veterinary Physiology
- Institute of Veterinary Pharmacology and Toxicology
- Institute of Veterinary Pharmacology
- Institute of Laboratory Animals

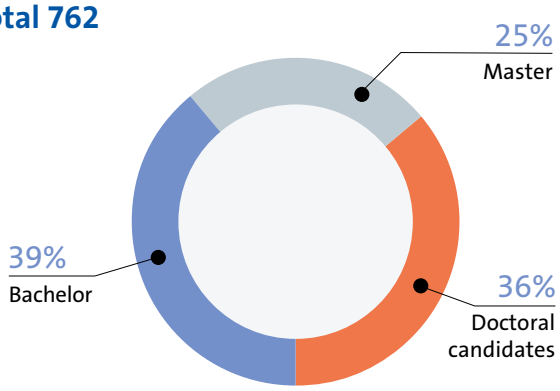
Employees per 31.12.2020

Total 842

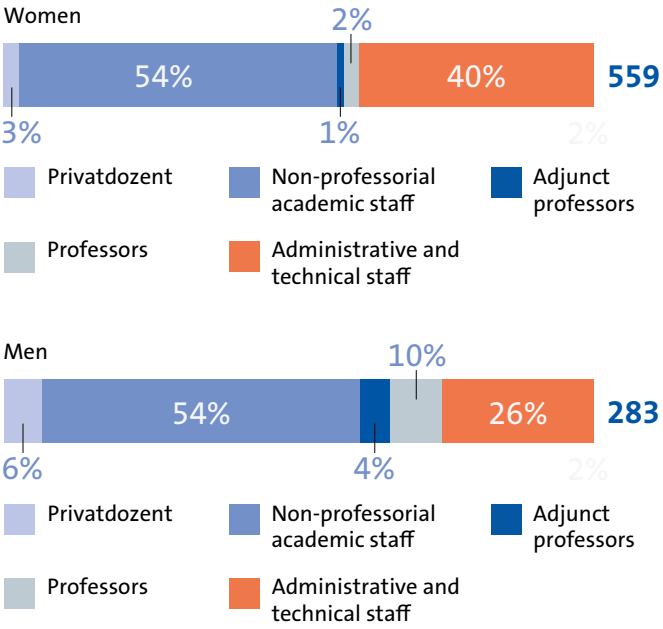


Students

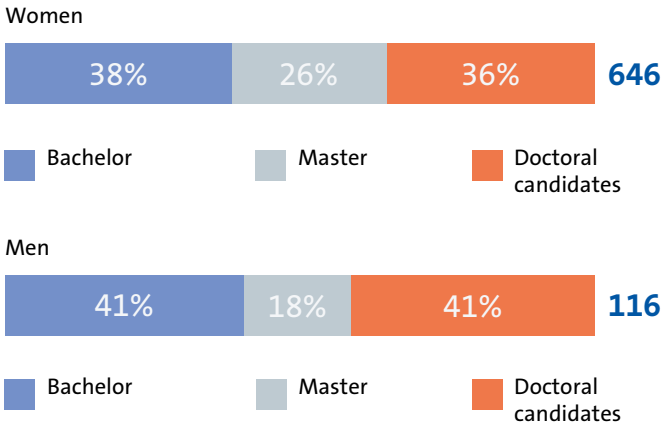
Total 762



Number of employees according to gender



Number of students according to gender



Appointed professors 2020

Nicole Borel
Associate professor for Infection Pathology

Regina Hofmann-Lehmann
Full professor *ad personam* for Laboratory Medicine

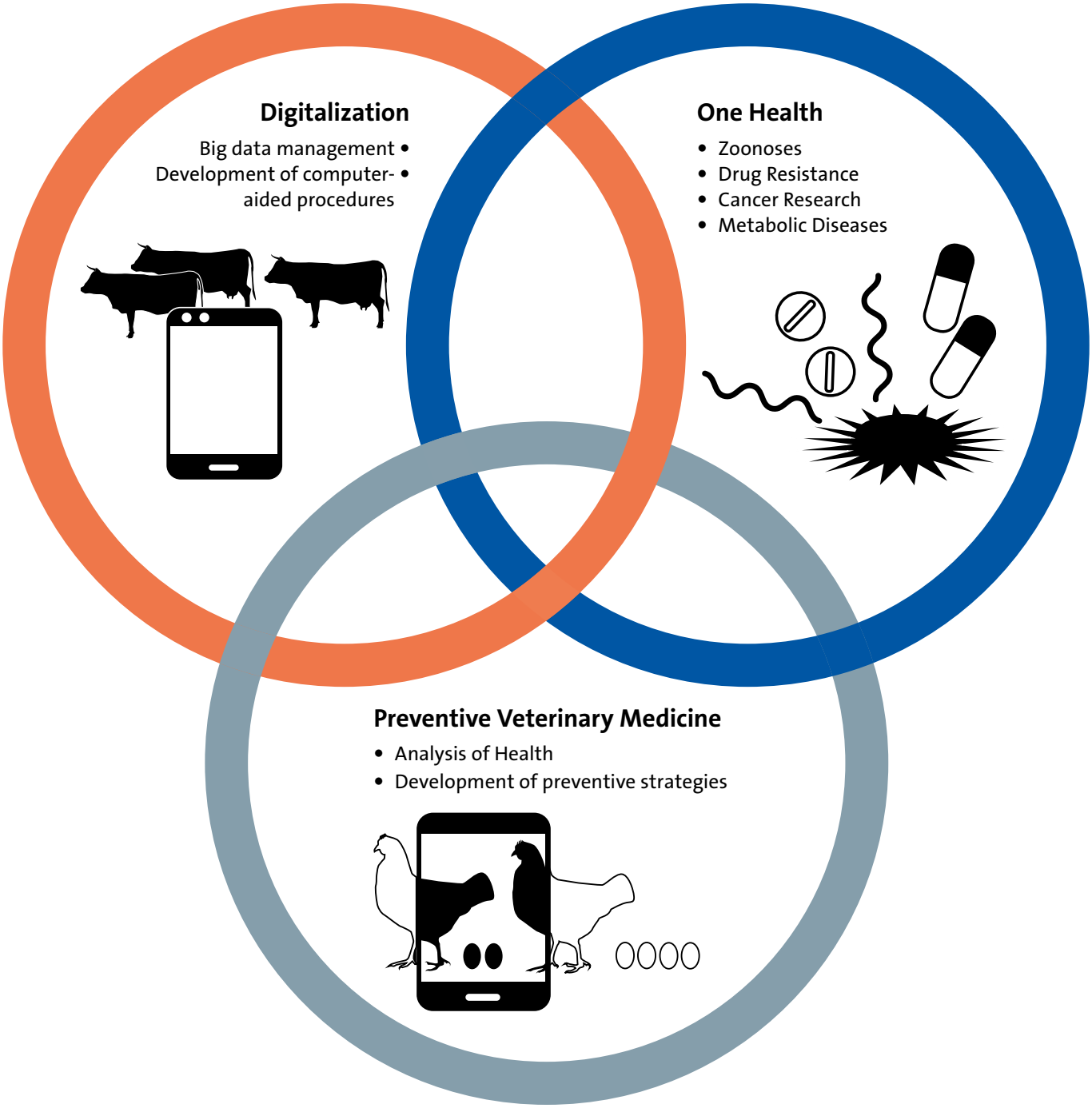
Christian Gerspach
Associate professor for Internal Medicine of ruminants

Frank Steffen
Associate professor *ad personam* for Neurology

Mariusz Pawel Kowalewski
Associate professor for Veterinary Anatomy, Histology and Embryology

Matthias Altmeyer
Associate professor *ad personam* for Quantitative Cellular Biology

Core research areas of the faculty



Click here for more information about the core research area

Cover Story – One Health

Digital Teaching

One Health – Research Highlights

Petri dishes with cultures of antibiotic resistant bacteria | 9 cm

Hygiene mask | 17,5 cm

Farm animals, pets, the water cylce and the food chain — all of this is connected and provides pathways for pathogens to jump between these different domains.

One World, One Health: How science needs to connect the health of humans, animals and environment

Many health issues are common to both humans and animals, and both domains are influenced by social and environmental factors. For this reason, 'One Health' is one of the foundations for research at the Vetsuisse Faculty. Whether for the fight against zoonotic diseases, antibiotic resistances, cancer, or diabetes, the 'One Health' approach calls for experts of different medical and scientific sectors to work together.

In 2017, scientists at the Robert Koch Institute in Berlin collected and examined pathogenic bacteria that lurked on door handles in airports — the portals to our fastest and most favourite way to travel. In total, 400 door handles in 136 airports in 59 different countries were analysed. The results were alarming: The scientists not only encountered numerous pathogenic strains, but many of them were resistant to vital antibiotics; some even carried resistances to multiple antimicrobial drugs. And like people and goods, the resistant pathogens are travelling. A multidrug-resistant bacterial strain found in Paris, for instance, had its origins in far India.

The spread of antibiotic resistance has long been a pressing public health issue. "Because of our intensified mobility and globalised lifestyle, infections and resistant pathogens spread extremely fast," says Roger Stephan, dean of the Vetsuisse Faculty. "This development makes the 'One Health' approach even more crucial."

Lately, 'One Health' has become a major theme in health protection and research. "'One Health' denotes a holistic approach, in which experts from different scientific sectors work together to address health issues that cannot be solved by each sector alone," Stephan explains. Primarily, 'One Health' calls on professionals in veterinary and human medicine to work together, since the health of animals and humans is closely connected. For instance, the formation and spread of antimicrobial resistance is facilitated by the excessive use of antibiotics in human medicine as well as in animal breeding and medicine. Thus, the application of these drugs in either domain, human or animal, has consequences for both. Furthermore, insights from sectors like the environmental and social sciences are important, as the health of humans and animals is often influenced by the same lifestyle or environmental factors.

One Health to fight zoonotic diseases

The connection between human and animal health is perhaps most obvious in zoonotic diseases such as the SARS-CoV-2 virus responsible for the current pandemic, the Middle East Respiratory Syndrome Coronavirus (MERS-CoV), swine flu and bird flu. In fact, 60 percent of all human pathogens originate from animal populations, and on average, five new human diseases are discovered each year. "This makes veterinary medicine a key player not only in the health of animals, but also in human health and the entire 'One Health' concept," Stephan points out.

Pathogens can be transmitted to humans in several ways: They can pass directly from an infected host, for instance through a bite from a rabid animal; they can pass from a smear infection in direct contact — from an animal in a petting zoo, for example; and they can pass through ingestion of contaminated meat or dairy products. However, pathogens can also transmit indirectly from animal populations to humans, as was most likely the case with the SARS-CoV-2 virus that we now know originated in a bat population and was transmitted to humans via an intermediate host, possibly a pangolin. Other common vectors, meaning intermediate transmitters of pathogens, include insects such as mosquitos. The Asian tiger mosquito, for example, can carry a variety of dangerous viruses like the West Nile virus, which mostly infects birds but can also infect mammals like squirrels, horses or humans.

