
FVO
Research Report
2008 – 2011
In future, increased travel, global trade and climate changes could lead to disease pathogens spreading even faster and jeopardizing animal and human health in Switzerland as well. The early detection of animal diseases and the initiation of preventive action are therefore becoming increasingly important. Great importance has thus been attached also to these aspects in the FVO's main research issues for 2012–2016.

Hans Wyss
Director FVO
Blood-sucking midges transmit several different diseases, e.g. bluetongue. In the context of a research project, they were caught using UV light traps. It was found that midges are active in all areas used for agriculture in Switzerland, except in winter (project 1.08.10).
Introduction

Irene Schiller, FVO
The Federal Veterinary Office (FVO) promotes the health and wellbeing of animals, protects humans from zoonoses (diseases transmissible to humans) and contributes to the production of safe food of animal origin. The FVO thus directly supports agricultural efficiency, because two thirds of gross agricultural yield comes from animal production.

It is important that the decisions taken by the FVO are always based on scientific principles. The FVO has a statutory mandate to generate the knowledge needed to fulfil its duties through research. For this reason, the FVO initiates, promotes and supports research in the fields of animal welfare and zoonoses, as well as animal welfare and food hygiene. A further area in which research is supported is species protection, because the FVO is also responsible for the implementation of the international convention on species protection (CITES).

Current analyses and medium-term forecasts on the relevance of animal welfare and zoonoses, animal welfare and food hygiene have led to the following estimations:

- The potential risk that diseases pose to animal health is on the increase. Examples of this are the BSE crisis and bird flu. Moreover, 70% of newly emerging diseases are zoonoses and thus also of significance for the health of humans.

- Animal health and animal welfare have become highly emotive issues in the last few years. Examples of this are disputes concerning vaccinations for economically important animal diseases (bluetongue) or the problem of dog bites and attack dogs.

For effective risk management, it is crucial that not only risk assessments, but also subsequent implementation and communications are done on a scientific basis. In response to the increasing risk posed by animal diseases, the FVO has launched its Animal Health Strategy TGS 2010+, in which prevention plays an essential part.

Since diseases are oblivious of national frontiers, effective international cooperation has a major role to play. The FVO was involved in a successful transnational research project on bird flu (Constanze), which produced essential insights into the role of wild birds in the spread of bird flu. The FVO is an active partner in European research networks. In EMIDA ERA-NET (Emerging Major Infectious Diseases of Animals) the FVO has acted as a sponsor of two research calls. In both cases, projects of research groups from Switzerland qualified and are currently being conducted. The FVO is also an active partner in the newly formed ANIHWA ERA-NET (Animal Health and Welfare), which is concerned not only with the health of animals, but also with their wellbeing.

It is of key importance for the FVO that the results of research supported by the FVO are directly acted on. Implementation is always an essential part of the research process. The efforts of the FVO to network the state veterinary service and science by sponsoring research are likewise part of the focus on implementation.

In the last few years, the FVO has also reformed its research with the aim of using research funds more effectively and increasing efficiency. This has involved reducing in-house research. At the same time, we have seen the emergence of strategic partnerships with external research institutions. These institutions handle topics efficiently and offer additional skills. For example, research on zoonoses, animal diseases and animal welfare has been outsourced to the newly established Veterinary Public Health Institute (VPHI) at the University of Bern. The FVO also supports and promotes joint research with other federal offices, the universities and the ETH. Partnerships enable synergies to be exploited in research and overall allow greater suitable resources to be drawn on in special situations.

Research is thus an essential prerequisite for the fulfilment of the FVO’s mission in the fields of animal health and zoonoses, animal welfare and food hygiene.
The duties and responsibilities of the FVO influence its research strategy very directly. FVO research provides politicians, the authorities and institutions, as well as society, with the basic knowledge for future decisions and action on the issues of animal health, food safety, animal welfare and species protection. It also creates a foundation on which the veterinary service can achieve its objectives.
Animal health and zoonoses as a key focus of research

The main points of focus in the research fields of animal health and zoonoses are very much shaped by the Animal Health Strategy Switzerland 2010+. The focus is on internationally controlled animal diseases and zoonoses, as well as on economically relevant diseases of infectious origin. Great importance is also attached to newly emerging and re-emerging animal diseases that are gaining in significance as a result of climate change, increasing migration and the growth of global travel and trade.

Issues of key importance concern the early detection and prevention of diseases. The same applies to cost/benefit analyses of measures to prevent, monitor and eradicate diseases. Research on economically relevant diseases of infectious origin in production animals should be driven forward in coordination and cooperation with other institutions, especially agricultural institutions.

Knowledge on the biology of microorganisms and the interaction between host, pathogen and vector is a prerequisite for effective and efficient approaches to the prevention, surveillance and control of animal diseases. The establishment of the basic pathogenetic and epidemiological principles of transmissible diseases is therefore a constant focus of research.
Projects are promoted in the following areas:

**Prevention of animal diseases and zoonoses**
- Prevention of infection with pathogens
- Implementation of biosafety measures in business (Good Farming Practice)
- Methods of increasing and measuring disease awareness
- New technological tools in the field of vaccines and diagnostics for transmissible diseases that are a focus of FVO research, but are seen internationally as a niche research activity (e.g. vaccines that no one else is developing because they are not commercially interesting)
- Research on the role and reservoir function of wild animals
- Animal by-products: methods and risk assessments for pathogen inactivation, biosafety in biofermentation on agricultural farms
- Measurement of the efficacy and cost-effectiveness of preventive measures.

**Monitoring and surveillance systems**
- Early warning systems: efficient tools for early detection of new and recurring animal diseases and zoonoses
- Research and development of tools for “syndrome” surveillance
- Refinement and further development of surveillance programmes methods to increase their sensitivity and cost efficiency
- Modelling of outbreaks of diseases and zoonoses with different control strategies taking into account various technological methods
- Development of sensitive, specific and low-cost diagnostics for surveillance, monitoring and control programmes
- Cost/benefit analyses of control programmes, especially in the field of economically relevant diseases of infectious origin.

**Food hygiene as a key focus of research**
In the hygiene of food of animal origin, there are numerous points of intersection with animal health and zoonoses, as well as animal welfare. This is also true of the key areas of research. The primary focus is on the concept of the food chain. Particular attention is paid here to the impact of management, monitoring and surveillance of housing and feeding, as well as production and processing of food, on the safety of food of animal origin. What conclusions, for example, can be drawn from information that is gleaned in the production and inspection of food (e.g. in meat inspections or milk quality control) with regard to animal welfare, animal health and food safety risks in the place of origin? Projects on the following themes are welcomed:
- Strategies and measures to reduce the use of antibiotics in production animals: survey and analysis of material flows of antibiotics and analysis of the correlation between use of antibiotics and the situation regarding resistance and resistance development. Aspects of regional and supraregional comparability should be considered here
- Impact of surveillance, inspections, management, animal housing and business type on food safety and quality taking into account the points of intersection with animal health and animal welfare
- Evaluation of the possibilities for drawing conclusions on primary production based on data obtained in the production and inspection of food of animal origin
- Research on associations between findings in slaughter animal studies (live animal examinations), in meat inspections and in herd problems
- Elaboration of basic principles with regard to alternative meat inspections
- Acquisition of knowledge concerning latent zoonotic pathogens found in production animals that also occur in plants representing basic food resources for humans and animals. Establishment of strain collections with adequately characterised strains (virulence and genotyping)
- Cost/benefit analyses of measures, interventions and control programmes for improving the safety of food of animal origin
- Safety of food of animal origin from the consumer's and the expert's perspective: Where are the differences in perception?
- Milk hygiene: causes and intervention strategies in problem businesses
- Game hygiene: establishment of basic data for risk assessments.

**Animal welfare as a key focus of research**
Research of high scientific quality and a high degree of relevance to animal welfare has priority, because it is most likely to result in sustainable improvements for the wellbeing of animals. The effect of animal welfare research could be increased if research was better focused on the areas in which the population shows a lack of understanding for animals (prevention of the humanisation of animals) and on what society understands by the dignity of the animal. Therefore research projects are to be supported that address basic methodological principles for promoting knowledge of the needs of animals and understanding for animals in the population.
Projects on the following topics are desirable:

- Basic scientific principles for assessing animal needs or animal wellbeing. These projects should consider methods both of quantitative and of qualitative animal welfare
- Elimination of animal welfare problems with existing forms of husbandry and development of new concepts for keeping production animals, pets, laboratory animals and wild animals
- Association between animal wellbeing, animal health and food safety with different forms of husbandry from the point of view of the herd and of the individual animal
- Evaluation of the impact of animal wellbeing on existing and future animal welfare regulations
- Cost/benefit analyses of animal welfare measures and husbandry systems appropriate to the animals (in collaboration with agriculture)
- Research in the context of the approval procedure for animal housing facilities
- Avoidance, prevention and refinement of procedures and operations on animals in relation to breeding, husbandry and management
- Evaluation of the validity and benefit of animal experiments
- Aspects of animal breeding relevant to animal welfare
- Methods of anaesthesia and euthanasia.

**Species protection as a key focus of research**

Most FVO research in the field of species protection concerns the implementation of the CITES Convention on International Trade in Endangered Species of Wild Flora and Fauna. The Federal Office for the Environment (FOEN) leads species protection research on indigenous flora and fauna (BAFU). The focus of FVO research in the field of species protection concerns:

- Elaboration of basic principles to support the implementation of the species protection agreement (CITES Identification Manuals)
- Procurement of information that is essential for decision-making processes in the framework of the Conference of the Parties to CITES
- Projects concerning species that are commercially or politically relevant for Switzerland.

**3Rs: reduction, refine and replacement of animal experiments as a key focus of research**

High priority is attached to the support of projects from fields of work in which efforts are focused on abiding by the 3Rs (Reduce, Refine, Replace). These include:

- Projects in which results of animal experiments are replicated using an alternative method, so that the results allow conclusions to be drawn on the relevance of in vitro tests or on the validity of in vivo methods
- Projects with a 3R impact in relation to constraining animal disease models, e.g. in the field of psychiatric disorders, degenerative brain disorders, inflammatory diseases, cancer, infectious diseases, respiratory diseases, metabolic disorders and cardiovascular diseases
- Alternative methods in the field of acute and chronic toxicity testing
- Alternative methods in the field of vaccine development and batch testing as well as in quality control.

The contact point for 3R research projects is the 3R Research Foundation Switzerland (www.forschung3r.ch). The funds in support of the 3R Research Foundation are provided equally by the FVO and Interpharma.
The Federal Veterinary Office (FVO) spent around 21 million francs (CHF) on research and development in the period from 2008 to 2011. This corresponds to an annual average over CHF 5 million and 11% of the entire FVO budget. The spending was around CHF 5 million higher than in the previous reporting period (CHF 15.9 million).
The funds spent on the four-year programme from 2008 to 2011 were invested in research on animal health, animal welfare, species protection and the 3R Research Foundation. The field of animal health also includes meat hygiene and veterinary public health. “General” covers expenditure on research management and projects that cannot be assigned to any of the other fields.

Spending in terms of absolute figures and percentage distribution are shown in table 1. The percentage distribution is also illustrated in figure 1. The values from the period 2004 to 2007 are shown by comparison.

In absolute figures compared with the previous reporting period (2004 to 2007), spending has increased enormously in the field of animal health and fallen slightly in the field of animal welfare. Spending was slightly down in the field of 3R research, as it was also under the heading General.

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Figure 1: Percentage distribution of research spending in the various fields

Table 1: Research spending by specialist field (in CHF 1000s)
Animal health

Research spending in animal health goes on the diagnosis of transmissible diseases (Diagnostics), epidemiology of transmissible diseases (Epidemiology), Latent zoonoses, Residue analysis, Transmissible spongiform encephalopathy (TSE) and Miscellaneous. Table 2 shows the expenditure on these various subfields in absolute figures and in percent compared with the figures for the period 2004 to 2007.

Between CHF 3.3 and 4.2 million was spent on research projects in this field. Compared with the previous reporting period, spending increased in all subfields.

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Animal welfare

Research spending in animal welfare goes on the subfields Anaesthesia, Poultry husbandry, Pet husbandry, Rabbit husbandry, Horse husbandry, Cattle husbandry, Pig husbandry and Miscellaneous. Table 3 shows the expenditure broken down by these various subfields in absolute figures and in percent compared with the figures for the period 2004 to 2007.

In total, over CHF 1 million per annum was spent on research in the field of animal welfare. Spending on the subfields of poultry, rabbit, horse husbandry and anaesthesia was higher than in the last reporting period. Much less was spent on the subfields of pet and cattle husbandry. Research spending on pig husbandry fell slightly.

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Outlook

For the period 2012 to 2015, the FVO has a total research budget of around CHF 20.4 million.

Table 2: Spending on research in the field of animal health (incl. meat hygiene and veterinary public health) by subfields (in CHF 1000s)

Table 3: Spending on research in the field of animal welfare by subfields (in 1000 CHF)
Research for the welfare of animals

Michelle Howald, FVO

Animal welfare legislation regulates the way people deal with animals. The aim of the legislation is to ensure that animals are protected against the unjustified infliction of pain, harm, suffering, fear or against the abuse of its dignity. In very few cases it is about the maltreatment or tormenting of animals. In most cases, animal wellbeing is compromised during the housing, use and breeding of animals without their keepers being aware of this. A feature that is common to all FVO-funded animal welfare projects is that they are seeking solutions to practical problems of this kind. They show animal keepers, supervisory authorities, agricultural consultants and other interested groups how the requirements of the revised animal welfare legislation that came into force in 2008 can be put into practice. In the process, the entitlements of animals and humans are taken equally into account.