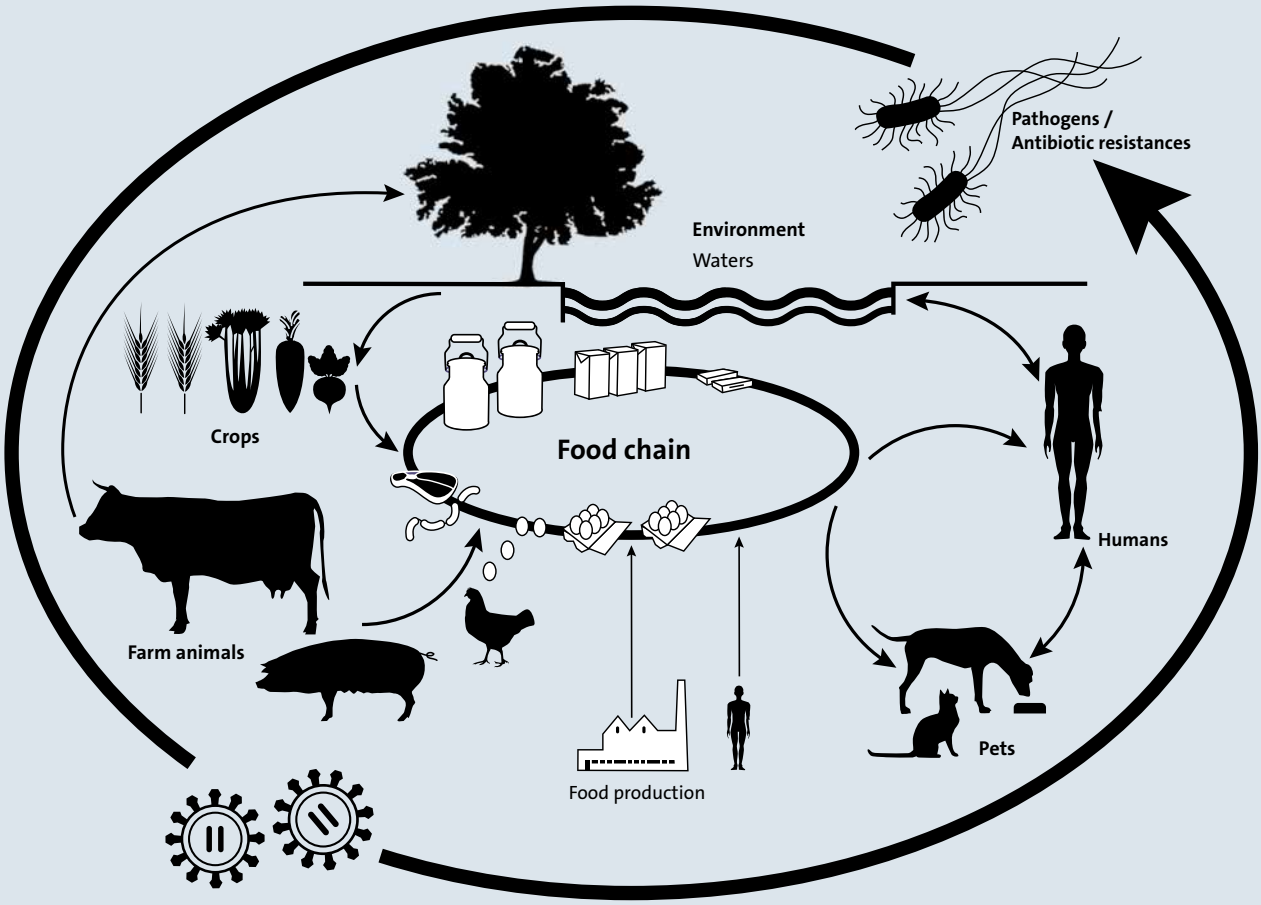
"Veterinary medicine is a key player not only in the health of animals, but also in human health and the 'One Health' concept."

Roger Stephan, dean of the Vetsuisse Faculty and head of the Institute for Food Safety and Hygiene

Zoonotic coronaviruses

The last three major global epidemics were all caused by coronaviruses. In 2003, SARS-CoV-1 caused the first outbreak of Severe Acute Respiratory Syndrome (SARS), soon followed by a Middle Eastern variant (MERS) and now by SARS-coronavirus 2, which causes COVID-19. The first two of these originated in bats and were passed on to an intermediate host, which for MERS was the camel and for SARS, the civet cat. The current pandemic may also have originated in a bat and spread to humans via an intermediate host, possibly a pangolin.

How pathogens and antibiotic resistances circulate between different domains – animals, humans, and the environment



Due to climate warming, these mosquitos have migrated north during the last decade, like to the south of Switzerland. In the spirit of 'One Health', researchers at the Vetsuisse Faculty are helping to identify and analyse pathogens carried by this new mosquito population (see article on zoonosis research, page 22). "If we want to prevent outbreaks of indirectly transmitted diseases like West Nile fever, we must monitor the mosquitos as well as infected animals and humans in a joint and coordinated way," Stephan points out.

Not a brand-new idea

While the 'One Health' approach has been promoted by the World Health Organisation (WHO), particularly in the last five years, the importance of close collaboration between veterinary and human medicine was recognised much earlier. Back at the end of the nineteenth century, the German pathologist Rudolf Virchow said, "There is no scientific barrier between veterinary and human medicine, nor should there be one. The experiences in the one must be used in research and development of the other." At the time, outbreaks of bovine tuberculosis in central Europe were a major concern, and the disease's pathogenic agent, Mycobacterium bovis, was being transferred to humans who drank the raw milk of infected animals.

Thanks to the work of scientists like Virchow, the disease has all but disappeared from central Europe now. However, every cow slaughtered in Switzerland is still tested for tuberculosis, and with good reason: As recently as 2013, a diseased cattle population was once again discovered. This time, the disease had been transferred to the animals from a human patient — zoonotic transmission can go both ways, of course.

The collaborative approach between veterinary and human medicine that Virchow supported was finally termed 'One Medicine' by the US veterinary epidemiologist Calvin Schwabe some 40 years ago. Later, as research increasingly revealed that social and environmental factors play a big role in health protection as well, 'One Medicine' became the holistic 'One Health'.

Microbial resistances also travel in water

When it comes to the spread of antibiotic resistances, the aquatic environment was shown to play a crucial role.

"Water bodies like lakes and rivers are abound with bacteria and favour the frequent exchange of resistance mechanisms between bacteria strains," says Stephan, and certain societal measures are not helping. Recently, for instance, it became clear that our sewage plants are accumulating antimicrobial resistant bacteria. Through the water cycle, resistant bacteria can then enter the food chains of animals and humans through crop irrigation (see article on antibiotic resistance, page 28). "Unfortunately, this exchange of antimicrobial resistances from waters into the food chain was neglected for a long time," he points out.

A total of 60 percent of all human pathogens originate from animal populations.

Aside from being a veterinarian, Stephan also trained as a food safety specialist — he is both the dean of the Vetsuisse Faculty and head of the University of Zurich Institute for Food Safety and Hygiene. He emphasises that not only can antibiotic resistances move between humans, animals, the food chain and the environment, but our globalised lifestyle also accelerates their dispersion. For example, a new multi-resistant variant of a bacterium that causes Pneumonia in humans, a *Klebsiella pneumoniae* variant that obtains its resistance from the production of the enzyme carbapenemase NDM-9, was first discovered in India but found in sewage water in Basel, Switzerland — just one month later. "No matter where in the world a certain resistance first develops, it will spread around the globe alarmingly quickly," says Stephan.

A unified effort is needed

"In order to spot potentially dangerous pathogens and disease outbreaks as quickly as possible, we need to monitor changes in humans, animals and the environment jointly and in a harmonized way," the scientist explains. In his opinion, this requires coordinated and harmonized scientific approaches, data collection and data sharing between clinicians and researchers across the human, animal and environmental domains. Only then can new trends, like new infection spreads or mutations, be identified and chains of infections be followed and counteracted effectively.

This holistic approach is reflected in the various Vetsuisse institutes' designations as Switzerland's national reference laboratories for specific pathogens in animals, the food-chain and humans alike — for instance for *Listeria monocytogenes* or Chlamydia. In the case of ovine chlamydiosis, which humans can acquire from infected sheep or goats, the Vetsuisse Institute of Veterinary Pathology has also been designated as the international reference lab by the World Organisation for Animal Health.

Fighting cancer and diabetes

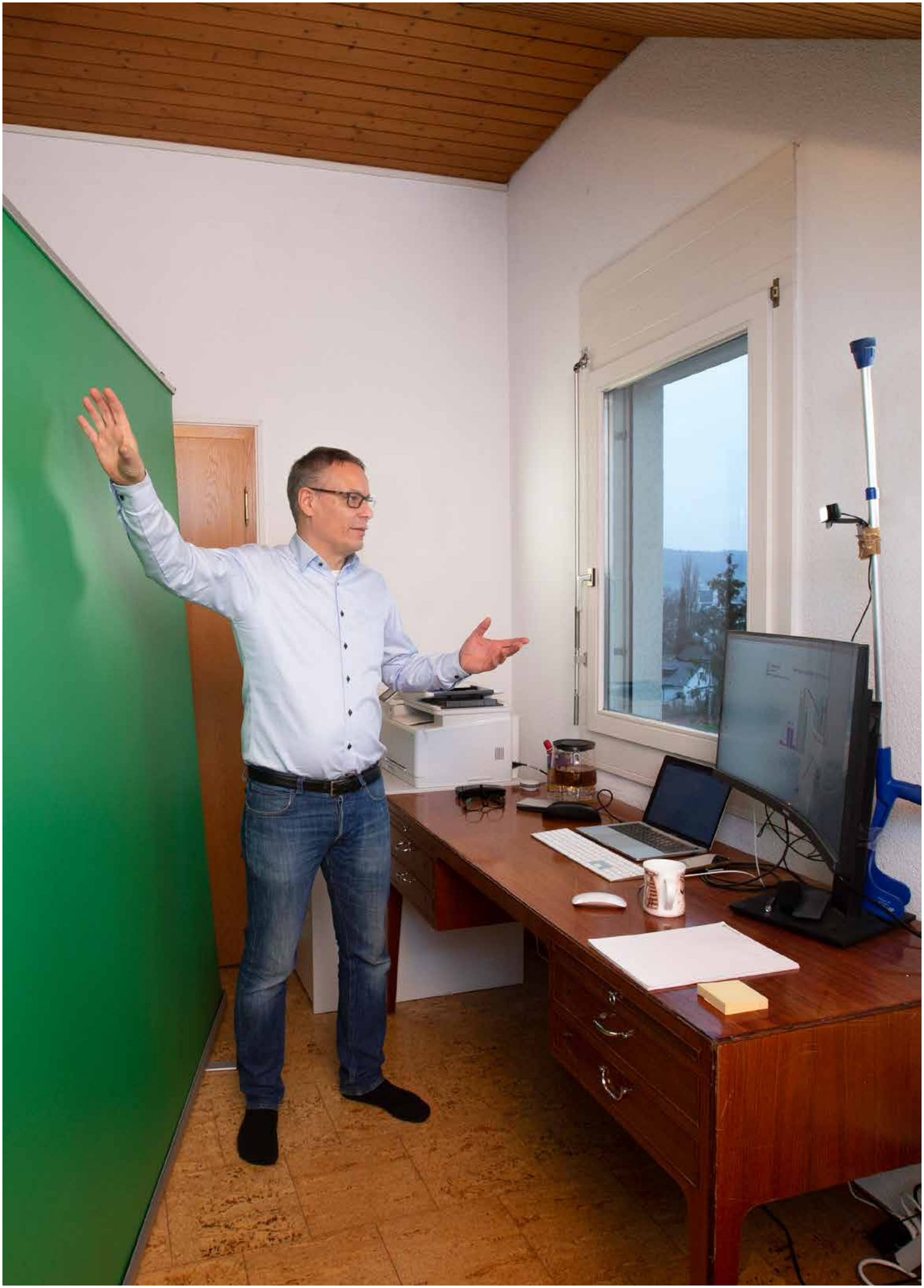
It is not only infectious diseases can benefit from the 'One Health' approach. Along with zoonosis and antibiotic resistance, Vetsuisse researchers also focus on cancer and metabolic diseases like diabetes (see articles on pages 24 and 30). As in humans, metabolic diseases are amongst the most common health issues in pets and farm animals, and they share many similarities with the respective human diseases. They have similar biological causes which are, in turn, influenced by the same lifestyle factors — like nutritional habits and obesity — or environmental factors when it comes to certain cancers. "That's why the translation of research findings from animals to humans and vice versa has the potential to elucidate the specific causes for diseases and to improve prevention and therapy for people and animals alike," says Stephan.