The research topics presented here concern problems of relevance to animal welfare, such as white veal, pain in the castration of calves, harmful floors in cow pens for dairy cattle, bone deformations in laying hens, heart disease in dogs and also possible stress in horse walkers and goat pens.

► Online data on individual research projects

Every research project is assigned a project number (e.g. 2.09.03), which enables the data sheets of the projects to be found in the federal ARAMIS database: www.aramis.admin.ch > Project search > (enter number in search field).
Influence of solid feed on the health and production of Swiss fattening calves (2.09.03)

Fattening calves have hitherto been fed with milk or milk by-products, because buyers demanded light, tender meat. This type of feeding leads to iron deficiency, which makes the calf weak and susceptible to disease. To prevent this, the animal welfare ordinance from 2013 onwards requires that “calves aged more than two weeks be provided with an ad libitum supply of hay, corn or other suitable feed to ensure they receive sufficient raw fibre. Straw alone is not considered a suitable feed.”

Ruminant-appropriate feeding of a calf consists of milk supplemented with readily digestible raw feed with an adequate iron content. This strengthens the immune system of the calves, which in turn minimises the use of antibiotics. Straw has hitherto been mostly the only source of raw fibre for calves. Because of its high content of indigestible lignin, it is not suitable for this.

In a research project different feed supplements were tested at various businesses. They had both to be suitable for producing good fattening performance and carcasses in conformity with the market and also to take the health of the calves sufficiently into account. The study results show that whole-plant corn cubes are the most suitable for this purpose. Farmers will thus already have a practicable method at their disposal before 2013.

The optimum supply of calves with iron will lead to reddish veal, the acceptance of which will have to be increased among buyers and consumers.

Effect of different rubber ring techniques on postoperative pain following castration in the calf (2.07.02)

According to the animal welfare ordinance, trained animal keepers may only castrate male calves up to the age of two weeks themselves under local anaesthesia. It is known that the rubber ring technique preferred for castration causes long-term pain.

The aim of this study was to reduce the chronic pain and find a method that can be performed by technically trained people. Various combinations of rubber rings were compared with other techniques: clamping the spermatic cords using Burdizzo forceps; using several rubber rings at the same time and as a result increasing the clamping force of the rings; cutting off the necrotic scrotum.

Calf behaviour displaying signs of pain and clinical pain symptoms were assessed. It could thus be scientifically demonstrated that the method of applying the rubber ring and cutting off the dried scrotal tissue on the ninth day is the method of choice for postcastration healing that is almost pain free without complications. Compared with the previous traditional rubber ring castration, the new method is only associated with minimal extra time and effort. Since this study, animal keepers have been learning to use the improved method in compulsory training courses.
Elaboration of basic recommendations for the loose housing of goats in small groups (2.05.05)

Although loose housing for goats is the appropriate form of housing for these animals, goats in Switzerland are still often tethered, especially in small herds. In a research project, recommendations were therefore elaborated for the design of the loose housing of goats in small groups.

The study examined the distance goats need when feeding and the structural measures required to ensure that weaker animals can also feel at ease in the group. It was found to be very important for goat pens in the activity area and the feeding area to be structured with sight screens, partitions and elevated levels, so that the goats can keep out of each other’s way at any time – especially when space is confined in the case of smaller herds. This has been proved to reduce the number of disputes between the animals and the risk of injury. This is especially important for horned goats. But the recommendations also apply to hornless goats.

It is likely to be of particular interest to goat keepers that, with a design appropriate to the needs of goats, the space required in the loose pen is hardly any greater than when the goats are tethered. The researchers have created a leaflet showing conversion solutions that is useful both for farming advice and also for cantonal enforcement. Download the German version at www.bvet.admin.ch > Enter “Merkblatt Ziege” in the search field.

Sternal deformations in Swiss laying hens (2.09.01)

Most laying hens in Switzerland are kept in cages. It is known from abroad that cage layers often show sternal deformations, most of which are due to healed fractures. In this research project, therefore, slaughter flocks were studied to establish our hens also suffer from painful fractures and their consequences. The hens were palpated for fractures either when they were taken out of the cages or when they were on the slaughter line.

In addition, experiments were carried out with a vitamin D3 feed supplement that was intended to strengthen the bones. The effect of different metal or plastic perches and also genetic influences were studied too. While the desired effect of vitamin D3 failed to materialise, plastic perches led to significantly fewer sternal lesions than the metal perches.

The study showed that sternal lesions are a common and painful problem – and thus of relevance to animal welfare – for the housing of laying hens in Switzerland. The approving authority of the FVO has therefore not yet issued a permit either for mass-produced housing systems or for the new, high cage systems. The results of supplementary studies first have to be awaited.

Evaluation of the nest characteristics crucial to the appropriateness of group laying nests (2.08.02)

According to Swiss animal welfare legislation, mass-produced nests for laying hens have to be tested for their appropriateness to the animals’ needs before they are approved for marketing. What characteristics do commercially available group nests with a built-in collection belt have to show to make sure the hens lay their eggs there and not in the bedding?

It is already known from earlier studies that hens prefer nests enclosed by curtains, because these nests offer the possibility to retreat. Yellow nests are also better accepted than red, blue and green nests.

This project was devoted to the importance of the incline of the nest floor – important for the rolling of the eggs onto the collection belt –, the construction of the curtains and the landing facility. Hens prefer nests that show only a very slight incline. And strip curtains that allow easier access to the nest are preferred to curtains made of a single piece of plastic. The number of nest visits and the quantity of eggs laid in the nests are the basis for these findings. It was further shown that it is better to fit plastic railings in front of the nests rather than two perches made of wood. Hens feel safer in the group when search-
ing and moving on the plastic railing platforms than on wooden perches. The approving authority of the FVO thus has at its disposal further criteria of assessment for group nests based on scientific evidence.

**Studies on the use of horse walkers (2.09.02)**
An estimated 15% of horses are regularly walked in so-called carousels. These horse walkers have several spacious sections, in which one horse each can run. The partitions arranged in the shape of a fan between the horses determine the direction in which the horses move, because the horses veer away from them as they approach.

With a group of young horses that have not yet had any experience with horse walkers, this study tested whether the horses are stressed when the partitions are electrically powered.

At the start of the observation phase, several horses managed to change sections of their own accord, which resulted in two horses in the same section. When an electric current was applied, the horses learned permanently to stop the potentially dangerous behaviour of changing sections – regardless of whether the electricity was switched on or not.

The animal welfare ordinance forbids the practice of driving or punishing animals with electricity. In the carousel, however, the electricity serves to keep the horses apart. Measurements of cortisol concentration and heart rate as proven stress parameters also showed no differences, regardless of whether the horses ran with or without the use of electricity. It was thus concluded that horses are not stressed by electrified partitions in horse walkers.

**Genetic transmission of subaortic stenosis in Newfoundlands (2.09.08)**
Newfoundlands are one of the dog breeds in which subaortic stenosis (SAS), a heart disease of various animal species and breeds, is quite common and often leads to death in early adulthood. It is becoming an ever growing problem in Europe.

To determine a suitable breeding strategy, the genetic background of this disease had to be investigated, since just as little is known about this as is known about how subaortic stenosis is passed on.

Breeders of Swiss and German Newfoundland clubs, which enjoy a lively exchange of animals and information, provided the research project with extensive information on parentage and descent. Newfoundlands suffering from SAS were more frequently inbred and more closely related than healthy dogs, which suggests that the disease is genetic.

Segregation analysis provided clear evidence of an individual main genetic risk factor. It thus makes sense to conduct molecular genetic studies in search of a causal mutation, with a view to then developing a genetic test. As long as there is no genetic test, breeders should have heart certificates for all breeding animals. It is further recommended that breeding values be used as a selection criterion for SAS, in order to breed against the disease. It is possible that not all carriers show SAS symptoms.
Future research for the welfare of animals

Michelle Howald, FVO

Studies on the appropriateness to animals of ever more popular forms of housing, such as group housing of horses, are research topics that are just as important as painful procedures which, for reasons of cost, also have to be carried out by semi-skilled animal keepers. A research project is being undertaken to establish whether the training courses offered and the devices specially developed for this will prove successful.

For the first time, an extensive project is being carried out to investigate the situation regarding hoof care and hoof health of dairy cows. Initial results show that there is urgent need for action here. An innovative approach is to determine animal welfare criteria that enable animal welfare inspections to be conducted in the slaughterhouse. Since these inspections allow conclusions to be drawn on animal welfare in the businesses of origin, the businesses could be checked using a risk-based approach – as a result, good animal housing would be inspected less often and the resources of the enforcement bodies deployed in those places where there is a need for action.

Online data on individual research projects

Every research project is assigned a project number (e.g. 2.09.03), which enables the data sheets of the projects to be found in the federal ARAMIS database: www.aramis.admin.ch > Project search > (enter number in search field).
Assessment and improvement of social coexistence of adult horses in group housing systems in Switzerland (2.12.03)

Horses are increasingly housed in groups, because this form of housing best meets the natural needs of these social animals that are built for movement. But it is demanding in terms of group composition, design of the housing systems and feeding management, especially when space is limited or unsuitable. If a stable hierarchy has not been established or there is competition for feed or resting places, there is a risk of injury and negative effects on the wellbeing of animals are increased.

These risk factors are being studied in the research project through observations of neighbourhood preferences and measurements of resting behaviour, activity and heart rate during feeding. This will provide indicators for evaluating the social structure and compatibility of horses. During inspection visits, the status quo of the group housing will also be assessed and implementation of the new animal welfare legislation will be recorded. Based on the impact of the business-specific proposals for optimisation, practicable measures are to be defined for the improvement of group housing systems and feeding management. These measures will be of equal benefit to animal keepers and to advisory and inspection organisations.

Scientific monitoring of anaesthesia during castration of piglets (2.11.02)

Since 1 January 2010, male piglets may only be castrated under anaesthesia. The farmer carries out the procedure himself using anaesthesia with isoflurane gas, if he is qualified to do so. Otherwise the veterinarian carries out the procedure administering the anaesthetic by injection. Isoflurane has only a very weak analgesic effect. In the case of anaesthesia by gas, therefore, the piglets have to be given an additional analgesic 15 minutes before castration. There have been various reports of an inadequate depth of anaesthesia, dizziness in the farmer or loss of piglets. In this research project, therefore, the occurrence and causes of such problems during piglet castration are being scientifically studied.

In a questionnaire, farmers were asked about details of problems with anaesthesia. Later on, during castration, they were visited. Three problem areas were observed during the visit: the quality of anaesthesia both with isoflurane and with injection must be further improved; and the workplace safety of the farmer, who must not be exposed to isoflurane, is likewise to be increased.

Although the study is still in progress, measures for improvement have already been initiated. It is also planned to present the results at as many farming events as possible once the study has been completed, in order to inform farmers about the weaknesses and how to remedy them.

Hoof care in Switzerland – an analysis of the situation (2.10.04)

The situation regarding hoof health and hoof trimming in dairy cows is unsatisfactory in terms of animal welfare and animal health and is not in keeping with the requirements of modern dairy cattle husbandry and milk production. In a large-scale study it was found that lameness occurs in 80% of dairy herds, with two thirds of almost 1,500 cows tested suffering from at least one
major hoof disease. In a risk factor analysis, factors were identified that predispose to the occurrence of various diseases.

Painful procedures in the toes are often carried out without anaesthesia – contrary to animal welfare regulations. There is also a lack of well-qualified hoof trimmers. A project survey showed that hoof trimmers, veterinarians and animal keepers often fail to cooperate adequately and represent clearly differing views of pain and the benefit of anaesthesia. The aim of this project is to undertake an in-depth analysis of the situation and achieve sustainable improvements.

In the third subproject, the effect of congestion anaesthesia with or without the administration of analgesics on perioperative and postoperative pain and wellbeing was evaluated in the treatment of painful hoof diseases. It was also demonstrated that excision is painful. In addition, the practicability of local anaesthesia (retrograde intravenous anaesthesia) was studied. All this will lead to practicable recommendations for veterinarians on the subject of pain management in hoof treatment.

The results of the overall project will allow a first major step towards a sustainable improvement in the present unsatisfactory situation in the field of hoof health and painful hoof treatment.

Animal-focused animal welfare criteria in the slaughterhouse as a data source: survey and validation of animal-focused animal welfare criteria at Swiss cattle slaughterhouses (1.11.12)
Animal welfare criteria (e.g. lameness) that are animal focused (i.e. measured in the animal itself) reflect the interaction between the animal and its environment, unlike resource-focused animal welfare criteria (e.g. stable floor area). The study is part of the research project “The slaughterhouse as a data source for surveillance and inspection programmes” and is aimed at establishing and validating animal-focused animal welfare criteria at Swiss cattle slaughter businesses. The development of such animal welfare criteria is based on a political demand to objectify animal welfare in Switzerland and to design more effective animal welfare controls.

At the slaughterhouse, findings are obtained not only in the inspection of slaughter animals (e.g. degree of soiling), but also in the inspection of meat (e.g. inflammation of the lungs). With the aid of a survey among veterinarians engaged in meat inspections a selection of suitable criteria were established and specific keys developed for each one that enable them to be quickly and easily applied and reproducible results to be obtained. They were then tested for feasibility and prevalence in the framework of a continuous record of results obtained at two large cattle slaughterhouses. This sample record of results should serve to filter out the most suitable criteria. To facilitate interpretation of the findings and validate their significance, the data collected at the slaughterhouse are then compared with the situation at the businesses of origin.

If these animal welfare criteria stand up to the validation, then it is conceivable that this kind of data collection could be rolled out nationwide at cattle slaughterhouses throughout Switzerland. The businesses of origin could thus be assessed more comprehensively in terms of animal welfare, and future inspections at businesses of origin could be conducted using a risk-based approach. At the same time, such a monitoring system could provide indicators for evaluating the impact of Swiss animal welfare legislation.