For instance, drugs used to treat human diabetes patients can also help diabetic cats to get better, or dietary test runs with dogs can reveal information about the metabolism of fatty nutrition components that is useful for the prevention of metabolic diseases in both dogs and humans. "It is important to note that in such 'One Health' driven knowledge transfers, the animal patients are not used in the same way as classical animal testing," Stephan stresses. The veterinary research first aims to benefit the health of pets and farm animals and, in the process, ideally yields insights for human medicine as well.

"No matter where in the world a certain resistance first occurs — it will spread around the globe alarmingly quickly."

Roger Stephan, dean of the Vetsuisse Faculty and head of the Institute for Food Safety and Hygiene

"To make to most of the collaborating effort, veterinarians, physicians and environmental scientists should bundle their information, for example by inputting it into joint databases," suggests Stephan. He refers to a database in which Vetsuisse researchers started to bundle data about tumours in Swiss dogs. If such a database also contained data of human cancers, commonalities and trends could be better recognized, like regional environmental risk factors for instance. "In the future, we should make an effort to intensify such collaborations," advocates Stephan, "in order to further improve health protection of animals and humans."



Teaching in times of COVID-19: Thorsten Buch instructs his students about laboratoy animal science using a green screen – almost as if he were in the lecture hall.

"The pandemic was a challenge, but it also spurred new developments"

As Vice Dean of Studies at the Vetsuisse Faculty, Thomas Lutz led the shift to digital teaching that was necessary due to the COVID-19 pandemic. At the same time, he is overseeing the full revision of the Vetsuisse curriculum. In an interview, he speaks about the challenges faced, the changes that were necessary, and the outcome for students and faculty.

Dr. Thomas A. Lutz
Professor for Veterinary Physiology and
Vice Dean of Studies

Thomas Lutz, the impact of the COVID-19 pandemic on teaching must have been massive. What changed?
The daily life of teachers and students changed completely. While some practical trainings were still held on site under safety precautions, all other classes were shifted to a videoconference platform. The instructors held classes from home or from their campus offices, and the students attended virtually from home.

How hard was this transition to digital teaching?
In the end, things went smoother than I expected. Of course, a lot of quick faculty council meetings were necessary to make the required decisions. But since keeping a strict distance between people was unconditionally required, at this point, there was no room for concerns about digital teaching like there had been before.

What kind of concerns had been raised?
We had discussed some forms of digital teaching, such as taping the lectures and providing them as podcasts for the students. However, members of the teaching staff feared that students would then attend classes less frequently, that lectures would become public, and instructors would lose control over their contents. Instead, through the pandemic, we developed a tremendous potential in digital teaching. Instructors procured green screens and got creative in establishing new teaching formats.

Such as?
Videos, for instance, are being used a lot to illustrate examination exercises or clinical cases. We had been recording rare clinical cases from the teaching hospital for instructive purposes before, but now this has become much more common. Digital teaching has also facilitated wider use of student surveys. These surveys can be used to measure students' previous knowledge of a subject or to check learning progress.

Will you go on to use these kinds of digital formats after the pandemic?
I expect so, yes. In many ways, the pandemic helped us to see the benefits of digital teaching. At the same time, we had the opportunity to learn about potential disadvantages, like the missing personal contact. Before COVID-19, instructors and students would meet and talk rather frequently, in the cafeteria for instance. This exchange is being missed now, by teachers and students alike. Also, remote exams were difficult to adapt. From the technical point of view, there is no issue, as exams can easily be held digitally with students located at multiple sites. But with students writing exams from home, there was a lot of concern that they were not being assessed under equal conditions. This is something we could not yet solve to our satisfaction.

In addition to dealing with COVID-19, you are currently revising the entire Vetsuisse curriculum. Why was this necessary?
We wanted to address some suggestions made by the European Association of Establishments for Veterinary Education (EAEVE), the organisation that accredits our curriculum. For one, the new curriculum will extend the studies from 5 to 5,5 years, which will provide the students with prolonged clinical training and a dedicated time frame for their master thesis. Also, students will receive more practical training in their first years than before. Content-wise, we increased the focus on certain fields, like herd health management, and on communication and digital media skills. This is not to say that the current curriculum didn't already provide an excellent education, but it was just time to think it through afresh.

This sounds like an incredibly large task.
Yes, it is, such a process takes years and involves a lot of people — mainly the teaching commission, but we also invited clinicians and students to contribute. What helped was that we kept some basic thematic blocks and focal points intact and rearranged the new and altered parts around them.

When will the new curriculum be applied?
The rough planning is all finished and ratified by the official organs. Now, the fine-tuning of teaching modules and schedules remains to be done. The new curriculum will be launched in the fall semester 2021.

Selection of body fluid samples | 21 cm

A sample of the common liver fluke, a parasite that infects mammals, including humans | 5 cm

Skull of a rabbit | 8 cm long

Blood sample of a dog patient | 8.5 cm

The danger of zoonoses and the human-environmental impact

Our interactions with wild animals, livestock, and pets are opportunities for diseases to spread from species to another. The SARS-CoV-2 pandemic is only the latest example of how close proximity between humans and animals, along with environmental conditions shaped by human lifestyles, create potentially dangerous conditions for the transmission of viruses or other pathogens.

For virologist Cornel Fraefel, 2020 was a busy year. With the coronavirus pandemic offering first-hand evidence of the dangers of zoonotic respiratory diseases, he and other members of the UZH Institute of Virology were in high demand as media commentators — at the same time that their research became more urgent. In fact, Fraefel himself only recovered from a mild case of COVID-19 in January 2021.

About a year before the pandemic began, Fraefel's team founded the Environmental Virology Group to study how changing external conditions affect the evolution and transmission pathways of pathogens in host animals. Specifically, they looked at the virome, or the totality of virus genetic material present, in animal hosts like bats and wild boars, both of which are so-called disease reservoirs where viruses naturally reproduce. In 2019, the team also went to Ticino to collect mosquitos, known transmitters of disease, to compile their virome and assess the zoonotic risk.

Invasive and native species

Nearly all specimens collected during daylight were Asian tiger mosquitos. Native to Southeast Asia, the species has recently established itself north of the Alps, like in Ticino, favoured due to the effects of climate change. These mosquitos can transmit many dangerous human diseases such as dengue fever, Zika virus, or West Nile virus. "We determined that the mosquitos harbour hundreds of different viruses," Fraefel says, though none were dangerous to humans.

However, native species can transmit diseases, too. Virome analyses on wild boars showed that, depending on the geographical region, up to 30 percent carried the Hepatitis-E virus, one of the most common causes of acute liver disease in humans. A similar study of Swiss bats revealed a range of viruses from 39 different families, including coronaviruses. "Wild animals need space," says Fraefel. "If we constantly invade their space, we will pick up new and potentially dangerous viruses."

Listeria monocytogenes: A chilling threat

One third of all Swiss households include animals, and interactions between humans and animals are close and frequent even in Switzerland's growing urban centers. Humans can contract diseases directly from livestock and companion animals, as well as indirectly through the food chain. And it's not only viruses that pose a risk — bacteria, parasites, or prions can also be dangerous.

"The human impact on the environment and wildlife needs to be reduced, and virus research should no longer be neglected."

Cornel Fraefel, head of the Institute of Virology, Vetsuisse Faculty

Dr. Taurai Tasara heads a research group at the Institute for Food Safety and Hygiene. His work focuses on *Listeria monocytogenes* and its impact on food safety and public health. This bacterium causes listeriosis, which can result in meningitis, encephalitis, sepsis, neonatal infection, and other human diseases. Tasara studies the response of Listeria to environmental stress, in particular to hygiene and preservation measures, and found that it is very tough. Through a sequence of molecular adaptive response mechanisms, Listeria often manages to survive food hygiene measures including salt, acid, detergents, and refrigeration. It can even continue growing in very low-temperature environments. "Listeria can turn every space into a niche where they can live," Tasara points out. "And unfortunately, we are sometimes helping them to prepare to face whatever they will encounter in the human body through some of the food preservation measures we apply." Until about 40 years ago, *Listeria monocytogenes* was primarily an animal infection issue. The implications for humans were only understood after a listeriosis outbreak in Canada was traced to cabbage contaminated with sheep manure. As such, it is a typical example of a disease that crossed the boundary from animals to humans in an agricultural setting.

Chlamydia: A promiscuous pathogen

Like Listeria, the Chlamydia genus of bacteria is not choosy when it comes to its host. It is best known for causing a sexually transmitted infection in humans, but this pathogen includes species that can affect sheep, goats,

Bildautor: Stefan Eichholzer, Stiftung Wildnispark Zürich

Wild boar like this female living in a wildlife park near Zurich are a reservoir of potentially dangerous viruses. They are monitored by Vetsuisse researchers.

cattle, horses, chickens, pigs, and pets such as parrots or guinea pigs. Nicole Borel, professor of veterinary pathology, studies the chlamydial organisms in animals, including recently discovered species that may be dangerous to humans. "At the moment in human medicine, it's all about COVID-19," she says, "but there are many different other pathogens that can cause respiratory diseases, too. *Chlamydiae* belong to that group."

Her research aims to determine which hosts can be affected, whether they exhibit disease signs, and their level of pathogenicity and zoonotic potential. For example, exotic birds can infect humans with *Chlamydia psittaci*, which can cause serious diseases including severe pneumonia. In animal husbandry of sheep and goats, *Chlamydia abortus* causes abortions or stillbirth. These bacteria are also dangerous to pregnant women, leading to miscarriage after close contact with affected animals.

Risk awareness and pandemic prevention

Borel emphasizes that all veterinary practitioners should be aware of the threat and the necessary precautions. "As lab researchers, we carefully adhere to safety measures and, depending on the species we are working with, we rely on dedicated labs at biosafety levels 2 or 3," she notes. "But other people who are in close contact with infected animals can also contract the diseases, including veterinarians, bird keepers, or people working in pet shops."

So, how worried should we be? For Borel, one major concern is the discovery of antibiotic resistance to tetracycline in *Chlamydia suis*, found in fattening pigs. "We have to observe this very carefully and learn more about potential transmission mechanisms, because there is a possibility that this resistance can jump to other chlamydial species, including in humans," she says.

As far as viral zoonoses are concerned, the SARS-CoV-2 pandemic has cast a spotlight both on the health hazards and on the massive economic consequences. "This pandemic teaches us that we cannot control everything," says Fraefel. "We were really unprepared for this virus." According to him, the risk from zoonotic viruses is particularly high because of human activity, habitat loss, climate change, and urbanization. "The human impact on the environment and wildlife needs to be reduced, and virus research should no longer be neglected."

Yummy! Two-year-old neutered tomcat Minki gobbles his food – all the more, since he has been on a diet lately. His overweight is a risk factor for diabetes.

Researchers find new ways to control blood sugar and fat

Be it foraged grass or canned food, an animal's feed is metabolized into its smallest components — like sugars and fats. Metabolic diseases, such as diabetes, affect the balance of these nutrition components. Veterinarians at the Vetsuisse Faculty are working to find better prognoses and therapies of such imbalances and to study their causes, which may also help to improve treatment of humans.

Switzerland is home to 1,7 Million cats — nearly 30 percent of all households include a cuddly feline. A large proportion of these pets spend their life indoors, where instead of hunting for mice and birds, they eagerly brush around our legs as we open the canned food. It is no wonder that roughly 60 percent of our velvet-pawed friends are now overweight. In addition, many cats are spayed or neutered, which increases their propensity to put on too much flab.

Because of this lifestyle and the concomitant rise in body weight, cats are increasingly diagnosed with type 2 diabetes. "Fifty years ago, this type of diabetes was very rare in cats," says Claudia Reusch, veterinarian and director of the Clinic for Small Animal Internal Medicine. "Now, it is the most common hormonal disease in cats." Overweight felines can become resistant to insulin, a hormone needed to control blood glucose levels. It enables cells to absorb glucose from the blood and inhibit its release from the stores in the liver. In insulin-resistant cats, however, blood glucose levels may rise uncontrollably.

This glucose instability can often be compensated for by the activity of so-called beta cells in the pancreas, which increase their production of insulin. However, in some cats these cells carry a defect: They can only increase insulin secretion up to a certain point. Therefore, the blood glucose level keeps rising and, in turn, further damages the beta cells so that they release less and less Insulin and eventually die. This phenomenon is called glucotoxicity. Ultimately, the combination of obesity-induced insulin resistance and defective beta cells leads to type 2 diabetes.

Improving diabetes treatment

Normally, diabetic cats are treated by their owners, who inject them with insulin twice a day. Recently though, Reusch and her colleague Thomas Lutz, deputy director at the Institute of Veterinary Physiology, have found a new way to improve the therapy. A continuous intravenous infusion of insulin for one week allowed them to tightly control the patient's blood sugar level. This led to a lasting effect: The treatment substantially reduced the necessity to treat diabetic cats with insulin during the following months. A large proportion of them even achieved diabetic remission, meaning they no longer needed any antidiabetic therapy.

In another study, Reusch and Lutz investigated how the treatment of diabetic cats can be further improved with medication. They divided feline patients with diabetes into two groups. All patients received insulin therapy and were put on a low-carb diet, but one group received an additional so-called GLP1-analogue once a week. This drug mimics the effect of the hormone GLP1, which stimulates insulin secretion and is also used to treat diabetes in humans. The results showed that therapy with the GLP1-analogue achieved a more stable blood glucose level and a higher remission rate, again potentially improving long-term outcome.

"Fifty years ago, this type of diabetes was very rare in cats. Now, it is the most common hormonal disease in these pets."

Claudia Reusch, director of the Clinic for Small Animal Internal Medicine at the Vetsuisse Faculty

Owners can recognise potential diabetes in their pets from the increased thirst and urination, as well as from unhealthy fur. Early diagnosis is an important factor for achieving a positive outcome. "The likelihood that diabetes will go into remission is the highest within the first three months of diagnosis," says Reusch. "At the moment, we achieve remission in 20 to 40 percent of the diabetic cats we see."

Could this research also be of interest to human medicine? "Currently, it is rather veterinary medicine that benefits from human medicine," says Lutz. But there is one aspect of human health that could be better researched in cats, rather than in mice and rats: These rodents can become insulin resistant when obese as well, but they do not develop all aspects of human diabetes. And, unlike cats and people, the laboratory animals do not develop so-called amyloid plaques. These are deposits in certain cells of the pancreas that lead to a deterioration in insulin secretion. "Cats could therefore in theory be a good model organism

to study amyloid plaques before the problem is studied in humans," says Lutz.

Breeding for high milk yield can make cows sick

Switzerland is not only home to cats but also to ruminants. Here, about half a million dairy cows produce milk for our daily needs. However, these animals frequently suffer from a disease called fatty liver. It develops in the weeks before and after the birth of a calf, when cows start to produce milk, during the so-called transition period. "The frequent occurrence is a direct result of intensive breeding for high milk yields", says Christian Gerspach, head of the Clinic for Farm Animals. "About 80 percent of the cows we treat during the transition period have a problem associated with fatty liver."

The disease develops because of the high energy demand necessary for the sudden surge in milk production. In this period, cows simply cannot eat enough to meet this energy demand. Therefore, they mobilize energy by breaking down body fat, which is taken up by the liver. In some cows, however, this fat metabolism is impaired. As a result, lipids called triglycerides are stored in excess in the liver cells, causing the liver to turn pale and yellow. Such a fatty liver can then lead to further illnesses.

Is the cow healthy or diseased? Christian Gerspach performs a liver biopsy.

Fatty liver is usually diagnosed through biopsies, which are invasive, expensive and laborious. Therefore, Gerspach and his colleagues set out to find biomarkers in the blood to improve both the early diagnosis and the prognosis of the disease. To do this, they took blood samples from cows at different times before and after the birth of the calf and analysed the blood lipid content using mass spectrometry. At the end, they took a liver biopsy to check for fatty liver disease and compared the lipid composition of healthy cows with that of cows showing different degrees of fatty liver. "This approach requires fundamental knowledge in many disciplines", explains Gerspach. Thus, he and his team collaborated with experts from the University of Zurich and the ETH Zurich.

"The frequent occurrence of fatty liver is a direct result of intensive breeding for high milk yields."

Christian Gerspach, head of the Clinic for Farm Animals at the Vetsuisse Faculty

The results are revealing: In cows with fatty liver, the concentration of the phospholipid phosphatidylcholine, which is important for the export of triglycerides from the liver, decreased significantly. In the future, this phospholipid could be used as a biomarker of fatty liver disease, offering farmers the possibility to screen an entire herd before cows become ill — and intervene at an early stage, for example by changing the feed composition.

Cause of cardiovascular diseases

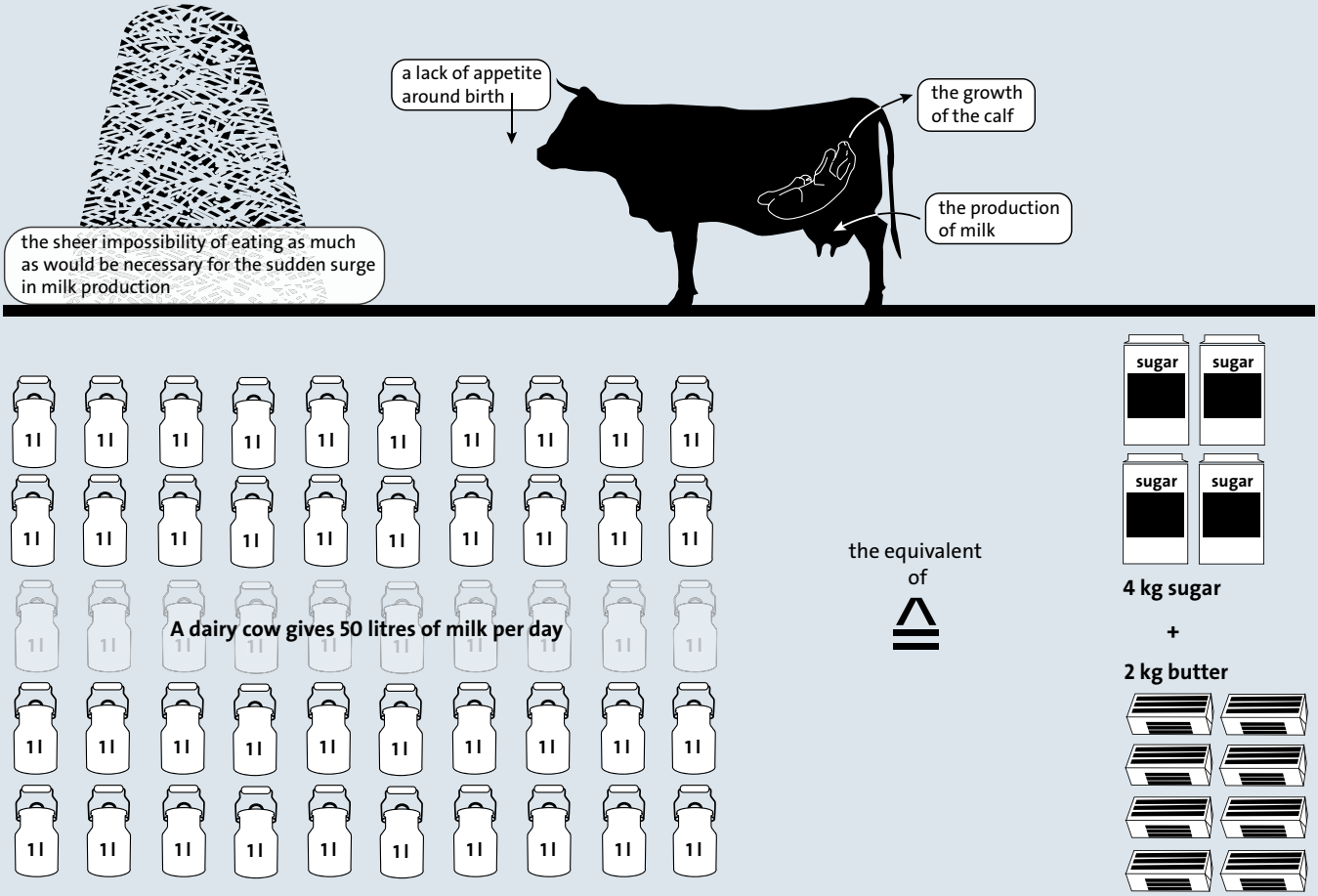
Understanding the composition of lipids in the blood is also important for human health. In humans, high blood fat levels can cause deposits or plaques to form in blood vessels, leading to their narrowing. This is called atherosclerosis, and the condition increases risk for cardiovascular diseases, heart attack or stroke.

Blood lipids are the research topic of Nadja Sieber-Ruckstuhl and Felicitas Boretti, both assistant professors in endocrinology and attending physicians at the Vetsuisse Faculty. In collaboration with a research team from the National University of Singapore, the two scientists used mass spectrometry to study the composition and levels of blood lipids in healthy beagle dogs. This way, they obtained a kind of fingerprint of lipids that acts as a reference point.

In a next step, the researchers experimented to see what would happen to this fingerprint if the blood lipids were artificially increased. For this, they treated dogs with glucocorticoids, which are generally used to treat inflammatory and allergic diseases and are known to elevate blood lipids. The researchers found an elevation of triacylglycerols, and

High energy demand of dairy cows

In the first week after calving, a cow's energy demand is three times higher than before. At the same time, she suffers from an energy deficit due to:



other important lipids such as sphingolipids, which can be crucial in the development of cardiovascular disease. Finally, Sieber-Ruckstuhl and Boretti set out to answer the question of how changes in blood lipids could explain the formation of deposits in the blood vessels. To do this, they studied dogs that suffer from two different illnesses: Dogs with Cushing's syndrome and dogs that suffer from hypothyroidism. Both diseases are characterised by high cholesterol and triacylglycerol levels in the blood — lipids that in humans can lead to plaques and cardiovascular disease. However, while dogs suffering from hypothyroidism show deposits in the blood vessels similar to humans, this is not the case in dogs suffering from Cushing's syndrome.

By comparing the composition of blood lipids of both illnesses, the two researchers hope to pinpoint changes associated with the development of atherosclerosis. "Detailed analysis is still ongoing," says Boretti. "Eventually the results may lead to specific therapies that could alter the lipidome so as to prevent the formation of plaques."