Is the cow lame? Is she very dirty? Animal welfare criteria such as these can be recorded at the slaughterhouse. High rates of unusual findings can lead to targeted inspections on individual farms (project 1.11.12).
In the period from 2008 to 2011, a wide range of issues were addressed in the field of animal health and food safety. The use of vaccines in the control of animal diseases is a topic of international debate, and in Switzerland, too, knowledge on this issue is needed for the decision makers.

Two national control programmes (Blue-tongue and Bovine Virus Diarrhoea) are subject to close scientific monitoring, and the results of research work are continuously being integrated into the control concepts.

In Switzerland, there are 17 different surveillance programmes in total. The development and improvement of methods ensures that the validity and costs of these programmes are constantly being optimised.

Addressing issues concerning campylobacter, the use of veterinary medicines and slaughter hygiene allow the Swiss Veterinary Service to ensure that food safety is maintained at a high level.

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Vaccine concepts in the control of animal diseases

With the occurrence of highly infectious animal diseases, the selective use of vaccines in the control of diseases is increasingly demanded by various countries in Europe. In order to reach a comprehensive decision on the use of vaccines in the control of a given animal disease, it is necessary to be fully abreast of the epidemiological, economic and socio-ethical aspects of control for the animal disease in question. Such knowledge has often been lacking in Switzerland and Europe to date.

In the reporting period, various projects addressed one or more of these aspects of animal disease control. The focus in these projects was on the use of vaccines in an outbreak of a highly infectious animal disease, such as foot-and-mouth disease (FMD) or classical swine fever (CSF). Following the unexpected emergence of cases of bluetongue (BT) in northern Europe and Switzerland in 2006 and 2007 and the start of the BT vaccination campaigns in 2008, some projects also specifically addressed the question of the most suitable vaccination strategy for BT in Switzerland.

Findings from the studies form the scientific basis for selecting appropriate control strategies for highly infectious animal diseases and BT, and thus serve to optimise the control of animal diseases in Switzerland. These selection procedures consider not only the influence of the various control strategies on the epidemiological course following an outbreak of disease, but also the economic costs and the perception of the disease in the population. This is illustrated below on the basis of some examples.

Vaccination concepts for the control of highly infectious animal diseases as part of Switzerland’s animal health strategy (1.08.06)

Foot-and-mouth disease (FMD) and classical swine fever (CSF) are two highly infectious animal diseases that can cause substantial economic damage. They make susceptible animals (all biungulates, such as cattle, sheep, goats and pigs, in the case of FMD and pigs in the case of CSF) severely ill. Switzerland is free from both diseases. However, there is a risk of the diseases being imported through the purchase of animals or via contaminated meat. To be well prepared for a possible outbreak, it is important to know what the most effective control measures are for Swiss circumstances.

Switzerland primarily pursues a non-vaccination strategy in the prevention and control of highly infectious animal disease. In the event of a disease outbreak, the culling of all susceptible animals of affected herds and restrictions on the transportation of animals are the central control measures. In a simulation model, this basic strategy was compared with control strategies that include, as additional measures, vaccination within different radii of infected farms and also, in the case of CSF, ring culling (culling of all pigs within a certain radius of infected farms). Results show that the basic measures are adequate for CSF and neither different vaccination strategies nor ring culling within 1 km – either alone or in combination with vaccination – offer any advantages in terms of the scale and duration of an outbreak.

In the case of FMD, it has also been shown that additional emergency vaccination at the start of an outbreak does not offer any advantages over the basic strategy. However, if a major outbreak has
already taken hold and vaccination within a radius of 10 km is used, this will tend to reduce the scale and duration of the outbreak. Such scenarios no longer represent an actual emergency vaccination strategy, but rather a comprehensive vaccination strategy as a supporting measure in the eradication of the disease. The results of this study help determine the most effective control strategy in the event of a highly infectious disease such as CSF or FMD entering Switzerland. This scientific basis is important for implementing individual performance targets of the Animal Health Strategy Switzerland 2010+ and in particular for optimum emergency planning for highly infectious animal diseases.

After the decision in 2008 to vaccinate all cattle, sheep and goats nationwide against bluetongue (BT), the question arose as to which vaccination strategy is most effective for Switzerland and what immunisation coverage rate is needed to protect the susceptible population from infection with the pathogen. To answer these questions, a simulation model was developed. The parameters of the model were estimated on the basis of BT outbreak data from Germany. Using the estimated parameters and population and temperature data stratified according to altitude, the effect of various vaccination strategies on the course of the BT epidemic was simulated. The results of the simulations showed that, depending on the rate of immunisation coverage achieved, vaccination can substantially reduce the scale of the epidemic and hence also the associated economic damage, especially in the event of a first outbreak of BT in a naive population. In a closed population, vaccination can also lead to eradication of the disease. In the case of annual reinfections, however, a vaccination cannot completely prevent an outbreak or at high altitudes can only do so with a high rate of immunisation coverage. This shows that the epidemiological situation and control measures in the countries bordering on Switzerland have a substantial influence on the success of efforts to eradicate BT in Switzerland.

Economic assessment of surveillance programmes that form part of the National Control Plan of Switzerland (1.08.09)

Both surveillance and control are aimed at protecting the health of animals and humans and avoiding losses arising as a result of disease, such as reduced milk or meat production or zoonotic infections in humans. However, since the requisite measures also cost money, economic assessments are also needed to estimate what combinations of surveillance and control programmes are acceptable and offer the greatest benefit. Economic principles and concepts provide a basis for analysing how public money can be used as cost-effectively as possible to reduce animal diseases and can achieve the greatest possible added value for society. An important concept here is the consideration of surveillance and control activities as economic substitutes, i.e. for the reduction of animal diseases they are replaceable to a certain degree. In such a case, the most cost-effective combination of surveillance and control should be used so that the benefit to society is maximised.

In this project, the surveillance and control programme for bluetongue (BT) in Switzerland was evaluated on the basis of a cost-benefit analysis amongst other things. A retrospective analysis was carried out for the period 2008–2009 and a prospective analysis for the period 2010–2012. In both analyses, the national vaccination and surveillance programme used was compared with the hypothetical best possible alternatives. The best possible alternative for the retrospective analysis was described as voluntary vaccination in combination with surveillance. Two alternative scenarios were selected for the prospective analysis: surveillance plus voluntary vaccination and surveillance without vaccination. For all scenarios the expenditure for surveillance and control as well as disease costs in the ovine, caprine and bovine population were calculated and compared.

In the period 2008–2009, the implemented programme achieved a net benefit of 3.95 million Swiss francs (CHF) compared with voluntary vaccination plus surveillance. By contrast, the prospective analysis showed that a continuation of the implemented programme would result in additional net costs of CHF 12.93 million and CHF 8.11 million compared with voluntary vaccination plus surveillance and surveillance without vaccination, respectively. This is explained by the fact that the losses caused by disease – and therefore the possible profits – are very small in a completely vaccinated population, whereas the continuous vaccination of the bovine and ovine population generates high annual costs. Continuation of the national compulsory vaccination programme for BT was therefore not recommended for economic reasons. On the basis of these results and since no more animals fell sick with BT virus infection in 2010 and the infection risk was markedly reduced thanks to the successful vaccination campaign in Switzerland, it was decided to stop the compulsory vaccination of cattle and sheep in Switzerland in 2011.

Culling or vaccination of animals: acceptance among Swiss consumers (1.09.05)

The culling of infected and at-risk animals is meeting with growing resistance among the public, and conservative disease control that preserves the lives of animals is increasingly being demanded at national and international level. This study was aimed at investigating the acceptance of a culling strategy versus a vaccination
strategy in the Swiss population. One question that remains to be answered with regard to a vaccination strategy is whether Swiss consumers buy the meat of animals that have been vaccinated against a disease. Associated with both issues is the identification of factors that influence acceptance.

To investigate these questions, surveys were carried out among the general population, farmers and veterinarians. An experiment was then carried out with the Swiss population to establish whether differences in information lead to different reactions. The results showed that vaccination strategies tend to be more acceptable to the general population and also to veterinarians and farmers than culling strategies. However, there are marked differences between the three stakeholders in terms of the degree of acceptance. Further results in relation to the population showed that, compared with culling, the vaccination strategy was perceived as the more ethical of the two strategies. However, trust in the federal offices (FVO, FOPH) has a positive influence in the population both on the acceptance of a vaccination and culling strategy. Only 26 % of the respondents from the general population would accept meat from animals vaccinated against purely an animal disease or against a disease that is transmissible to humans. This means that people do not link their considerations on the acceptance of animal vaccinations with the fact that the meat from these animals might enter the food chain later on. In conclusion, people estimate situations differently depending on the role in which they are approached (citizen vs consumer).

The fact that differences were found between all stakeholders surveyed should be taken into account in any possible implementation strategy. For example, farmers tended to be closer to the general population in their judgments than to the veterinarians. A further important result that could play a role in implementation, especially with regard to communication, is the fact that farmers from German-speaking Switzerland tend to trust the veterinarians more than the FVO. A further point that should be considered for communication is that the perception in the general population differs substantially depending on whether the disease concerned is purely an animal disease or is transmissible to humans. Generally, the population has very little knowledge of meat production, vaccination in general and the applicable guidelines on vaccination and control strategies in Switzerland. When there is little knowledge, trust plays an especially important role. This factor is therefore not to be underestimated. Overall, however, few public debates are to be expected in relation to animal vaccinations, because, compared with other approaches (e.g. antibiotics), they were seen as less risky and more acceptable.

Scientific monitoring of bluetongue vaccination campaign

In the summer of 2008, all cattle, sheep and goats were vaccinated against bluetongue (BT) for the first time. The short-term planning and implementation of the nationwide vaccination campaign against BT posed a major challenge for Switzerland. The vaccination campaign was closely monitored by research in order to learn from the experience for future vaccination and control programmes.

Regional and spatial analysis of bluetongue in Switzerland in 2009 and 2010: surveillance and vaccination (1.10.18)

Active surveillance of bluetongue has been practised in Switzerland since 2007, when the first cases of the disease occurred. From summer 2008 onwards, it was controlled annually with national vaccination campaigns. The cantons were responsible for their implementation. In 2008, availability of the vaccine meant that vaccination could not start until late in the year. It was found that the regional vaccination rate varied widely in some cases. After the vaccination in 2009, however, these differences were much less marked.

The aim of this project was to establish whether there were any geographical differences in the occurrence of BT cases after the vaccination campaigns of 2008 and 2009 and to what extent this might be due to the differences in vaccination rate between cantons.

With the aid of a model it was possible to show that, although the number of BT cases fell nationally between 2008 and 2009, there was no correlation between the vaccination rate and the number of cases in the various regions. In 2008 the risk of infection was increased in the western and north-western parts of the country, regardless of the vaccination rate. The results show that a national vaccination campaign can be successful, even if there are regional differences in the vaccination rate. A higher risk of infection was also found in those parts of the country that border on French territory with a very low vaccination rate.

The results allowed the vaccination regulations to be relaxed in 2010 and animal keepers to be exempted from the obligation to vaccinate. The importance of coordinating the measures with other countries was shown. This coordination reached a high level in efforts to control bluetongue.

Surveillance and increase in awareness of bluetongue (1.07.15)

After the first cases of bluetongue were discovered in 2007, it was uncertain whether there might not already be other cases in Switzerland. A study was therefore carried out to establish whether surveillance revealed geographic differ-
ences in intensity. The surveillance of 2007 and 2008 was studied. This consisted of regular monthly testing of tank milk samples from 200 selected farms, increased clinical surveillance and targeted clinical surveillance of selected herds of sheep.

Global and specific tests were carried out in geographic clusters. The latter were tested for significance using a Bayesian method. Taking into account geographic differences in surveillance, regional prevalence estimates were also calculated with the aid of a model. Two clusters were identified in which the surveillance was statistically significantly better: a large cluster lay in cantons AG, BL, BS, JU and SO. A small cluster lay in canton TI. The global cluster test confirmed this finding. The calculation showed that prevalence was ten times greater in the northern cluster area than in the rest of the country.

The results showed a high level of surveillance in Switzerland in 2007 and 2008. The higher prevalence in a region with increased surveillance suggests a regionally limited infection and makes a nationwide spread of the disease unlikely at this time. The increased surveillance in the region where the first cases were found shows that the first infection in Switzerland probably occurred here. The study showed that a gradual approach to vaccination in 2008 would have made sense, starting with the first vaccinations in the cluster region.

Bluetongue vectors (Culicoides spp.): definition of parameters that determine vector-free periods and regions in Switzerland (1.08.10)

When the bluetongue virus (BTV) suddenly occurred in Europe, hardly anything was known about the geographic and temporal occurrence of biting midges of the genus Culicoides. These are the insect vectors of BTV and other disease pathogens currently or potentially occurring in Europe. For three years, midges were caught at one site each in the 12 climatic regions of Switzerland using UV light traps, always once a week over-night. Since the morphological determination of these tiny (1–3 mm) insects is time-consuming and in some cases extremely difficult, molecular tests (real-time PCR, mass spectrometry [MALDI-TOF-MS]) were developed.

Midges were found in all climate zones. So there are no farmed regions in Switzerland without midges. The largest traps (about 60,000 per season) were made around Basel; in the highest trap location (Juf, 2,130 m) the fourth most numerous midges (about 22,000) were caught. The midge-free period for Switzerland in all three years was the time between week 51 (mid-December) and week 18 (end of April). The molecular identification of the midge species gave different results at the various trap locations. At the nine sites below 1,500 m midges of the Obsoletus complex were by far the most predominant (85–98 %). In Central Europe they are held largely responsible for the transmission of BTV. At the three higher test sites, the dominant species of midges were from the Pulicaris complex, although midges of the Obsoletus complex were also present at all sites.

The seasonal vector-free period determined in this study enables appropriate relaxations in international animal trade to be established in relation to diseases transmitted by midges. The newly elaborated molecular tests of determining species will allow the prompt identification of the locally involved midge species in future outbreaks of diseases transmitted by midges.

Accompanying scientific study on the vaccination campaign against bluetongue in Switzerland 2008/2009 (1.09.04), Bluetongue disease: impact of the 2008 vaccination on fertility in supervised dairy herds (1.08.21) and Investigation of abortions and other animal health problems associated with bluetongue virus vaccination (1.09.07)

In compulsory vaccination campaigns, possible adverse effects of the vaccines and undesirable consequences of the vaccination campaign are of key importance. Even before the start of the vaccination campaigns against bluetongue (BT) various accompanying scientific studies were planned to estimate the occurrence and extent of adverse effects. In the course of the vaccination campaign, clusters of abortion events and increased milk cell counts were repeatedly observed on farms. Three studies focused on a possible correlation of these observations with BT vaccination. Data on fertility and milk quality from periods before and during BT vaccination were evaluated at population and herd level and the results compared with each other. A cross-section study also reviewed the problems reported by business in relation to BT vaccination.

There was no evidence to suggest that the vaccination against BT had a significant negative influence on the fertility or udder health of dairy cows at population level. In particular, it was demonstrated with a degree of probability verging on certainty that there was no link between BT vaccination and abortions that were frequently reported to be a result of BT vaccination. Experiences gathered in the course of the projects showed that serious problems may occur in a few isolated cases, either directly or indirectly, following BT vaccination. When the vaccination campaign is subjected to a nationwide cost-benefit analysis, however, the BT vaccination must continue to be recommended.
Bluetongue (BT) in Swiss sheep breeds: evaluation of clinical signs and diagnosis in experimental infection with the BT virus serotype 8 (1.07.10)

The clinical picture of bluetongue (BT) varies in sheep depending on their breed and age, as well as on the serotype and strain of the BT virus (BTV). Until now there have been no data describing the susceptibility to BT, the clinical picture and any differences between breeds in sheep indigenous to Switzerland. Yet such information is very important as a basis for the clinical surveillance of flocks of sheep in Switzerland. The same applies to data on the pathological changes to be expected and to any leads on parameters of relevance for laboratory diagnosis. To clarify this, infection studies were carried out in 2007 with BTV serotype 8 (BTV-8), which is in circulation in northern Europe. In this study, the four most common sheep breeds in Switzerland were infected with BTV-8.

Results showed that the four Swiss sheep breeds studied were susceptible to BTV-8. Moderately severe symptoms characteristic of BT were observed. No differences were found between breeds. Most of the infected animals showed fever, swellings of the head, erosions of the mouth and subcutaneous haemorrhages. In addition, all infected animals showed bleeding in the wall of the pulmonary artery that was typical of BT. A pregnant animal gave birth to a malformed lamb. The diagnosis of BT was established and optimised thanks to animal experiment samples. Training material for veterinarians, pathologists and animal owners as well as publications were also produced to increase awareness of the disease.

Scientific supervision of the eradication of bovine virus diarrhoea (BVD)

Since 2008, Switzerland has had a mandatory national programme in place for the control of bovine virus diarrhoea (BVD), aimed at eradicating the disease from the Swiss cattle population. In economic terms, BVD is one of the world’s most significant animal diseases. It is responsible for significant losses because it causes abortion and leads to reduced fertility and performance of infected animals. The disease is spread mainly by persistently infected (PI) animals, which continue to excrete the virus throughout their lives. The eradication programme is therefore based on identifying and removing these PI animals from the population. To this end, all cattle and newborn calves are tested for the virus. Switzerland is the first country to use this method for eradication. Scientific supervision of the control measures used is therefore vital. Close supervision by researchers has made it possible to update and therefore fine-tune the programme in line with the prevailing disease situation and current expertise. This is illustrated below by a number of examples.

Efficiency of control measures for BVD eradication in Switzerland (1.08.19)

As part of the bovine virus diarrhoea (BVD) eradication programme, an epidemiological model was developed in order to evaluate various surveillance strategies for the period after the eradication phase.

The model was based on the data gathered during the eradication programme and on data from the national databases. It took account of both dairy herd dynamics and animal movements within Switzerland. Based on changes in the prevalence of PI animals and the prevalence of antibodies in the population, it was possible to demonstrate the effect of different surveillance and control strategies. Two possible surveillance strategies were compared: first, the antibody testing of blood from young calves, starting from June 2010, and second, the antibody testing of milk from animals in their first lactation, starting from June 2011.

The results revealed no clear difference in effectiveness between the two surveillance strategies. Taking the costs into consideration, it emerged that antibody testing of milk is the cheaper of the two strategies. The model also showed that the continued testing of newborn calves for the BVD virus (nationwide calf testing) for an additional year, before changing over to monitoring by testing animals for antibodies, would accelerate the eradication process. This finding had a significant influence on the decision to continue nationwide calf testing until the end of 2012.

Optimisation of BVD eradication in Switzerland (1.08.15) and BVD seroprevalence pilot projects (1.11.10)

Following the successful control of bovine virus diarrhoea (BVD), the success achieved is to be consolidated and safeguarded in future by top-quality surveillance. But what is the most efficient way to design the surveillance programme? It was necessary to investigate the information required about the most suitable testing method and surveillance strategy.

A study was carried out to compare different methods (western blot and various ELISA tests) for detecting antibodies in blood and in milk. The results showed that the detection of antibodies to BVD virus in blood is more reliable than that in milk. In addition, the generally higher antibody titres in blood make it possible to pool blood samples, leading to cheaper testing.

To prepare for the transition to serological monitoring of BVD, two seroprevalence testing studies were carried out in the autumn of 2010
and the spring of 2011. Blood samples from young animals between the ages of 6 and 18 months and milk samples from cows in their first lactation were tested for BVD antibodies. A distinction was drawn between farms which had had no persistently infected (PI) animals in the herd for at least 12 months (group 0) and those which had had a PI animal in the herd within the last 3 months (group 1).

In autumn 2010, the seroprevalence among the young animals was 2.3%. Around 9% of the farms tested had at least one seropositive animal in the herd. In spring 2011, the seroprevalence in the group 0 farms was 0.6% for the young animals and 13.8% for the cows in their first lactation. On the group 1 farms, 47.2% of the young animals and 66% of the first-lactation cows were seropositive. With regard to sensitivity, the study showed no significant difference between the testing of young stock and first-lactation cows. On the other hand, specificity was significantly higher for the testing of young animals. In addition, there was a slightly (but not significantly) higher specificity when only the animals that had never left the farm were tested. The results also showed that herd management can have an effect on the seroconversion of the animals on a farm. Based on the results of the studies, the recommended, preferred option is to test the blood of young animals for BVD antibodies. The animals tested should have been kept on the farm since birth. Even a single animal testing seropositive in the young animal group should lead to whole-herd testing.

The study findings formed the scientific basis for future BVD surveillance in Switzerland and are reflected directly in the concept for the BVD monitoring phase.

Seroprevalence and characterisation of pestivirus infections in small ruminants and New World camelids in Switzerland (1.08.20)

In connection with the eradication of bovine virus diarrhoea (BVD) in the Swiss cattle population, it is important to investigate the incidence of pestiviruses in other domestic animals which might serve as a potential reservoir. This project therefore tested sera from sheep, goats and New World camelids in order to obtain an up-to-date estimate of the seroprevalence of pestivirus infections in these species and to differentiate the pestiviruses concerned.

The results showed that the seroprevalence of BVD virus in sheep, goats and New World camelids is low. The risk of retransmission of BVD virus from small ruminants and New World camelids to cattle seems to be low, therefore, except in the case of close direct contact in mixed herds, common pasturing and shared Alpine grazing.

Risk of transmission of infectious diseases from wild animals to domestic animals

Animal diseases or zoonoses that also occur in wild animals are particularly difficult to control and monitor. In such cases, the disease persists in the wild animal population even after its eradication in domestic animals and continues to pose a threat to domestic animals from that wild reservoir. With increasing extensive farming of livestock, there is more frequent direct contact between farm animals and wild animals and an increased risk of disease transmission.

In order to assess the risk posed to the livestock population by a possible wild animal reservoir, we need information on the disease situation in the wild animal population. After establishing factors that favour the risk of disease transmission, targeted measures can be taken to protect the livestock population against infection. A project that was concerned with these themes and issues is presented below.

Risk factors for a spillover of infectious diseases from wild boars on outdoor pigs in Switzerland (1.07.19)

The wild boar population and the number of outdoor-reared pigs in Switzerland have been rising for many years, increasing the risk of contact between wild boars and domestic pigs and hence the risk of transmission of disease agents. The aim of this study was to gauge this risk.

From 2008 to 2010, blood samples were collected from 252 wild boars from two risk areas. Tests indicated infection with Brucella spp. (identified as B. suis biovar 2) in nearly 30% of the wild boars. Indeed, antibodies were demonstrated in 36% of the animals, which was significantly higher than in previous studies. This points to a spread of B. suis biovar 2 in the Swiss wild boar population. The animals were also tested for porcine reproductive and respiratory syndrome virus (PRRSV). Antibodies were detected in only one animal, so PRRSV does not appear to be significant at present.

A comparison of the geographic distribution of registered domestic pig farms and the occurrence of wild boars showed that the risk of interaction between wild boars and domestic pigs is highest in the southern foothills of the Jura. Two factors might increase this risk in the future: on the one hand, the wild boar population in Switzerland is increasing dramatically according to the evaluation of hunting and road accident statistics. On the other hand, photo trap monitoring of green bridges shows that barriers such as motorways are no obstacle to the spread of wild boars from the Jura to the Mittelland region. A survey of gamekeepers and pig farmers on wild boar/domestic pig interactions showed that these – including cross-breeding – are on the
increase and set to rise further. Close proximity of buildings and forests or poor fencing encourage such contacts. Cross-breeding was more frequent in woolly pigs than in other breeds.

Blood and tissue samples from over 200 outdoor-reared pigs on 13 farms were tested for *Brucella* spp. A brucellosis outbreak was detected on one of the high-risk farms. Infected domestic pigs were subsequently discovered on two further farms. The origin of the infection remained unknown. However, the exchanging of animals between small farms led to the spread of the infection.

Overall, there is a serious risk of *B. suis* transmission from wild boars to domestic pigs. The risk factor analysis offered suggestions for the targeted use of protection measures, with a focus on the quality (height, robustness) of fences. The study also points to the need to provide farmers and slaughterhouse workers with better information about infectious diseases and to carry out serological testing before any exchange of animals, in order to improve disease surveillance.

**Developments in surveillance systems**

Since 1994, Switzerland has carried out surveillance programmes to document freedom from infectious bovine rhinotracheitis (IBR) and enzootic bovine leukosis (EBL) on a sampling basis. Switzerland has a total of 17 different surveillance programmes. 15 programmes have their legal basis in bilateral arrangements to simplify commercial activities. These many surveillance programmes with high technical standards related to statistical power (reliability, detection limit, accuracy and representativity) are expensive and resource intensive.

Several studies have developed methods in which the loss of statistical power of a surveillance programme is estimated into the following year. A quantitative import risk assessment, a model of the spread of unrecognised cases of disease, and an estimate of the decline in the predictive value of historical data based on population renewal by restocking led to the optimisation of the surveillance programmes. Carrying out programmes on an annual basis compensates for the expected reduction in validity of the documenting of disease-free status. These methods lead to much smaller sample sizes while maintaining statistical power.

Further steps to optimise methods were taken in the reporting period (2008–2011). The use of the scenario tree method and risk categories, and the inclusion of bulk milk samples as test material make it possible to optimise the programmes further in terms of validity, sample sizes and costs.

**Development and evaluation of a model for risk-based herd sampling to substantiate freedom from disease (1.08.16)**

Surveillance programmes that are carried out repetitively (e.g. to document freedom from a disease) need to be optimised on an ongoing basis. The validity and cost efficiency of a targeted selection procedure were compared with random sample selection, as applied in Switzerland. Using the examples of infectious bovine rhinotracheitis (IBR) and enzootic bovine leukosis (EBL), the major risk factors for the introduction of the infection into cattle farms were identified based on the literature and a survey of expert opinion. A quantitative model based on the scenario tree method was devised in order to calculate the size of the sample. Thanks to targeted selection, the costs of the surveillance programme were reduced by up to 40%, with the same level of validity. The annual surveillance programmes to document IBR and EBL free status will be carried out using a targeted selection procedure as from 2013.