The importance of what we eat and feed

One other simple, albeit effective, form of therapy for dogs and humans may be a change in diet. In a collaboration with Annette Liesegang, head of the Institute of Animal Nutrition, Vetsuisse faculty, University of Zurich, Sieber-Ruckstuhl and Boretti investigated its role in another animal experiment with beagles. The dogs were fed conventional dry food and then separated into two groups: One group obtained a commercially available dry food diet and the other one home-made raw food containing meat, bone, innards, vegetables and fruits. The raw-food was supplemented with linseed oil, which is known to be rich in omega-3 fatty acids. After three months, the researchers analysed the blood of the dogs and found that the supplementation with linseed oil did influence the fingerprint of lipids in the canine blood. Specifically, it lowered the amount of triacylglycerols and cholesterols — a development known to aid the prevention of atherosclerosis.

"This shows how strongly the lipid levels and composition is influenced by diet", says Sieber-Ruckstuhl. Her colleague Boretti adds: "It is impossible to do a similar study with humans. People cannot be restricted to eat the same thing every day, and it is also difficult to make sure that study participants stick to a certain dietary regime." Therefore, this research could serve not only to improve nutrition of our four-legged friends, but also to help find a good animal model to study the effects of diets on health and disease in humans.

Less is more: Prudent use of antimicrobials to prevent resistance

Antibiotics are a powerful weapon in our medical arsenal, but they remain most potent when used sparingly. Vetsuisse researchers have found that resistant bacteria are proliferating in animal clinics, private homes, and the environment. Diligent hygiene measures and guidelines for prudent use can help extend the usefulness of these vital drugs.

It's Thursday morning at the Veterinary Clinic for Small Animals, and the waiting area features the usual mix of dogs, cats, and the occasional bird with their owners. In one of the treatment rooms, a cat is receiving an ultrasound scan, while next door another pet is undergoing surgery. The patients may be non-human, but the standards here resemble those of human hospitals. And just as in human medicine, adherence to hygiene standards is extremely important, not least for the prevention of antimicrobial-resistant microorganisms (ARM).

"There are many opportunities here for direct contact between the animals and the vets, caretakers, and the environment," says Barbara Willi, senior physician at the Clinic for Small Animal Internal Medicine. She has been supervising an 18-month research project on infection prevention and control (IPC) measures in Swiss small animal clinics and how they can prevent the spread of antimicrobial resistance.

Alarming findings

Infections with resistant bacteria are an increasingly alarming public health issue. Willi's study of IPC standards in seven Swiss companion animal clinics and practices shows that certain bacteria resistant to the carpabenem class of antibiotics pose a real and potentially growing risk in these settings, as do other drug-resistant bacteria. "IPC must be included in student training and implemented by professionals to protect themselves and prevent community spread, especially in high-risk settings such as the intensive care units of companion animal clinics," says Willi.

However, ARM can be traced to the households where the animals live as well, suggesting a transmission of bacterial strains from hospitals to private homes and vice versa. "Antimicrobial resistance is a classic One Health challenge. Given the continuous transfer of resistant bacteria, and of resistance itself, between different species and their ecosystem, our efforts must consider all aspects: human health, veterinary medicine, and the environment," says Willi. "We see a trend towards high-end resistance, meaning the occurrence of bacteria against which we have only few antibiotics left for treatment. This is a very concerning development."

Health and environmental hazard

One way multidrug-resistant bacteria are circulating in the environment, as Willi's colleague Magdalena Nüesch-Inderbinen found, is through water sources. In 2019, her team took 164 samples from surface waters across Switzerland. One in ten samples contained *E. coli* which were resistant to carpabenems; most were also resistant to other widely used antibiotics.

The researchers also detected a strain of *Enterococcus faecalis* carrying a gene named *optrA*, which makes the bacteria resistant to linezolid, a last-resort antimicrobial for humans, and to florfenicol, which is used in veterinary medicine. "Linezolid belongs to one of the last new classes of antibiotics — it was developed about 20 years ago," says Nüesch-Inderbinen. "The discovery of enterococci with this resistance in the aquatic ecosystem is really concerning. The genetic elements on which the resistance genes are located, are self-replicating, which means that the resistance genes won't just disappear by dilution in the waters.

"We see increased occurrence of bacteria against which we have only a few antibiotics left for treatment. This is a very concerning development."

Barbara Willi, senior physician at the Vetsuisse Clinic for Small Animals Internal Medicine

ARM can also enter the food chain through crop irrigation or watering of livestock. And the use of antibiotics in livestock farming leads to ARM being frequently found in raw meat. This is why veterinary experts view the so-called Biologically Appropriate Raw Food (BARF) diet as problematic: When owners feed their animals uncooked meat, bones, and organs, there is a heightened risk of bacterial pathogens being transmitted.

To some extent, however, resistance formation is inevitable. "As soon as you use an antibiotic, you are selecting for resistance. The more you use it, the more you find resistant bacteria," Nüesch-Inderbinen says. That's why prudent use of antibiotics — maximizing their effect while minimizing the development of resistance — is especially important.

Philippe, a six-month-old Grand Anglo-Français is looking forward to his meal of raw meat. However, this feeding method heightens the risk of pathogen transmission.

A new stewardship tool

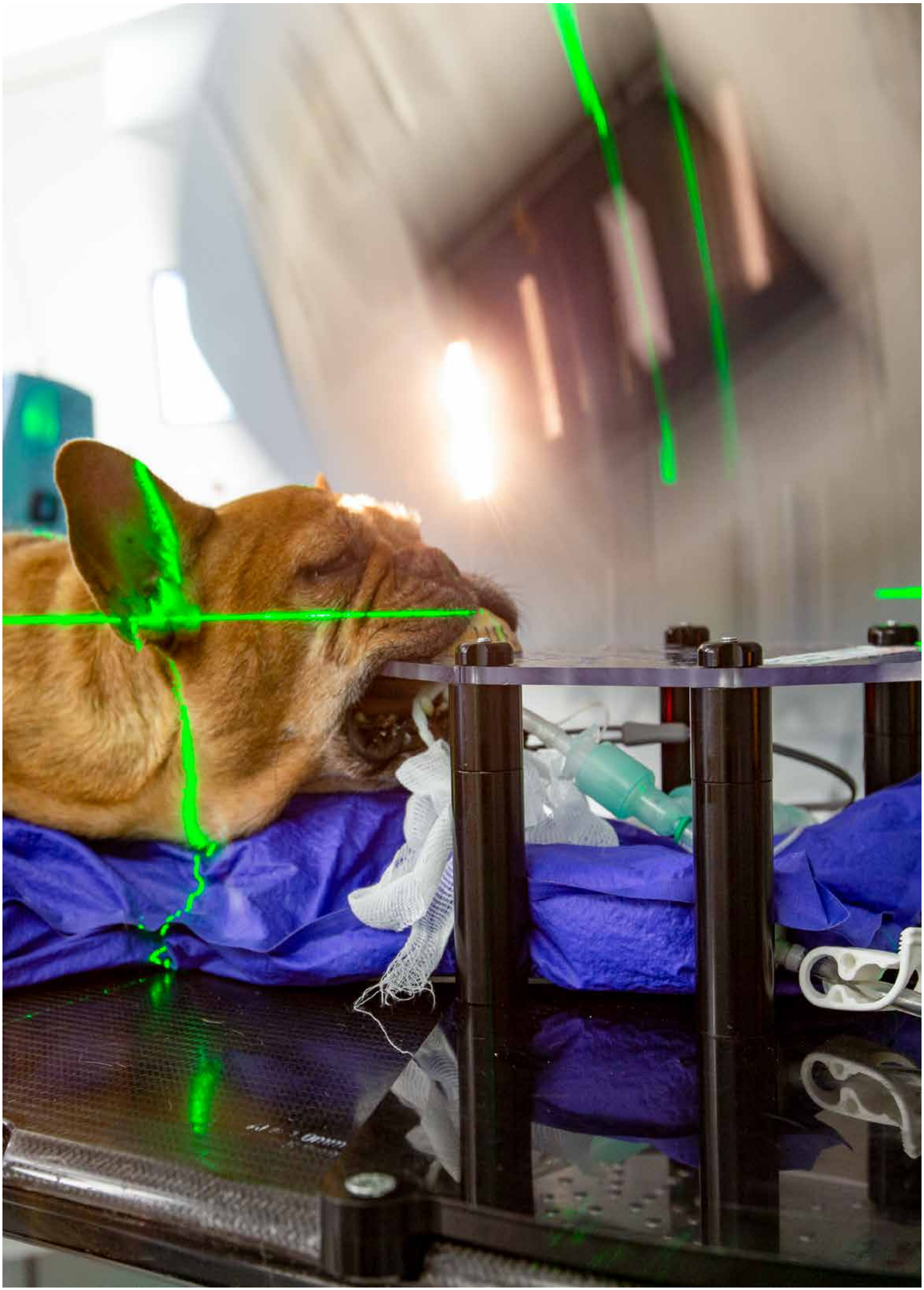
To ensure that antibiotics remain effective, veterinary practitioners, owners of animals, and the general population must use them responsibly. That's why Willi and other clinicians of the Vetsuisse Faculty have helped to establish antimicrobial use guidelines that are available through an online stewardship tool (AntibioticScout.ch). It offers information about how vets, through sensible and sparing use, can help to preserve the efficiency of antibiotics as long as possible. Practitioners can specify the animal species, the organ system, and the medical indication they wish to treat, and the tool suggests appropriate therapy pathways, including recommendations for suitable antibiotics.

Another research outcome is the publication of infection prevention and control guidelines for companion animal clinics and practices. Compiled under Willi's leadership, the guidelines explain the challenges faced and recommend measures for avoiding the risk of pathogen transmissions in companion animal veterinary settings. This educational tool has helped raise awareness among specialists, too: "We educate our staff and discuss the issue of antimicrobial overuse in our clinical rounds," Willi points out as she passes an examination room where an MRI scanner is being disinfected between patients.

Despite these efforts to foster prudent antimicrobial use, Willi emphasizes that access to antimicrobials is a prerequisite for ensuring patient care in veterinary medicine. "But we also have to optimize herd management and healthy living conditions for the animals during meat and milk production," she adds. "This has a huge impact on the consumption of antimicrobials, and in my opinion, some of the responsibility also rests with consumers, who must pay the price for high-quality meat and milk and thus ensure that these animals have a good environment."

How to prudently use antimicrobials in veterinary medicine

- Employ hygiene measures, like hand and surface disinfection
- Justify use and diagnoses
- Only treat symptomatic animals
- Treat co-morbidities that support the bacterial infections
- Use appropriate dose of the optimal antibiotic (cultivate bacteria and choose the antibiotic with the narrowest spectrum)
- Make sure the owner is able to administer the antibiotic correctly for the intended period of time
- Realize and re-evaluate if treatment is ineffective
- Document the use



Luna is undergoing radiation therapy, which will hopefully destroy the tumour in her brain. The mat she is lying on and the denture block are custom-made for her.

A true friend indeed: How dog cancer research helps treat human patients

Our close companionship with dogs means that our lifestyle and environment affect their health. Cancer, for example, is also common in our four-legged friends. Canine patients receive treatment at the Vetsuisse Faculty, but they also take part in studies that help researchers improve and develop therapies and also find ways to predict cancers in humans – improving health for both them and us.

Luna, a cute 8-year-old female French Bulldog, is standing on a treatment table in the Division of Radiation Oncology at the Vetsuisse Faculty. Veterinarian Chris Staudinger administers an anaesthetic through a catheter in her left leg. Slowly, Luna lies down to sleep. She is about to undergo radiation treatment, which hopefully will destroy or at least reduce the size of the tumour that sits between her cerebellum and the delicate brain stem area.