**Assessment of the capacity for the monitoring of antibiotic resistance, mastitis pathogens, epizootics and zoonoses by bulk milk samples (1.08.24)**

Many surveillance programmes are based on blood samples taken from individual animals. In some countries, bulk milk samples (BMS) are used as well. The aims of the study were to identify appropriate pathogens, to assess feasibility and to gauge the costs of surveillance programmes using bulk milk. For the surveillance programmes for infectious bovine rhinotracheitis (IBR) and enzootic bovine leukosis (EBL), the cost efficiency of the variants carried out routinely was compared with the inclusion of bulk milk samples. This integration of bulk milk samples can halve the costs of a surveillance programme without reducing its validity. Testing of bulk milk samples was included in the surveillance programme for documenting IBR and EBL free status for the first time in 2012. However, under current conditions, the monitoring of zoonotic pathogens such as listeria and salmonellae cannot be carried out more cost-efficiently by using bulk milk.
Constanze, investigations of avian influenza in wild birds at Lake Constance (1.07.01, 1.08.07, 1.09.02)

In February 2006, wild birds that had died of highly pathogenic avian influenza H5N1 (HPAI) were found in the Lake Constance region. An international interdisciplinary research programme by the countries bordering on Lake Constance (D, A, CH) investigated the role of wild birds in the transmission of influenza viruses. Over a period of 33 months, four subprojects focused on project management, monitoring, bird migration analysis and modelling/risk assessment. Throughout the study, no cases of H5N1 infection occurred either in wild birds or in poultry. Evaluation of all test results revealed a 2.2% prevalence of low pathogenic avian influenza (LPAI) viruses among the wild birds. An efficiency analysis of the different surveillance methods by means of a scenario tree analysis showed that the testing of findings of dead wild birds to detect HPAI and the sentinel systems to map the LPAI situation in wild birds are worthwhile measures. Bird migration analysis shows that the most important movements are the outgoing migration of breeding birds in a westerly and south-westerly direction and the incoming migration of moult migrants, passage migrants and winter visitors from an easterly and north-easterly direction. Evaluation of telemetry data revealed that mallard ducks undertake long-distance migrations as early as high summer and that regular flights of geese and mallards into the interior of the country might encourage the regional spread of an infection. None of the risk factors studied for the occurrence of avian influenza in poultry populations carried particular weight. Contacts between wild birds and poultry are rare. However, contact between poultry keepers (animal movements, exhibitions, etc.) might encourage the spread of disease. No risk farms, risk regions or high-risk times of year could be identified. The registration of all poultry keeping establishments in a central database was recognised as a necessity, both for prevention (e.g. promotion of disease awareness and biosecurity measures) and for monitoring and control.

The project management allowed the researchers to concentrate fully on their research questions. A coordinated and targeted flow of information was ensured by means of an Internet portal, teleconferencing and annual meetings. The interdisciplinary network built up will continue to exist beyond the term of the project. A survey found that poultry keepers would like more information. This wish was met by the production of a DVD (Bird Flu: Prevent it now!).

Campylobacter research

Molecular biology characterisation to clarify the epidemiology of campylobacter (1.08.05, 1.08.12, 1.10.08)

Campylobacteriosis is the most common food-linked infectious disease of humans in Switzerland. To control an infectious disease successfully and efficiently, we have to know the sources of infection and the importance of the individual transmission routes. Using a new RT-PCR, a sensitive method was developed for the direct quantitative determination and differentiation of Campylobacter jejuni and coli from neck skin samples from broiler chickens. Genetic tests on campylobacter strains obtained from broilers show that cross-contamination in the slaughterhouse does occur but that the majority of cases of slaughterhouse contamination with campylobacter originate in the slaughtered flock itself.

Molecular biological comparison of chicken isolates and human isolates shows a high degree of similarity. However, the degree of similarity differs depending on whether the infection occurred during a trip abroad or within the country. Further testing should clarify the role of broiler chickens in more detail and also include the role of other species of animal. An attempt should also be made to find genetic virulence characteristics based on the different incidence of strains in humans and animals. The results of these studies will be incorporated directly into the action plan to reduce campylobacteriosis in humans drawn up by the Federal Office of Public Health and the FVO.

A project on the incidence and characteristics of food-associated zoonotic pathogens in healthy rabbits for slaughter (1.08.05) found no listeria or salmonellae and only a small number of campylobacter and Shiga-toxin-forming E. coli in rabbit dropping samples in the slaughterhouse. The rabbit therefore appears to play only a minor role as a reservoir for these major zoonoses.

Development of a campylobacter vaccine (1.10.05, 1.12.04)

One of the main sources of infection for campylobacter in humans is chicken meat. Broiler flocks are often colonised with campylobacter. However, this colonisation does not lead to disease in the poultry. Because campylobacter are unable to grow outside the host, preventing colonisation would be the most effective method of reducing contamination in the meat. However, to date there are no known effective measures which could protect a broiler flock against campylobacter contamination. In particular, there is no suitable vaccine which demonstrably leads to a significant reduction in colonisation in broiler chickens. A recently developed vaccine strain de-
Mastitis research (1.08.14, 1.08.22, 1.10.06, 1.10.17, 1.11.09, 1.11.13, 1.11.21, 1.12.10)

Mastitis, or udder inflammation, is one of the most economically important diseases in Swiss dairy cattle. Mastitis is not one of the classical animal diseases. However, the FVO supports a number of research projects in order to work out a basis for systematic improvements in udder health. Udder inflammations are also relevant to public health. They not only cause loss of milk yield but are associated with the use of antibiotics, higher culling rates and reduced animal welfare. In addition, mastitis interferes with milking and is frustrating for the farmer. Mastitis can be caused by a range of pathogens, and various pathogens have several different strains.

The forms of mastitis caused by Staphylococcus aureus (S. aureus) are particularly important in Switzerland. S. aureus is a contagious mastitis pathogen (i.e. it can be transmitted from animal to animal), which is treatable only with limited success, tends to be chronic and is accompanied by significant losses. There are a number of different genotypes. In Switzerland, genotype B (GTB) is particularly important. This is an especially contagious genotype which usually leads to herd-wide problems. In projects 1.08.14 and 1.10.06, a highly sensitive and specific diagnostic method was developed and validated using artificially produced bulk milk, making it possible to detect S. aureus GTB in bulk milk. Project 1.11.09 confirmed the results by means of a large-scale field study. This also demonstrated that the results for S. aureus GTB diagnosis using samples from milk recording are the same as those obtained with milk samples taken under aseptic conditions. In project 1.12.10, the method was developed for routine application. It is this step that makes it possible to use the new technology on a large scale.

Significant diagnostic progress was also made by project 1.11.21, which developed MALDI-TOF based methods for the diagnostic differentiation of coagulase-negative staphylococci from mastitis milk samples. Coagulase-negative staphylococci are detected very frequently in mastitis milk samples, and several members of this group of pathogens play a role as primary udder-pathogenic bacteria. The usual diagnostic methods did not allow these to be distinguished from the largely mildly pathogenic to apathogenic coagulase-negative staphylococci, which made the interpretation of mastitis diagnostic results much more difficult. The project also studied the antibiotic resistance genes of these bacteria.

A further study (1.10.17) was concerned with the clinical recording and molecular analysis of emerging Mycoplasma bovis (M. bovis) outbreaks in Switzerland. M. bovis is another of the primary udder pathogens. Fortunately, the suspicion that a new strain of pathogen is involved was not confirmed.

Another study in the area of udder health focused on the impact of fed milk quality on development and health of calves with particular attention to the juvenile mammary gland (1.08.22). The question was whether feeding milk containing pathogens to calves favours the later occurrence of mastitis. Risk assessment and possible solutions for the control of mastitis in first-lactation dairy cows in Switzerland were the focus of another study (1.11.13). No results are available as yet from the latter two studies.

Clinical and molecular epidemiology of circovirus-associated diseases in pigs in Switzerland and investigations in their pathogenesis (1.06.07)

Postweaning multisystemic wasting syndrome (PMWS) has gained in importance in Swiss pig production in recent years, and has led to significant losses. PMWS is a multifactorial disease, which means that, in addition to circovirus type 2 (PCV2), other promoting factors (poor hygiene, other diseases) must also be present in the population in order to trigger the disease. The aim of this study was to investigate the causes of the increase in PMWS diseases since 2003.

Using immunohistochemistry and various PCRs, lymphatic tissue samples from pigs in Switzerland were studied from 1979 to 2005. This showed that PCV2, with its genotypes PCV2a and 2b, was already present in the Swiss pig population in 1979. Whereas the sporadic cases of diseases before 2003 were caused mainly by PCV2a, the frequent outbreaks in 2003 were triggered by the subtype PCV2b.
This subtype was studied further by means of PCR, in order to identify the reason for the sudden increase in cases from 2003. This investigation discovered the subgroup PCV2b-CH, which was then detected retrospectively in pre-2003 tissue samples as well. It is suspected that individual mutations in the genome of PCV2b-CH led to increased virulence and the higher incidence of outbreaks in 2003. This study provided valuable information about the epidemiology of circovirus-associated diseases in pigs. This study also makes it possible to strengthen research into circoviruses in Switzerland, as well as cooperation with the EU in this area.

Research for safe food

Monitoring of the use of antimicrobials in the production of farm animals (1.04.07)
The use of antibiotics in animal production is the subject of vigorous public debate. The reasons for this are the worsening resistance situation and antibiotic residues in foodstuffs. For a long time, the use of antibiotics in veterinary medicine in Switzerland was not recorded in detail. However, the basis for gathering of data was created with the Heilmittelgesetz (Medicines Act) of 15 December 2000. Good data quality is one of the most important preconditions for any surveillance system. The aim of this study was therefore to assess the quality of recording of antibiotic consumption on dairy farms and to conduct an analysis of antibiotic use in veterinary practices. These data would then be used to develop a method for the gathering of information on animal health and antibiotic consumption.

The quality of recording of antibiotic consumption, both by Swiss dairy farms and by veterinary practices, was satisfactory and improved greatly when the dairy farm data were supplemented by the data supplied by the herd vets. The eight veterinary practices studied used mainly sulfonamides in 2004 and 2005, followed by tetracyclines and beta lactams. 75% of the antibiotics used were administered orally to calves and pigs; 90% of the antibiotics were fed in medicated premixes. The use of medicated feeds containing antibiotics should therefore be monitored more closely in future. This study created the basis for future monitoring at the dairy farm/veterinary practice stage.

Gathering data on organ findings and condemned material in slaughterhouse pigs in Switzerland and correlation with farm and management data (1.08.17)
Slaughterhouses in Switzerland record a great deal of health-relevant data on organ changes and condemned material which could provide important management assistance and advisory input if fed back appropriately to farmers, herd vets or the Swiss Pig Health Service (SGD). The data collected would therefore help not only to improve animal health but also to increase food safety.

In the study, all organ changes, condemned material and other relevant slaughterhouse findings were recorded over a period of 6–12 months in the larger Swiss pig slaughterhouses, and their aetiology explained. The slaughterhouse data were then linked with farm data from the SGD in order to establish correlations between organ changes and the characteristics of the relevant farm. Animals from SGD farms and farms with animal welfare labels have significantly fewer lung and liver lesions. SGD farms also have fewer cases of pleuritis/pericarditis. In addition, established factors such as large pens, many different suppliers, inadequate biosecurity, other animals as vectors, and poor cleaning and disinfection were confirmed as risk factors for pathological changes.

The slaughterhouse would be an ideal location for surveillance of animal health in Switzerland, provided the changes could be recorded uniformly, entered in a central database and correlated with farm data. A follow-up project is now being undertaken to develop concepts and methods in order to use the slaughterhouse as a data source for surveillance and monitoring programmes in the area of epizootics, zoonoses and food safety (project 1.11.12).

Microbiological status of rabbits for slaughter (1.08.05)
Rabbits are gaining in importance in Europe in terms of meat production. Annual rabbit meat production in Switzerland is around 1,160 tonnes. Information on the occurrence of food pathogenic microorganisms in healthy slaughter animals and on the microbiological status of rabbit carcasses and rabbit meat is largely absent from the literature. The aim of this study was to record these data in live and slaughtered rabbits in Switzerland, in order to identify potential risks to human health.

No listeria or salmonellae were detected in the dropping samples, but small numbers of campylobacter and Shiga-toxin-forming E. coli were found. Indeed, eae-positive E. coli were found with a high prevalence in dropping samples. However, they were not detected in the meat. Based on the serotypes found and genes
expressed, slaughter rabbits appear to be a reservoir for atypical enteropathogenic *E. coli* and have probably been underestimated to date as a source of infection in humans. Bacteria from the Enterobacteriaceae family (enterobacteria, indicators of faecal contamination) and coagulase-positive staphylococci (an indicator of *Staphylococcus aureus*) were found in nearly 25% and 30% of rabbit carcasses respectively. Based on the results of this study, it is vitally important to maintain strict slaughterhouse hygiene in order to prevent surface contamination during the slaughtering of rabbits. Rabbit slaughtering guidelines containing relevant information are being drawn up.
Future research for healthy animals and safe food

Elena Di Labio, Ruth Hauser, Dagmar Heim, FVO

Based on the focal areas of research for 2012 to 2016, projects are being carried out on the following topics: “Influence of wild animals on the success of animal disease control programmes”, “Importance of vectors in the transmission of animal diseases”, “Development of early detection surveillance programmes” and “Economically important animal diseases”. International research collaboration with European partners is increasingly important.

► Online data on individual research projects

Every research project is assigned a project number (e.g. 2.09.03), which enables the data sheets of the projects to be found in the federal ARAMIS database: www.aramis.admin.ch > Project search > (enter number in search field).
Influence of wild animals on the success of animal disease control programmes

Occurrence of infections with bluetongue virus, bovine virus diarrhoea virus, and of tuberculosis in free-ranging wild ruminants in Switzerland (1.10.07)

In the context of the bluetongue (BT) vaccination campaign and the eradication of bovine virus diarrhoea (BVD) in farm animals in Switzerland, the question was raised of whether free-ranging wild animals might jeopardise the success of these disease control measures. Wild ruminants are susceptible to the BT and BVD viruses and might play a role in maintaining the diseases in the domestic animal population. In addition, recent years have seen an increase in cases of bovine tuberculosis (TB) in farm and wild animals in the countries neighbouring Switzerland and the Principality of Liechtenstein. A study is therefore being conducted to investigate the Swiss and Liechtenstein wild animal and cattle populations for the possible occurrence of the pathogens mentioned above. The results will show whether the native wild animal population is a reservoir for the pathogens of these diseases, and whether or not wild animals should be regarded as a threat to the health of farm animals.