Dogs suffer from cancer roughly as frequently as humans. "About 20 to 30 percent of the dogs we have in radiation treatment have a brain tumour," says Carla Rohrer Bley, head of oncology at the Department of Small Animals at the Veterinary Hospital. The centre is renowned throughout Europe for the treatment of brain cancer, and some patients come in from other European countries to be treated here.

"When a dog is diagnosed with a brain tumour, typically their neurologic condition is bad. Without an antitumour treatment, they may live for only six or eight more weeks, all the while suffering from symptoms such as epileptic seizures, balance problems or stupor," says Rohrer Bley. Luna, for example, sways slightly when she is walking. To destroy the tumorous cells that cause her symptoms, veterinarians use radiation therapy. First, the animal's body is precisely positioned so that a state-of-the-art device — the same used on human patients — can deliver high-energy X-ray radiation with the utmost accuracy, so as to prevent damage of the surrounding healthy brain.

Luna's radiation treatment takes a mere two minutes. Afterwards, vet Staudinger wraps her in a warm blanket while she slowly wakes up. A few moments later, she is up on her paws and hungry, barking to make her needs heard.

Improved treatment

In an ongoing research project, Rohrer Bley and her team aim to make radiotherapy more effective by targeting small areas of tumours with higher radiation levels. Conventionally, the radiation dose is distributed homogeneously throughout the tumour tissue. The total dose is limited by what the surrounding healthy tissue can tolerate without being damaged. However, in some parts of the tumour, a higher dose might be desirable to better destroy cancerous cells. Therefore, Rohrer Bley and her team plan to deliver a higher dose to areas of the tumour that are not adjacent to sensitive organs. This would allow them to treat each animal with its individual highest dose without increasing the risk of severe side effects.

In a first step, the researchers will simulate the effect of this radiation plan in a computer model. Next, they will compare the effects of the regular protocols to these higher-dosed, heterogeneous treatments on the canine patients. In order to direct the high-energy X-rays accurately to certain areas of the tumour while avoiding others, a high level of expertise in physics and treatment planning skills are needed. That's why the Vetsuisse researchers have teamed up with medical physicists who optimise radiation therapy and radiation devices in human medicine. The outcomes of this interdisciplinary team effort will potentially benefit animal and human patients alike.

Deep dive into cancer cells

The researchers at the Vetsuisse Faculty are also working to better understand how cancers grow and develop: Why do cells suddenly start to multiply uncontrollably? How can this growth be predicted, and which molecules in these cells could be suitable targets for new drugs? As model animals for many types of cancer in humans, dog patients can help to answer these questions (see box).

One of the researchers involved is Franco Guscetti from the Institute of Veterinary Pathology. As a pathologist, he regularly examines cancerous tissue that has been removed during surgery to determine if a tumour has been completely excised. But, he also uses these tissue samples to better understand how cancer grows and to find new therapies. Specifically, Guscetti and his team have investigated canine oral squamous cell carcinoma (COSCC), a malignant tumour that develops in the mouth and infiltrates the surrounding tissue, sometimes including the bone.

Cancer cells are reprogrammed to no longer produce proteins in the same way as normal cells. Using a method called RNA-sequencing, the researchers identified genes

affected by this reprogramming that had a role in cancer growth and development. Because COSCC in dogs is very similar to human head and neck squamous cell carcinoma (HNSCC), the researchers compared their results with pre-existing genetic data from humans and found that the canine and the human cancer cells were very similar in their reprogramming. In cooperation with Enni Markkanen from the Institute of Veterinary Pharmacology and Toxicology, the team pinpointed two genes named CDK4 and CDK6, which are affected in both the human and the canine cancer variant. This indicated that dogs suffering from this type of tumour could be treated with a drug already in use in human breast cancer therapy.

A biobank to boost research

Pathologists all over Switzerland increasingly store tumourous tissue in biobanks together with information such as the diagnosis and sample origin, preparation, and type. Because of the data's high value in research, Guscetti is currently establishing a biobank information system to manage samples collected at the Vetsuisse Faculty. "These samples will then be accessible to a wide community of researchers and offer the possibility to address a variety of research questions," says Guscetti.

His colleague, Markkanen, also uses surgically removed tumour tissue from dogs in her research. Originally, the young group leader wanted to work as a veterinarian at the clinic. After all, her passion for helping animals extends to her private life, which she and her family share with several horses, three dogs, a cat and three geckos. Last year, she nursed over 70 hedgehogs that were sick or injured. In addition to her veterinary work, however, Markkanen discovered her enthusiasm for research that aims to understand how the tissue surrounding cancer cells can drive tumour growth.

"Typically, researchers look for these growth drivers inside the cancer cells," says Markkanen. The role of surrounding normal tissue, called cancer-associated stroma (CAS), is often overlooked, she says, even though it may influence whether an emerging tumour growth is able to establish itself in a cellular environment. For example, the stroma contains a variety of cells, including immune cells, which can release substances that inhibit the growth of cancer cells or even kill them. However, tumour cells know some tricks as well and are able to manipulate their surroundings to become more hospitable. To find out how exactly the tumour cells achieve this feat, Markkanen and her co-workers have focused on breast cancer as an example. This is not only the most common cancer in women but also in female dogs, about 24 percent of whom develop it.

Predicting a tumour's aggressiveness

Markkanen and her colleagues put thin slices of canine breast cancer tissue samples under a microscope and used a fine laser to separate stroma from cancer tissue. Using RNA-sequencing to compare CAS to normal stroma from the same patients, they found specific genes that appear to influence tumour growth. Currently the researchers are investigating the function of those genes more closely. "We want to understand how exactly the stroma influences the tumour and whether specific genes have a positive or a negative effect on its growth," explains Markkanen.

Making a prognosis of whether a lump of tissue will develop into a vicious tumour is also important in human medicine, but the first step towards such a prognosis is to understand how tumours grow and develop on a molecular level. Once researchers know which genes or molecules set off the chain reaction of unchecked cell division, they can use these genes and molecules as markers to watch out for in tissue samples.

So far, Markkanen and her team found that the genetic make-up in stroma cells was different in benign breast cancers compared to malignant, and the genetic changes happening in the stroma of dogs are strikingly similar to those in humans. Based on these results, scientist can now go on to identify biomarkers for diagnosis and prognosis of breast cancer in women as well.

Prognosis of tumour aggressiveness is likewise important for prostate cancer, the third-leading cause of cancer death in men. Although it can be detected by a blood test, the majority of prostate cancers are not aggressive at the time of initial diagnosis and do not require immediate intervention. Not treating these cancers minimizes overtreatment, but it also runs the risk of missing early intervention options for cancers that turn out to be aggressive. "We need to find ways for early prediction of a tumour's aggressiveness," says molecular biologist Raffaella Santoro from the Department of Molecular Mechanisms of Disease.

A revolution for prostate cancer

Santoro's research is focused on how healthy prostate tissue turns into a tumour. However, scientists have not yet managed to grow prostate tumours in a lab in order to study them, so Santoro and her team had to come up with an entirely different solution: They use prostate cells from mice and grow them into a 3D structure, thus constructing mini-organs, or so-called prostate organoids. "Having such a laboratory prostate cancer model is truly a revolution," says Santoro.

Group leader Enni Markkanen reviews the results of an RNA-sequencing run. This method enables her to pinpoint genetic features of different cancer variants.

Using such a prostate cancer model, she can now mimic the cancer by manipulating the model organ's genetic make-up. For example, the deletion of a gene called PTEN turns the organoid into cancerous tissue. Santoro and her team were also able to identify another gene called TIP5 that is closely linked with aggressive prostate cancer. In the future, it might be used as an early prognostic biomarker to facilitate treatment choices in human prostate cancer patients.

Finding such prognostic markers and optimising therapies will also help dogs like the French Bulldog Luna. After her radiation therapy session, she is done for the day and waits for her owner to pick her up. Typically, treatments stretch out over ten sessions. "After therapy, canine brain tumour patients typically enjoy two more years of life, mostly without any symptoms," says Rohrer Bley. "In nearly all cases, 97 percent actually, we see a long-lasting improvement."

Why dogs are a good model for cancer in humans

1. Dogs intimately share our environment and lifestyle, be it passive cigarette smoke at home, pesticides used in the garden, or excessive UV radiation from sunlight. Hence, factors that cause cancer in humans also do in dogs.
2. In comparison to laboratory models such as rats and mice, cancers in dogs are not induced on purpose. As in humans, tumours in dogs arise spontaneously and have a high degree of variability.
3. Similarly, dogs have a functioning immune system, whereas the immune system in laboratory animals is suppressed.
4. Cancers have a genetic component. Such genetic predispositions also exist in dogs and can be retained in some breeds.
5. The anatomy and physiology of cancers in dogs and humans are similar. For example, canine cancers are similar in size to those of humans.

Honouring excellence in research

Research awards are not just for show: They boost the outreach of scientific work and help the recipients to take on even more challenging projects. That is why the Vetsuisse Faculty is committed to annually honouring excellent scientific achievements on an international level. In turn, the success of our own research efforts is reflected by the awards granted to faculty members in 2020.

Honorary Doctorate

Prof. Marcel Tanner

Epidemiologist, professor emeritus of the University of Basel and former director of the Swiss Tropical and Public Health Institute (Swiss TPH)

Renowned epidemiologist and public health expert Marcel Tanner has investigated parasitic diseases in Cameroon and Liberia and led the Swiss Tropical Institute Field Laboratory in Tanzania, where he helped to implement major public health plans and training programs for health professionals. He also had a substantial part in the development of a malaria vaccine for African countries. Throughout his career, Marcel Tanner continually focused on the 'One Health' approach of connecting human and veterinary medicine, thereby helping to sustainably improve healthcare, particularly for the poor, in developing countries. For his accomplishments, the Vetsuisse Faculty granted him the title of Honorary Doctor in 2020.

Walter Frei Prize

Prof. Stefan Schwarz

Professor in veterinary medicine and director of the Institute of Microbiology and Epizootics at Freie Universität Berlin

The Vetsuisse Faculty awarded the Walter Frei Prize to Prof. Stefan Schwarz for his achievements in the crucial field of antimicrobial resistance. First as a group leader at the Friedrich-Loeffler-Institut in Neustadt (GE), and, since 2016, as director of the Institute of Microbiology and Epizootics at Freie Universität Berlin, Stefan Schwarz has explored mechanisms of antimicrobial resistance and how they globally disperse in human and animal pathogens.

The Walter Frei Prize — named after the erstwhile director of the Institute of Veterinary Pathology at the University of Zurich — is awarded every two or three years for outstanding achievements in research in veterinary medicine.

Vetsuisse Highlights

International Awards

Prof. Brigitte von Rechenberg, professor for experimental veterinary surgery, won the **2020 Women's Leadership** Forum Award granted by the Orthopaedic Research Society (ORS).

Prof. Roger Stephan, professor and head of the Institute for Food Safety and Hygiene, was appointed **Fellow of the American Academy of Microbiology**.

Prof. Claudia Reusch, professor and head of the Clinic for Small Animal Internal Medicine, received the **Richard-Völker-Medal** from the German Association for Small Animal Medicine for her achievements in science, training and veterinary practice in small animal medicine.

Awards from University of Zurich (UZH)

Dr. Julia Ettlin won the **UZH Annual Award** for her PhD thesis entitled "Investigating stromal gene expression in metastatic and non-metastatic canine mammary tumours".

Stephanie Lüthi und Andrea Treier each obtained the **UZH Semester Award** for their master's theses entitled "A Proteomics Approach to Identifying the ADP-ribosylome in Serum" and "Raw pet food as a potential cause of high prevalence of ESBL-producing Enterobacteriaceae found in clinical isolates from dogs in Switzerland", respectively.

Awards from Vetsuisse Faculty

PhD student **Louise Martin** won the **Young Scientist Paper Award 2020** with her publication in Proc. R. Soc. B **286** (2019): "The way wear goes: phytolith-based wear on the dentine-enamel system in guinea pigs (*Cavia porcellus*)".

Networking event fosters interdisciplinary exchange and collaboration

Despite restrictions due to COVID-19, the third annual Poster and Networking Day was a full success. Junior researchers at the Vetsuisse Faculty gained visibility, laid the foundation for future collaborations, and bridged research culture gaps.

Be it a cheerful stage play about salmonella in rabbit meat, a fairy tale picture book about the search for a new drug against chlamydia, or a poem about the state of animal welfare in equestrian sports — adapted no less from the famous "Erlkönig" by Johann Wolfgang von Goethe — "The presentations at the Poster and Networking Day were extremely creative," says Ramon Eichenberger proudly. He is the head of the organising committee of the Vetsuisse networking event that, in the times of COVID-19, had to be held a bit differently than usual.

Unlike in the years before, the third Poster and Networking Day took place digitally in December 2020. A total of 29 junior scientists at the Vetsuisse Faculty seized the chance to present their research projects in a creative three-minute 'elevator pitch' competition. The corresponding project posters were displayed on site for a week for colleagues to consecutively view.

Along with virtual rooms for giving and watching the presentations, the organising committee also provided virtual rooms for discussions. "Imagine the discussions happening after a live presentation and in front of project posters," says Vice Dean of Research and Academic Career Development Adrian Hehl. These virtual discussion rooms were meant to provide a similar space — for scientists to answer questions, get input, discuss common ground in their research, and share knowledge, methods, or instruments. "This worked really well," Hehl points out. In the end, instead of leading to constrictions, the COVID-19-imposed boundaries boosted creativity and interchange.

Overcoming the cultural differences

The need for this networking event was recognized by faculty management and junior researchers alike. "It's a win-win event," says Hehl. The Vetsuisse Faculty benefits from better-connected researchers, and the junior scientists get more visibility, a platform to practice their communication skills, and a chance to get new perspectives.

Moreover, the event has another useful side effect: It fosters understanding and improves communication between the different research cultures existing within the faculty. "We still observe a certain alienation between basic and clinical researchers," says Hehl. "Events like the Poster and Networking Day raise awareness for these cultural differences and ultimately lead to better interdisciplinary collaboration. That's why we are planning to introduce similar networking activities at the executive level."

Ramon Eichenberger

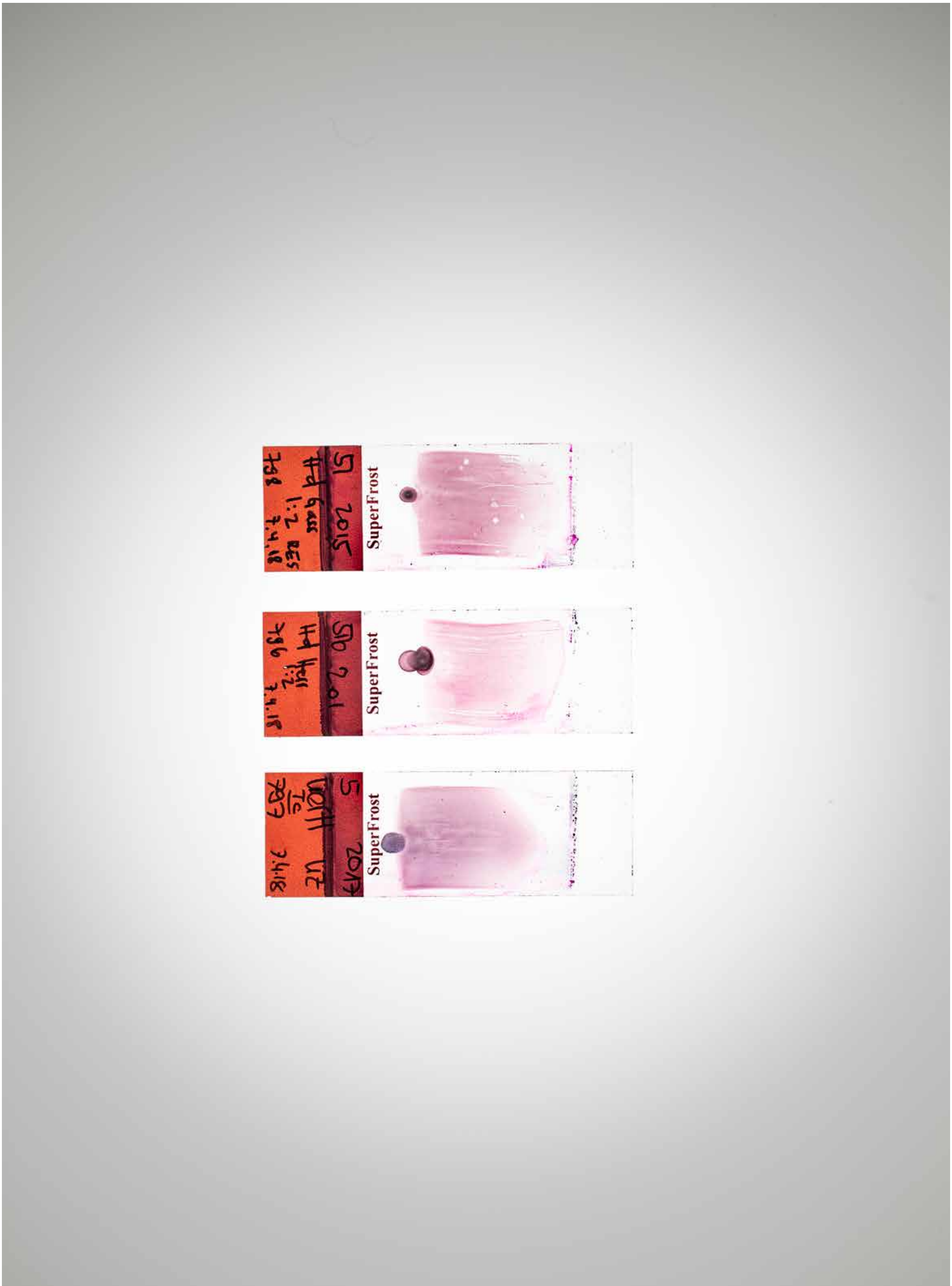
Parasitologist at the Vetsuisse Faculty and head of the Poster and Networking Day organising committee.

"By collaborating, we can address more complex research questions"

Ramon Eichenberger, you lead the Poster and Networking Day organisation committee. Why are you committed to this event?
Because networking and visibility are important to me. I can increase my visibility by not only participating but having a leading role in organising the event. Also, I like to meet my faculty colleagues — be it basic or clinical researchers — and to get to know what they are working on.

Is this just to satisfy your curiosity, or do you also aspire to forge new collaborations?
Basically, I am just open and curious. But of course, through the exchange, I get inspirations for my own projects and ideas for interesting collaboration as well. I am trained as a parasitologist myself, and while we have an advanced diagnostic lab infrastructure, I rarely come in direct contact with animal patients like clinicians do. So, by collaborating with clinical experts, together, we can address more complex research questions. Also, we basic researchers can, for instance, assist clinicians to diagnose patients that have caught a rarely occurring pathogen. Just recently, I helped a clinician colleague to identify a parasite that had not been reported in Switzerland before. Generally, initiating such mutual transfers of knowledge can only be beneficial.

Biopsy device | 27 cm



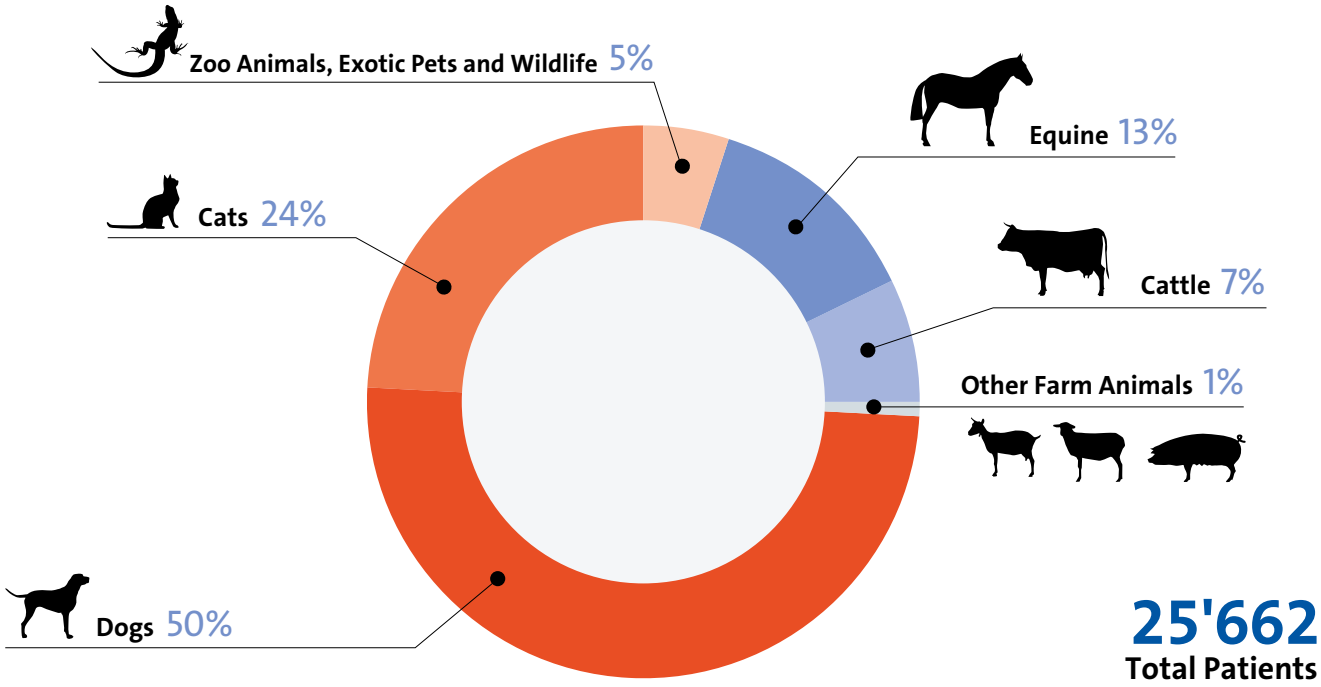
Stained blood smear slides | 7 cm

Denture block for X-ray treatment of canine patient | 10,5 cm

Infusion tube | 215 cm

Veterinary Hospital

The University Veterinary Hospital comprises all clinical facilities of the Vetsuisse Faculty. Number of animal patients in 2020:



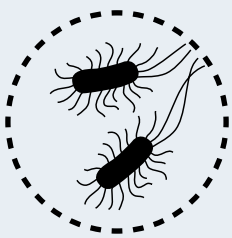
Pathobiology and Veterinary Public Health

In different institutes, diagnostic services are provided in laboratories which are accredited according to ISO 17025. In addition, various national and international reference laboratories – such as for animal disease diagnostics and foodborne pathogens – are affiliated to these institutes.