Importance of vectors

Vector capacity traits of Swiss mosquitoes from putative “hot spots” for West Nile virus introduction/transmission (1.12.17)

West Nile virus (WNV) circulates in southern and eastern Europe and has occurred in new areas (e.g. North-East Italy) in recent years. The diversity, seasonal frequency and preferred hosts of mosquitoes will be recorded in two possible “hot spots” for the introduction/transmission of WNV in Switzerland (extensive wetlands and city outskirts to the north and south of the Alps). If species of mosquito are identified as possible WNV vectors, basic data will be compiled on their vector capacity.

In two wetland areas (Robenhausener Ried and Bolle di Magadino), mosquitoes will be collected, identified and tested to determine if they have ingested blood from birds or mammals. Vector capacity will be tested under laboratory conditions as close as possible to the conditions found in nature (temperature). The adult mosquitoes will be offered a meal of WNV-contaminated blood and the presence of the virus in their saliva will be measured. This work will be carried out as regulated in a B3 safety laboratory. The data from this study are important for a future risk assessment with regard to the introduction and spread of West Nile Virus in Switzerland. The study will also compile and examine information and methods for mosquito identification, breeding, vector capacity determination and population dynamics, as will be required in a planned vector entomology centre.
Circoviruses

Is PCV2 virulence the main factor that triggered the PMWS epizooty? (1.10.09)

Postweaning multisystemic wasting syndrome has been gaining in importance in Switzerland since 2003. Major economic losses, the suffering of affected animals, and the recent finding that PCV2b genotypes can also be transmitted to other species (e.g. cattle) make it essential to step up research in this area. While research has been mainly retrospective and conducted in dead animals to date, the focus in future will lie on in vivo research in this area. The use of bulk milk as a data source has enormous potential for further increasing the efficiency of monitoring and surveillance systems. However, this covers only the farms that supply milk.

This project aims to research methods and develop concepts to enable the slaughterhouse to serve as an efficient data source for monitoring and surveillance programmes in the area of epizootics, zoonoses and food safety. To that end, it will be necessary on the one hand to record and describe the distribution of the slaughtered cattle population between the cattle slaughterhouses.

On the other hand, the project also aims to develop methods in order to identify groups of cattle slaughterhouses handling a subpopulation representative of the Swiss cattle population and in relation to the relevant surveillance programme and objective. It also aims to discover how samples of different organ parts are taken in the slaughterhouse’s routine practice, including in the case of individual animals identified in advance. Finally, an optimisation algorithm will be developed in order to allocate slaughter animals to a random sample.

This will take account of the objectives of the surveillance system, existing analytical results, practical feasibility and the costs incurred in comparison with the commonly used sampling systems.

In the context of pilot projects to (a) detect freedom from IBR and EBL in the cattle population not covered by bulk milk samples, (b) monitor BVD in the cattle population not covered by bulk milk samples, (c) estimate the prevalence of STEC in the Swiss cattle population and (d) estimate the prevalence of ESBL and the pool of resistance present in the Swiss slaughter calf population, the methods developed are to be investigated for suitability in the context of this project.

In addition, the recording of animal-oriented animal welfare criteria in the slaughterhouse is to be evaluated. On the one hand, these criteria will be used in evaluating the effect of animal welfare measures and of animal welfare legislation. Recording such objectifiable key figures which can be collected easily and nationwide meets a political demand in Switzerland. On the other hand, they will be used for the risk-based planning of animal welfare inspections by official veterinarians and, if implementation is successful, will aid the triage of primary production farms into a group with a low frequency of inspection, a group with moderate frequency and a group which may require immediate investigation and action.

Development of surveillance systems

In the context of early detection and prevention, verifying the success of control programmes and establishing disease-free status, monitoring and surveillance systems (MOSS) are continuing to gain in importance. On the other hand, staffing and financial resources are limited. Consequently, the research and development of methods for the cost-efficient, risk-based implementation of MOSS and their transfer into practice continues to represent an important theme of the FVO’s departmental research.
Development of algorithms for real-time syndromic surveillance to enhance early detection of emerging and re-emerging epizootics and zoonoses (1.12.12)

There is growing concern worldwide about emerging and re-emerging pathogens of animal diseases and zoonoses and their repercussions for animal health, public health and the economy. Accordingly, the EU is reinforcing the monitoring of animal diseases and zoonoses in its member states. There is particular interest in setting up reliable surveillance systems which, acting as early warning systems, will quickly detect new animal diseases and zoonoses and identify the pathogens so that efficient control measures can then be taken in good time.

In terms of animal diseases and zoonoses subject to statutory control, Switzerland currently has a high standard of animal health in comparison with its European neighbours. However, it is exposed to the same growing dangers. The Animal Health Strategy Switzerland 2010+ stresses the role of prevention in order to promote and achieve the strategic goals of sustainable animal health in Switzerland. The development of cost-effective tools for the monitoring and early detection of animal diseases, zoonoses and food safety is therefore a top priority for the decision-makers in the public veterinary services. The development of a “system for early detection by means of syndromic surveillance” is therefore a specific measure in the action plan for the implementation of the Animal Health Strategy Switzerland 2010+.

Syndromic surveillance means the virtually real-time recording, analysis, evaluation and dissemination of health-related data, in order to identify any effects (or the absence) of (veterinary) public health threats in good time and to guarantee effective and prompt intervention by the (veterinary) public health authorities.

Several veterinary syndromic surveillance systems are being developed in Europe at present, or are already partly established. These systems relate to the following data sources: mortality, dead animals, abortions, meat inspection results, laboratory data systems, etc. The overarching aim of this project is to contribute to the development of a system for the early detection of emerging or re-emerging diseases in Switzerland.

In an initial stage, the data potentially suitable for syndromic surveillance purposes will be studied and assessed in terms of current availability and their ability to generate early warning signs. A list of syndromes in relation to different types of diseases and different stages of the food chain will be drawn up.

A review of the literature on existing or developing syndromic surveillance methods will be carried out before existing algorithms are selected, developed for and adjusted to the Swiss situation and tested on the basis of available Swiss data for their suitability for use in detecting abnormalities and generating signals. Algorithms will be tested with regard to sensitivity, specificity and timeliness and, if possible, validated by means of retrospective analysis of historical disease outbreaks or simulated data.

Finally, in close collaboration with possible operators of such syndromic surveillance systems, solutions will be discussed and proposed for the technical implementation of algorithms in existing databases for real-time screening.

Mastitis research

With substantial support from the FVO, new diagnostic tools have been developed in Switzerland in recent years for the identification of pathogens causing different strains of mastitis (1.08.14, 1.10.06, 1.10.17, 1.11.09, 1.11.21, 1.12.10). In addition, new studies have shown that animal keepers’ motivation and attitude to management measures to improve udder health play a crucial role. Because there is a wide distribution in the incidence of mastitis between different herds, pathogen- and strain-specific mastitis control programmes can be expected to improve udder health.

The overarching aim of the active projects 1.11.06 (veterinary herd health management in Swiss dairies with a subclinical udder health problem) and 1.12.01 (evaluation of a novel, model-derived farm-specific mastitis control programme and of different communication strategies to support implementation in Swiss dairy herds) is to develop a new mastitis control programme for Swiss dairy herds.

Epidemiological and economic models will be used to develop effective, cost-efficient pathogen- and strain-specific intervention strategies. Surveys of animal keepers will provide information on their motivation and attitude to measures to improve udder health.

A major clinical study will be conducted to show how effective and cost-efficient the new diagnostic tools are. This study will also make use of synergies with other research projects of the Vetsuisse Faculty and of Agroscope Liebefeld-Posieux.
International research collaboration

Within the European research area (ERA-NET), the EMIDA programme (Emerging and Major Infectious Diseases of Animals) was launched in 2008. EMIDA has been receiving funding from the EU for three years. Switzerland (FVO) is a partner in this network. The EU funds only the necessary coordination or networking activities. The financing of the intended research programmes and projects themselves remains a matter for the individual EMIDA partners.

The aim of the EMIDA initiative is to develop extensive, transnational cooperation through the strategic planning and design of joint research programmes. EMIDA’s focus is on research in the fields of infectious diseases in farm animals and aquaculture, and research into pathogen resistance.

Two calls went out to research consortia in 2008 and 2011. In the first call, three research projects with Swiss participation were selected:

- **OrbiNet** – Molecular and reverse genetics studies of orbivirus transmission, host responses, epidemiology and diagnostic systems. (1.11.01)
- **TB Alpine Wildlife** – Tuberculosis in alpine wildlife – Monitoring, diagnostics and potential control strategies of tuberculosis in wild animals in the alpine provinces of Austria, Germany, Italy and Switzerland. (1.10.07)
- **PathoFish** – Control of Flavobacteriaceae infections in European fish farms. (1.11.11)

In the second call, four research programmes with Swiss participation were selected:

- **VICE** – Vector-borne infections: risk-based and cost-efficient surveillance systems
- **EMIRO** – The significance of rodent communities for the distribution of *Echinococcus multilocularis*: ecological and experimental investigations
- **APHAEA** – Harmonised approaches in monitoring wildlife population health and ecology and abundance
- **MINAPIG** – Evaluation of alternative strategies for raising pigs with minimal antimicrobial usage: opportunities and constraints.

Laboratory research is concerned with the world of the very small – but by no means always harmless – molecules, viruses, bacteria (projects in the areas of animal health and food safety).
Species protection research

Mathias Lörtscher, FVO

Support for research projects in the area of CITES/species protection is to be restricted predominantly to projects focusing on the following themes:

- The composition of relevant scientific data on species which are or might be endangered due to international trade.
- The development of protection and/or management plans for species threatened by international trade, with the aim of ensuring the sustainable exploitation of such species.
- Support for other contracting states in legal or scientific respects to improve implementation of the provisions of the Convention, including direct support for the development of legislative, trade-related and economic aids.
- The development and production of training material.
- Support for developing countries with the aim of improving participation in the Convention.

In this respect, Switzerland has provided financial support for a series of research projects in the period 2008–2011.
Research projects in the field of species protection

A long-term project in Argentina concerns the sustainable exploitation of the yellow anaconda (*Eunectes notaeus*). This project is recording data on the population dynamics, structure and genetics of this species. This analysis should show how the removal of wild animals affects the individual population parameters. The aim, with the inclusion of the local human population, is to build up sustainable exploitation of anaconda populations in order to obtain skins for the leather industry. An initial overall evaluation of this project is expected in 2012.

Also in Argentina, the FVO supported a project aimed at establishing the necessary biological criteria and trading criteria in order to apply for inclusion of the tree species *Bulnesia sarmientoi* in CITES Appendix II at the Conference of Parties (CoP) in Doha (Qatar) in 2010. This species is felled mainly for an extract obtained from its wood, which is used worldwide in the cosmetics industry. The FVO had already supported its inclusion in Appendix III. This application was finally accepted unanimously at CoP 10.

The CITES Conference of Parties (CoP) is held every three years and one of its tasks is to consider amendments to the appendices. In advance of the conference, proposals submitted by an independent organisation, the International Union for Conservation of Nature (IUCN), are analysed. In particular, trade and biological data on the species proposed are collected from all over the world in order to arrive at a scientifically founded assessment of whether the criteria necessary for inclusion are fulfilled. This well-founded analysis gives many delegations of parties from developing countries the evidence they need in order to form an opinion. As at previous conferences, Switzerland has also promised to make a substantial contribution to the analysis of proposals submitted to CoP15, held in Doha (Qatar) in 2010.

In Madagascar in 2008–2011, two projects were supported in partnership with WWF Switzerland. In recent years Madagascar has had recurring problems with placing the exploitation of the Nile crocodile (*Crocodylus niloticus*, CITES Appendix II) on a sustainable, legal basis. A project was therefore initialised to take an inventory of the crocodile populations of two major river systems and to describe the distribution of the animals along the different sections of river. The aim was to examine the factors that are most dangerous for the populations, analyse the human/crocodile conflicts and work out possible solutions with the local inhabitants. The project was also intended to demonstrate the shape and structure of the trade chain in relation to these animals. It emerged in the course of the project that the sustainable, legal exploitation of the crocodile populations is doubtful under the current circumstances. The breeding farms also need to be subjected to tighter and more stringent controls in order to put an end to the “whitewashing” of illegally wild-caught animals. The local human population has no, or minimal, involvement in the trade, which further worsens the human/animal conflicts. However, the study was able to formulate clear objectives and to list potential improvements which should enable the authorities to bring about targeted improvements.

The second project supported in Madagascar concerned rosewood species of the genera Dalbergia and Diospyros. The aim was to take stock of the distribution areas of these species in two regions where they are still common, to identify the biological parameters for establishing a plan for the sustainable exploitation of tree stocks by the forestry authorities, and to develop applications for these species’ inclusion in CITES Appendix III. In this project too, political upheavals in the country affected the results, so the distribution work could be completed only in part and the utilisation work hardly at all. However, the listing of the species in question in CITES Appendix III was published on 23.9.2011 under notification 2011/039.

For a number of years, Interpol has had a working group concerned with illegal trade in wild animals and plants, as well as derived products. In this connection the FVO supported the drafting of a publication setting out the most common methods of concealment and smuggling for the inspection authorities and giving tips for their discovery. The guide can be downloaded only with appropriate authorisation from inspection authorities or ordered from Interpol.
The 3R Research Foundation: Fewer animal experiments thanks to research and information

Ernst Diener, Peter Maier, 3R Research Foundation

The 3R Research Foundation approved and supported a total of 22 research projects to the tune of 2.5 million Swiss francs between 2008 and 2011. The results were published physically and on the Internet and were thus made available to interested researchers for practical application.
The research projects funded in the reporting period concern all three areas of Replace, Reduce and Refine. The list of projects illustrates the diversity of opportunities that are offered for putting the 3R principles into practice. The projects come from the fields of basic biomedical research, drug development, veterinary medicine and safety testing of chemicals. Rapid developments in the “-omics” disciplines (genomics, transcriptomics, proteomics, metabolomics, etc.) as well as in stem cell research permit a better understanding of the mechanisms of cell processes. In turn, this makes it possible to develop new methods which may not replace animal experiments immediately but do make them superfluous in many cases.

Promising examples include in vitro methods (biopsies, tissue sections, combined cultures), which can be derived directly from the procedures currently familiar in clinical research. Different types of human cells are often used and cultured in combination. This allows interaction between the cells, like that which occurs in the tissues of an intact organism. This means that the relevant mechanisms can be studied in cellular systems instead of observing effects or damage in the intact organism of experimental animals. In many cases, such methods allow a dramatic reduction in the number of animals used in an experiment and in the stress to which they are exposed. This applies both to university research and to drug development.

For the registration and classification of chemicals, new methods are being developed worldwide, but especially in Europe, which require fewer animals or no animals at all. Projects in this field are supported by the Foundation with a view to the inclusion of the methods in a European validation programme. Good coordination with international projects helps to avoid any duplication of efforts.

**Activities of the 3R Research Foundation**

The 3R Research Foundation supports research projects aimed at avoiding animal experiments (replacement methods), reducing them (fewer tests, fewer animals per test) or improving them (reducing the stress for the animals during the experiment). These efforts are generally referred to as the 3R principles (Replace, Reduce, Refine).

The Foundation is funded by equal contributions from the State (Federal Veterinary Office, FVO) and from Interpharma. It was established in 1987 by the parliamentary group for animal experiment issues, Interpharma and a foundation which is now known as Animalfree Research.

The Administrative Board is made up of members of the Federal Parliament and representatives of the FVO, Interpharma, animal welfare organisations and other interested parties. It defines the core areas of its research sponsorship, supported in this by the scientific adviser and the expert committee (currently comprising eleven members). The expert committee evaluates the applications submitted and presents the projects considered worthy of support to the Administrative Board for a decision.

The review period from 2008 to 2011 saw a total of 108 applications submitted for research grants. Of these, 22 research projects (20 %) were approved and awarded total funding of 2.5 million Swiss francs. There were three to six projects per year, which ran for one to three years. Grants were awarded every year to around 17 projects that were in progress.

In the past 25 years, 451 applications for grants have been submitted and, of these, a total of 130 projects have been awarded total funding of 17.0 million Swiss francs. This means that around 30 % of applications for grants were approved.

However, the rejection rate in 2011 was nearly 90 %. The reason for the high rejection rate is the Foundation’s limited funds, not the quality of the projects. In fact, there was a marked increase in submissions of high-quality projects pursuing a research objective in keeping with the objectives of the 3R Research Foundation. This is encouraging because the solutions for putting 3R into practice should come from the researchers in the different specialist fields. Solutions cannot be prescribed to order, because there are no standardised, universally accepted 3R methods in research. At the same time, the selection criteria have been tightened up. For example, only a few years ago, non-invasive methods were funded as “refinement”. Today this is a general precondition, wherever possible, for carrying out animal experiments. More than 95 % of the research funding was awarded to project leaders working at university institutes. Over 90 % of these were Swiss, and a few (3) were foreign universities.

Every approved project receives technical support from an expert who, together with the scientific adviser, keeps an eye on compliance with the research objectives, reviews the project leader’s annual interim reports and intervenes if necessary. The projects are not concluded for the Foundation until the research results are published in an international journal.
Implementation of research results

Information on the Internet, the 3R Info Bulletin, which is sent out three times a year, and members of the Foundation’s expert committee who are involved in the training and further education of specialists help to put the research results into practice.

The Foundation presents all the projects funded on its website, with a brief description of the background, the methodology used, the results achieved and the impact in terms of the 3R principles. Reference to publications from the various projects is periodically updated. This globally accessible information pursues three objectives:

1. Stimulation of ideas and definition of the scientific level for potential project leaders.
2. Information on 3R-related research in Switzerland, especially for the benefit of organisations which share the same objectives and of the ECVAM (European Centre for the Validation of Alternative Methods).
3. Information for the authorities and animal welfare organisations about efforts to put the 3Rs into practice.

A lot of value is attached to the publication of research results. The general accessibility of research results forms the basis for putting project results into practice. Ideally, this will lead to the global use of animal-free methods in biomedical and pharmaceutical research and development. The authorities responsible for approving animal experiments in Switzerland can also access published results to assess whether a research question can also be resolved without animal experiments. In the test methods prescribed by the authorities worldwide for determining the harmful effects of chemicals and in the safety testing of medicinal products, publications can form the basis for a method being adopted by other institutes, then validated worldwide and finally recognised. This is a lengthy process lasting five to ten years, in which the Foundation can support only the first few steps.

In the reporting period, another attempt was made to get across the issues relating to 3R and the successes achieved with projects especially to those people who conduct animal studies. These people are in the best position to achieve tangible improvements. The targeted 3R Info Bulletins, participation in training courses, offering of a news page and communicating of new developments by e-mail were the main channels for this flow of information.

In Switzerland, everyone who conducts animal experiments subject to approval has to complete a one-week training course providing them with the technical knowledge and practical skills they need in order to handle laboratory animals in a responsible and animal-friendly way (module 1). Project leaders receive more in-depth training in a second course (module 2). In the past few years, members of the Foundation’s expert committee and its scientific adviser have explained the 3R principles in these two modules and in further training courses, and have considered further options in working groups for putting these principles into practice. These courses also provided an opportunity to offer pointers to interested researchers that might prompt them to submit applications for research grants for 3R projects to the Foundation.

Networking in Europe

The Foundation was instrumental in the founding of ecopa (the European Consensus-Platform for 3R Alternatives to Animal Experimentation) in Brussels in the autumn of 2002 (www.ecopa.eu). Ecopa is an association of European organisations, in which the four interest groups of government, industry, academia and animal welfare got together to come up with a joint procedure regarding 3R. This umbrella organisation has expanded further in the last four years. In mid-2011, 14 countries were involved: Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Hungary, Italy, the Netherlands, Norway, Spain, Sweden and Switzerland.

As a co-organiser of the EU project START-UP, the Foundation contributed its expertise to three international meetings on the topic of 3R and to the drafting of the protocols that resulted in the final report for the EU Commission in 2010.

As a result of its membership of ecopa, the 3R Research Foundation is actively involved in European efforts relating to 3R. At the same time, it is the contact partner in Switzerland for foreign institutions that are committed to research based on 3R objectives.

The importance of this access to information on the development of 3R in Europe is demonstrated by the fact that the past four years have seen the EU Commission support 14 projects to the tune of nearly 60 million euros in the field of alternative test strategies.

In addition, two Europe-wide projects have a direct impact on the Foundation’s selection of research projects. These are the initiative of the EU and the pharmaceutical industry in Europe in the context of the EPAA (European Partnership for Alternative Approaches to Animal Testing), which has been underway since 2005, and since 2011, the initiative between the EU Commission and the European cosmetics industry. In the corresponding research projects, 3R-relevant methods and strategies are developed for toxicity testing. 10–15% of the animals in Switzerland and Europe are needed for the further testing of
chemicals in the context of REACH (Registration, Evaluation and Authorisation of Chemicals) and for the safety testing of medicinal products and vaccines. Around 60% of the animals are used in university research into diseases and medicinal products.

The information provided by the 3R Research Foundation

Internet: On its website www.forschung3r.ch the Foundation provides information in English, French and German on its aims and organisation. By providing information on grant applications and reporting, the website also serves as a working tool in communications with applicants and project leaders. All completed and active research projects and the results obtained, including publications, are presented in English in the form of a list of projects accompanied by uniformly structured summaries and graphics. New and completed projects are notified by e-mail to the 1,000 or so interested parties registered in the Foundation’s database.

The website also offers a section on 3R methods. This gives researchers the opportunity to present 3R-relevant methods selected by the expert committee, irrespective of whether their development was funded by the Foundation.

3R Info Bulletin: This English-language publication communicates the results of successful projects to around 1,000 specially targeted addressees. The target readership includes specialists who conduct animal experiments, potential applicants for research grants, interested animal welfare groups and course participants. The bulletins are also available on the Foundation’s website as PDF downloads. In the reporting period, twelve 3R Info Bulletins were published.

Further information is available from:
Sekretariat der Stiftung Forschung 3R
Postfach 1372
3110 Münisingen, Switzerland
E-mail: secretary.3R@bluewin.ch
Grant applications or questions relating to projects may be addressed to the Foundation’s scientific adviser:
E-mail: research.3R@bluewin.ch

3R projects 2008–2011

Reduction methods/Replacement methods in biomedical research:

- Establishment of an in vitro organ slice defect model for meniscal repair in orthopaedic research (Hunziker E., Center of Regenerative Medicine for Skeletal Tissues, University of Bern)
- The use of microfluidic chambers to study axonal transport in PTEN and SOCS3 dependent axonal regeneration (He Z., Children’s Hospital, Boston)
- Genetic modification of the human airway epithelium – a paradigmatic system to study host responses to human respiratory viruses (Thiel V., Institute of Immunobiology, Cantonal Hospital St. Gallen)
- Establishing a novel system for quantitative production of murine basophils in vitro (Kaufmann T., Institute of Pharmacology, University of Bern)
- Model development and validation to investigate myeloid cell homeostasis (Benarafa C., Theodor Kocher Institute, University of Bern)
- Development of non-invasive strategies to study spinal cord disease, injury and repair (Jabaudon D., Department of Basic Neurosciences, University of Geneva)
- Non-invasive electrical monitoring of the population spiking activity in the central nervous system (Gonzalez Andino S., Department of Clinical Neuroscience, University of Geneva)

Replacement/Reduction of stressful animal models (e.g. infection models, disease models):

- Engineering of an in vitro hepatocyte tissue system for malaria liver infection research (Mancama D., CSIR, Biosciences Division, Pretoria, South Africa).

Reduction methods/Replacement methods for toxicological questions (chemicals, medicines, biocompatibility):

- Model development and validation to investigate myeloid cell homeostasis (Benarafa C., Theodor Kocher Institute, University of Bern)
- Nerve cell mimicking liposomes as in vitro alternative to potency testing of toxins with multistep pathways, such as botulinum neurotoxins (BoNT) (Weingart O., Institute for Food, Nutrition and Health, ETH Zurich)
- Comparative in vitro and in vivo testing on biofilm formation on the surface of bone grafts (Clauss M., Orthopaedics, Cantonal Hospital Liestal)
- Use of “moribund” stage in the fish acute toxicity test according to OECD guideline 203 and its effect on LC50 values (Rufli H., ecotoxsolutions, Basel)
- Embryonic stem cell-derived in vitro model of tissue inflammation following confrontation with implant materials (INFLAPLANT) (Wartenberg M., Department of Molecular Cardiology, Friedrich Schiller University Jena)
- Reduction of the number of animals used in the fish acute toxicity test (Rufli H., ecotoxsolutions, Basel)

**Reduction methods / Replacement methods for drug development:**
- A new in vitro model to study therapeutic approaches to improve spinal cord regeneration and repair after injury or neurodegenerative diseases (Chrast R., Department of Medical Genetics, University of Lausanne)
- Development of non-invasive strategies to study spinal cord disease, injury and repair (Jabaudon D., Department of Basic Neurosciences, University of Geneva)
- Organotypic brain slice cultures derived from regularly slaughtered animals as an in vitro alternative for the investigation of neuroinfectious diseases in ruminants (Oevermann A., Neurocenter, Vetsuisse Faculty, University of Bern)
- Engineering of a human brain tumour model to replace animal experimentation (Preynat-Seauve O., Department of Pathology and Immunology, University of Geneva)
- Establishment of an organ ex vivo tissue slice model for cardiovascular research in particular for therapeutic atherosclerosis targeting (Hunziker P., University Hospital Basel)
- Development of an in vitro assay for the screening of antischistosomal drugs [bilharzia or schistosomiasis] (Keiser J., Swiss Tropical and Public Health Institute, Basel).