Institute for Food Safety and Hygiene

Scope of diagnostic services: microbiological testing of food samples for food companies.
Number of samples 2020: 25'000

National Reference Laboratory for Enteropathogenic Bacteria and Listeria (NENT)



Section of Poultry and Rabbit Disease

Scope of diagnostic services: investigations for veterinarians, companies and private persons in the poultry industry.
Number of samples 2020: 48'000

National Reference Laboratory for: Avian Influenza, Avian Chlamydiosis, Infectious Laryngotracheitis, Myxomatosis, Newcastle Disease, Salmonella Infection of Poultry, Rabbit Viral Hemorrhagic Disease

Section of Veterinary Bacteriology

Scope of diagnostic services: investigations for pathogens causing bacterial infectious diseases in animals.
Number of samples 2020: 7200

National Reference Laboratory for: Bovine tuberculosis, sheep and goat pseudotuberculosis, paratuberculosis

Institute of Parasitology

Scope of diagnostic services: investigations for parasites causing infectious diseases in animals and humans.
Number of samples from animals 2020: 10'500
Number of samples from humans 2020: 5'700

National Reference Laboratory for: Echinococcosis, Cryptosporidiosis, and Hypodermosis

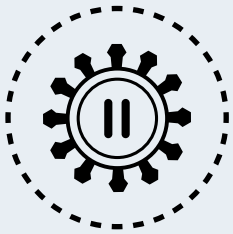
National Center for Vector Entomology

Institute of Veterinary Pathology

Scope of diagnostic services: post mortem examinations of food and companion animals, exotics, zoo and wild animals, and laboratory rodents; histological and immunohistological examinations of tissue biopsies; examination of cytological specimens.
Post mortem examinations 2020: 1'800
Biopsy and cytology examinations 2020: 4'800

OIE Reference Laboratory for Ovine Chlamydiosis

National Reference Laboratory for Chlamydia abortion in sheep and goats



Institute of Virology

Scope of diagnostic services: investigations for viruses relevant to veterinary medicine in pets, farm animals and zoo animals.
Number of samples 2020: 3000

National Reference Laboratory for: Infectious bovine rhinotracheitis / infectious pustular vulvovaginitis in cattle (BoHV-1, IBR / IPV), Aujeszky's disease in pigs (SuHV-1, Aujeszky), transmissible gastroenteritis in pigs (TGEV)

How we improve animal care brick by brick

Since the Vetsuisse teaching, research and clinical facilities are part of the larger Zurich University Irchel campus, our construction projects are integrated into the university's overall development strategy. According to this strategy, most of the Vetsuisse facilities are to be completely renewed within the next 30 to 35 years. Meanwhile, the short-term development of our facilities will continue with refurbishments and strategic construction to advance our research efforts and improve the care of our animal patients. In 2020, our construction developments were focused on three vital realms of animal health care: modern diagnostic imaging, the prevention of animal epidemics, and the support of animal welfare.

Leading the Way in Diagnostic Imaging

A new centre pools devices and knowledge

Ultrasound, computed tomography (CT), scintigraphy (NM) and magnetic resonance imaging (MRI) are just some of the non-invasive diagnostic imaging methods that have seen immense advancement in the last decades. They have long been vital for clinical diagnosis and research, and they are also important tools for training the next generation of veterinarians. To better utilize these technologies, the Vetsuisse diagnostic imaging domain will soon have a new, dedicated building that bundles them all on site. Until now, these diagnostic devices were rather scat-tered, many being located in the small animal clinic, the equine clinic, and certain research facilities. "We intended to change this and bring together all our technology and knowledge in one central hub," says Roger Stephan, dean of the Vetsuisse Faculty. Construction began in 2020 and is well under way. By mid-2021, the imaging centre will start its operation.

Standing MRI for gentler examination of horses

The only imaging device that will remain de-centralized is the equine clinic's new MRI machine for the examination of upright standing horses. Thanks to this valuable tool, the animals do not need to undergo full anaesthesia for the examination — a procedure that always entails a residual risk — but rather only light sedation. "Horses are very sensitive animals and scare easily," says Roger Stephan. "With conventional anesthetized imaging, upon waking up, a patient might get nervous and injure itself." With the standing MRI, this hazard is eliminated, making examinations of the horses' musculoskeletal system gentler and faster. However, the delivery of the vast, heavy-load MRI machine was no small thing: It required an especially high mobile crane to lift it to its final position. Since its launch in April 2020, the standing MRI has enabled the Vetsuisse staff to diagnose and treat over 130 animals.

Preventing Animal Epidemics by Smart Handling of Farm Animals

New cattle quarantine stable

From the outside, the building looks rather more like a giant concrete safe than a stable. And it actually is meant to be a safe — for the infectious bovine viral diarrhoea (BVD). Preventing the spread of this epidemic disease has been a difficult challenge for breeders and veterinarians in Switzerland. “As a centre for animal care, we have to prevent worst-case scenarios like an infected patient spreading the disease inside the facility,” explains Roger Stephan, dean of the Vetsuisse Faculty. The new BVD quarantine stable provides a hygiene-controlled space for isolating and testing possibly infected cattle and calves upon their arrival. Only after an infection has been ruled out can the animals be transferred to the general Veterinary Teaching Hospital stables.

Transporting animals without spreading diseases

Another worst-case scenario that needs to be averted is an infection leaking out the hospital facilities via an animal transport. That’s why from 2020 onward, every animal truck or ambulance must pass through the new washing bay on its way out of the Vetsuisse Teaching Hospital area. The system cleans and disinfects the transporters and thereby destroys all potential pathogens. “Until now, Switzerland has invested much and done well in fighting BVD and other animal epidemics compared to other European countries,” Stephan points out. “In order to maintain this safe status, we need to keep up our commitment.”

Supporting Animal Welfare in the Vetsuisse Facilities and elsewhere

New, larger horse paddock

Horses need space to move and exercise in order to be well and to heal well. To better accommodate our equine patients, the former paddock was replaced and significantly expanded in 2020. The new paddock is 500 square meters divided into two compartments, and it features a special volcanic ground material. “This volcanic sand has been found to be the best and gentlest material for the health of the horse’s hoofs,” Stephan points out. “In a way, stimulating animal welfare contains a strong ‘one health’ aspect,” he adds, “since the awareness that we value and foster animal welfare is important to us humans and therefore also adds to our own welfare.”

Slaughter in accordance with animal welfare

For very large cattle, like big bulls or highland cattle, conventional slaughtering methods do not comply with animal welfare standards. For one, adequately stunning them with a bolt shot before the killing is difficult due to their robust anatomy. In addition, the general facilities for cautious cattle driving and securing are simply too small for such big animals. The new driving facility at the Vetsuisse Faculty remedies this with dynamically adjustable parts that can fit very large body or horn sizes. Since December 2020, the facility is used for patients and as a service for breeders for the slaughtering of heavy farm animals in accordance with animal welfare. In addition, it offers the opportunity to investigate and improve stunning methods.

Teaching Awards

Virbac Best Coach Awards

Each year, the Vetsuisse graduates elect their "best coaches", meaning those individuals that stood out during the students' clinical rotational year for their commitment in teaching. Veterinarians and animal caretakers from all clinics and the Institute of Veterinary Pathology are eligible. The award is sponsored by the company Virbac.

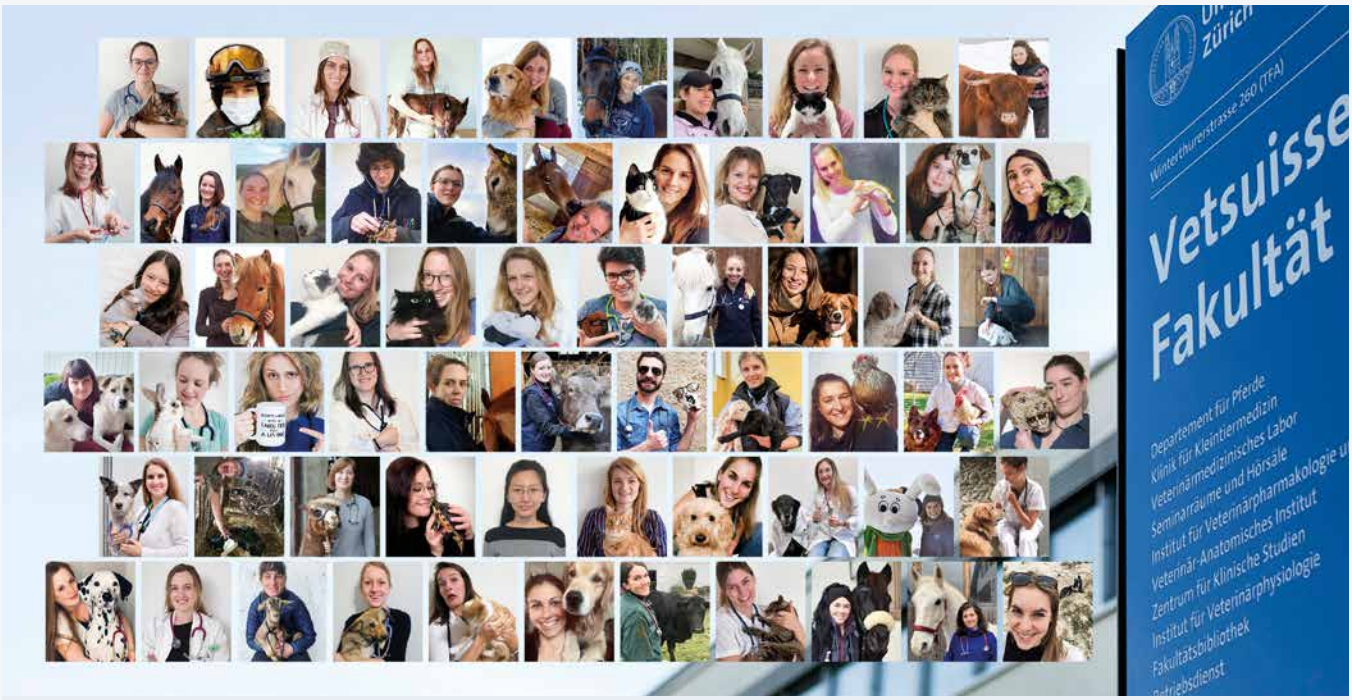
Small Animals:	**Claudia Kümmerle,** veterinarian **Simone Jäger,** animal caretaker	**Farm Animals:**	**Carina Oschlies,** veterinarian **Canan Acar,** animal caretaker
Horses:	**Felix Theiss,** veterinarian **Peter Schmid,** animal caretaker	**Pathobiology:**	**Frauke Seehusen,** veterinarian **Cédric Häuptli,** animal caretaker

Teacher of the year

The teacher of the year is designated by the Vetsuisse students from the first to the fourth year.
We congratulate:

Mariusz Kowalewski, professor for Veterinary Anatomy, Histology, and Embryology
and head of the Institute of Veterinary Anatomy

Final exams 2020 and graduation ceremony



On January 28rd 2021, the Vetsuisse Faculty UZH bid farewell to its 65 new graduate veterinarians with a digital festive event. We cordially congratulate all of you on your success!

Vetsuisse Faculty UZH Annual Report 2020

Vetsuisse Faculty UZH
Winterthurerstrasse 204
CH-8057 Zürich
Phone: +41 (0)44 635 81 21
www.vet.uzh.ch

Concept, Design & Layout
Roger Stephan, dean
Jeanne Peter, head of Vetcom, scientific illustrations
Serafina Fratto, graphic design

Editorial board
Santina Russo, freelance science journalist (editorial lead)
Cornelia Eisenach, science writer
Chris Findlay, freelance journalist
Sarah Waldrip, freelance editor

Photos
Michelle Aimée Oesch, science photographer