**Blood, serum and tissue samples can be stored for longer periods in liquid nitrogen. When new problems arise, it can be very useful to retrieve and reanalyse the frozen “witnesses” (projects in the areas of animal health and food safety).**
Active research projects 2008 – 2011

Animal health, meat hygiene 
and public health

Diagnosis of transmissible diseases
- Erforschung der Erreger von Mastitis, insbesondere des Nachweises von S. aureus (1.10.06)
- Detektion von anti-PCV2-maternalen Antikörpern sowie der replikativen Form von PCV2 dsDNA zur Bestimmung des relativen Immunstatus von Ferkeln (1.10.10)
- Isolation und Charakterisierung von aktuell zirkulierenden Lentiviren der kleinen Wiederkäuer (SRLV) in der Post-SRLV-Eradikationsphase als Voraussetzung für eine Genotypspezifische serologische Diagnostik (1.11.04)
- Überprüfung eines neuen Testes zum selektiven Nachweis des kontagiosen Mastitiserregers Staphylococcus aureus Genotyp B in Betriebstankmilch – eine Feldstudie (1.11.09)
- KoNS in Rindermastitis: Schnelle Identifikation und molekulare Charakterisierung der Antibiotikaresistenzgene (1.11.21)
- Staphylococcus aureus GTB: Implementierung einer entsprechenden Tankmilchanalytik in einem Routinelabor sowie Untersuchungen zum Zoonosepotenzial mittels Vollgenom- Sequenzierungen (1.12.10)

Epidemiology of transmissible diseases
- Vorkommen von Infektionen mit den Erregern der Blauzungenkrankheit, der Bovinen Virusdiarrhoe und der Tuberkulose bei frei lebenden Wildungulaten in der Schweiz (1.10.07)
- Ist eine erhöhte PCV2-Virulenz der ausschlaggebende Faktor, der die PMWS-Epizootie auslöste? (1.10.09)
- Untersuchungen zur Adaption aviärer Influenzavirusisolate aus wild lebenden Wasservögeln an Haushuhn und Hause (1.10.11)
- Identifizierung von Sequenzsignaturen zur Bestimmung der Virulenz von Viren der klassischen Schweinepest (1.10.13)
- Übersichtsstudie zum Vorkommen von Brachyspira spp. in Schweizer Schweinebeständen (1.10.16)
- Molekulare Studien zu Übertragung, Epidemiologie, Immunantwort und Diagnostik von Orbiviren, im Speziellen unter Berücksichtigung des Toggenburg-Orbivirus (TOV, Serotyp 25 von Bluetongue Virus) (1.11.01)
- Abschätzung des Risikos von Q-Fieber beim Menschen durch kleine Wiederkäuer (1.11.08)
- Probenahme am Schlachthof als Datenquelle für Überwachungsprogramme (1.11.12)
- Prävalenz, Risikobeurteilung und Lösungsansätze für die Kontrolle von Mastitiden bei primiparen Kühen in der Schweiz (1.11.13)
- Tiergesundheit und Tierbehandlungsindex (TBI) in Schweinemastbetrieben und deren Zuliefererbetrieben unter Berücksichtigung von Biosicherheitsaspekten und des Tiertransportes (1.11.14)
- Mycoplasma hyopneumoniae-Nachweis und Genotypisierung bei Wild- und Hausschweinen und Untersuchungen zur Rolle des Wildschweins als Reservoir (1.11.16)
Staupevirus-Epidemie bei frei lebenden Wildtieren in der Schweiz: Epidemiologische Untersuchungen und Abschätzung des Infektionsrisikos für Haushunde (1.11.17)

Gezielte Behandlung gegen gastrointestinale Nematoden bei Ziegen («targeted» und «targeted selective treatment»): Evaluation von Behandlungskriterien und Bewertung epidemiologischer und ökonomischer Parameter (1.11.18)

Trichomonas foetus bei Stier und Kuh: wirklich kein Problem mehr in der Schweiz? (1.12.03)

Untersuchung der Verbreitung maternaler Anti-C. jejuni-N-Glykan-Antikörper in Schweizer Masttierelterntieren (1.12.04)

Entwicklung von Algorithmen zur Erkennung von abweichenden Mustern in der Syndromüberwachung zur Verbesserung der Früherkennung von neu und wieder auftretenden Tierseuchen und Zoonosen (1.12.12)

Entwicklung syndrombasierter Überwachungsstrategien neuroinfektiöser Krankheiten bei Tieren (1.12.13)

EMIDA VICE Vektor-übertragene Tierseuchen: risikobasierte und kosteneffiziente Überwachungssysteme (1.12.14)

EMIDA APHAEA Integrativer Ansatz und Methodenharmonisierung in der Überwachung der Wildtiere: Populationsdynamik und Pathogenverteilung bei Wildschwein und Rotfuchs in der Schweiz (1.12.16)

Vektorkapazitätseigenschaften von Schweizer Mücken aus mutmasslichen «Hotspots» für West-Nil-Virus-Einschleppung/Übertragung (1.12.17)

EMIDA EMIRO Die Bedeutung von Nagetiergemeinschaften für die Übertragung und Verbreitung von Echinococcus multilocularis: ökologische und experimentelle Untersuchungen zur Risikobewertung (1.12.18)

Untersuchungen mit einem Border-Disease-infizierten Kalb (1.12.19)

Latent zoonoses
Bekämpfung der Alveolären Echinococcose und Management von Füchsen im Siedlungsraum (1.07.04)
Genotypisierung und Virulenzattribute von humanen und tierischen Campylobacter-Isolaten (1.10.08)

Residue analysis
Streptomycin-Resistenz-Monitoring bei der bakteriellen Flora von Tieren im Zusammenhang mit der Feuerbrandbekämpfung (1.10.03)

Miscellaneous
Untersuchungen zum Einfluss der Tränkequalität auf Entwicklung und Gesundheit von Kälbern unter besonderer Berücksichtigung von Infektionen der juvenilen Milchdrüse (1.08.22)

Qualitative Anforderungen für die Entwicklung des Nationalen Kontrollplans. Bewertung und Optimierung des Konzeptes für Prozesskontrollen (1.10.01)

Fraktionierte Gewinnung des Kolostrums von Milchkühen: Veränderungen der Immunglobulinlinkonzentration und Bedeutung für den Anti-körpertiter bei neugeborenen Kälbern (1.10.04)

Etablierung eines zellbasierten Schnelltests zur Bestimmung des Impfschutzes gegen das Maul- und-Klauneueche-Virus (1.10.12)

Basiserhebung zu Gesundheitsprophylaxe und Managementmassnahmen beim Schweizer Milchvieh (1.10.14)

Bienen: Virusresolution und -toleranz (1.11.02)
Informationsverhalten von Zielgruppen des Bundesamts für Veterinärwesen BVET: Tierärzte, Landwirte, Kleintierhaltende (1.11.03)
Implementierung und Effizienz von Kontrollmassnahmen gegen die Paratuberkulose in Schweizer Milchvieh- und Mutterkuhbetrieben (1.11.05)

Tierärztliche Bestandesbetreuung in Milchviehbetrieben mit einem latenten Eutergesundheitsproblem (1.11.06)

«Vision tollwutfreie Städte in der Sahelzone», Tollwutelimination in N’Djamena, Chad (1.11.07)
Control of Flavobacteriaceae infections in European fish farms (1.11.11)
Entwicklung einer Markervakzine zum Schutz vor der Afrikanischen Pferdepest und anderen Orbiviren (1.11.15)
Vergleich der Wirksamkeit verschiedener Bio sicherheitsmassnahmen auf Landwirtschaftsbetrieben (1.11.19)
SchafAlp: nachhaltige Schafzüchtung (1.11.20)
Kapsid-eingepackte Circovirus-DNA gibt Einblick in viral übernommene diskontinuierliche eukaryotische Replikation (1.11.22)
Klinische Bedeutung boviner Staphaurexnegativer Staphylococcus aureus-Mastitisstämme (1.11.23)

Vergleichendes Potenzial der Schlachthofüberwachung der Immunisierungsdichte und Krankheitsfreiheit in Kirgistan und der Schweiz (1.12.07)
There are fewer battles for dominance and associated injuries if new female rabbits are introduced into an existing breeding group in its established pen, rather than in a pen that is unfamiliar to all of the animals (project 2.05.09).

Animal welfare

Anaesthesia
- Wissenschaftliche Überwachung Ferkelkastration (2.11.02)

Poultry keeping
- Haltungssituation, Brustbeinveränderungen bei schweizerischen Legehennen und Aufzuchtieren und der Einfluss von Sitzstangentyp und Vitamin-D-Zusatz auf Brustbeinveränderungen bei Hybriden und Elterntieren (2.09.01)
- Einfluss der Anordnung und Qualität von Sitzstangen und Etagenkanten in einem Volierensystem auf Brustbeinverletzungen bei Legehennen zweier selektiv auf Knochenstärke gezüchteter Zuchtlinien (2.11.05)
- Einfluss der Verbesserung der Unterscheidbarkeit und Grösse von Nestern auf die Verlegerate von Legehennen (2.11.07)

Rabbit farming
- Untersuchungen zum agonistischen Verhalten unter Praxisbedingungen und zum Einfluss des Rammlers in Zuchtkaninchengruppen (2.09.05)

Horse husbandry
- Untersuchungen zum Gebrauch von Führanlagen beim Equiden (2.09.02)
- Untersuchungen zur stromführenden Einräumung von Einzelkleinausläufen für Pferde (2.10.07)
- Einfluss von sportartenspezifischen Beschlagsmethoden auf die Belastung der Gliedmassen und das Gangbild beim töltenden Islandpferd (2.10.08)
- Beurteilung und Verbesserung des sozialen Zusammenlebens adulter Pferde in Gruppenhaltungssystemen in der Schweiz (2.12.03)

Cattle farming
- Klauenpflege und schmerzhafte Eingriffe an den Klauen beim Rind (2.10.04)
- Interaktionen zwischen Stoffwechselbelastung und Tierwohl bei Milchkühen in grasdominiumten Fütterungssystemen (2.12.04)
- Optimierung von Melkplatzabmessungen in Melkständen (2.12.05)

Pig farming
- Metabolomics des Ebergeruches (2.10.01)
- Eignung von Liegeflächen mit einem geringen Perforationsgrad bezüglich Sauberkeit bei Mastschweinen (2.11.04)
- Auswirkungen technischer Ferkelammen auf das Verhalten und die Entwicklung frühabgesetzter Saugferkel (2.12.02)

Miscellaneous
- Einfluss der Mensch-Tier-Beziehung und der Aufzuchtbedingungen auf die Anpassungsfähigkeit von Zuchttieren (Rinder, Schweine) unter Einbezug von Kosten-Nutzen-Analysen (2.10.03)
- Eingliedern von Ziegen in bestehende Gruppen bei der Laufstallhaltung (2.09.04)
- Untersuchungen im Rahmen des Prüf- und Bewilligungsverfahrens für Stalleinrichtungen und Haltungssysteme von Legehennen: Die Bedeutung der Gestaltung und Anordnung der Legenester für die Nestwahl und von Sitzstangen für das Auftreten von Brustbeinverletzungen in Volierenhaltungen (2.10.05)
- Utilisation des vocalisations et des biais cognitifs pour mesurer les émotions, le tempérament et le bien-être chez la chèvre domestique (Capra hircus) (2.11.03)
- Etablierung von effizienten Schmerzbehandlungsmethoden für die Labormaus (2.12.01)
Completed research projects 2008 – 2011
**Animal health, meat hygiene and public health**

**Diagnosis of transmissible diseases**
- Etablierung und Anwendung von Methoden zum Nachweis von Anti-Virus-Antikörpern im Blut von Forellen (1.05.07)
- Towards identification of influenza A virus strains with pandemic potential in vitro: species tropism and inflammatory cytokine responses (1.05.10)
- IS711-based real-time PCR assay as a tool for detection of Brucella spp. in wild boars and comparison with bacterial isolation and serology (1.06.02)
- Neuartige rekombinante Impfstoffe gegen die klassische Schweinepest auf der Basis der Replikon-Technologie (1.07.07)
- Entwicklung eines universell anwendbaren ELISAs zum Nachweis und zur Differenzierung von Antikörpern gegen Influenzaviren bei Tier und Mensch unter Verwendung von rekombinanten HA- und NA-Antigenen (1.07.08)
- Rekombinante Geflügelpestviren: Identifizierung von molekularen Virulenzmarkern zur raschen Charakterisierung von neuen Virusisolaten (1.07.09)
- Blauzungenkrankheit (BT) bei Schweizer Schaffrassen: Evaluierung der Klinik und Diagnostik bei experimenteller Infektion mit dem BT-Virus-Serotyp 8 (1.07.10)
- Charakterisierung der Brucellose und ihr Einfluss auf die Nutztierproduktivität in Kirgistan (1.07.17)
- Improvement of diagnostic tools for molecular epidemiology of listeriosis: virulence genes and their implication in the pathogenesis of rhombencephalitis in ruminants (1.08.11)
- Beurteilung des Potenzials der Überwachung von AB-Resistenzen, Mastitiserreger, Tierseuchen und Zoonosen mittels Tankmilchproben (1.08.24)
- Genomsequenzierung von Staphylococcus aureus (1.09.08)
- Tritrichomonas foetus bei der Katze: Was bedeutet das fürs Rind? (1.10.02)
- Früherkennung der Sauerbrut mittels Realtime-PCR (1.10.15)

**Epidemiology of transmissible diseases**
- Untersuchungen zum Vorkommen und zur Ätiologie der Pseudotuberkulose bei Ziegen und Schafen in der Schweiz (1.02.20)
- Final phase of the Swiss CAEV eradication program: assessment, analysis and monitoring of small ruminant lentiviruses still in circulation in the goat and sheep populations (1.04.08)
- Bedeutung der caninen und equinen Babesiose in der Schweiz (1.05.11)
- Development of a risk-based surveillance program for Trichinella spp. in domestic swine and wildlife in Switzerland (1.06.03)
- Mäuse als mögliche Vektoren des Borna Disease Virus (BDV) (1.06.09)
- Monitoring der aviären Influenza bei Wildvögeln (1.06.10)
- Simulation von Ausbrüchen hochansteckender Tierseuchen mittels InterSpread Plus: Sensitivitätsanalyse der Eingabeparameter (1.06.11)
- Die Rolle von Tieren als Reservoir von resistennten Bakterien in Alters- und Pflegeheimen (1.06.12)
Molekulare Charakterisierung von Isolaten avierer infektiöser Laryngotracheitis (ILT) aus der Schweiz (1.06.13)

Untersuchungen zur aviären Influenza in Wildvögeln am Bodensee (Forschungsprogramm CONSTANZE) (1.07.01)

Wirksamkeit der Überwachungs-, Vorbeugungs- und Bekämpfungsstrategien der Vogelgrippe in der Schweiz (1.07.05)

Risikobezugschätzung zur Einschleppung von Tierseuchen und Zoonosen durch den illegalen Import von Tieren und tierischen Produkten (1.07.06)

Evaluation der Qualität von Meldedaten in der Schweiz (1.07.11)

Überwachung und Steigerung der Disease Awareness Bluetongue (1.07.15)

Aperçu de la séroprévalence à Salmonella abortusovis dans les troupeaux de mouton en Suisse (1.07.16)

Risikofaktoren für die Übertragung infektiöser Krankheiten von Wild- auf Hausschweine im Freiland in der Schweiz (1.07.19)

Virulenzmechanismen der Viren von Honigbienen (1.08.01)

Untersuchung bei Kälbern, die mit Border Disease-infizierten Lämmern zusammen gehalten werden (1.08.02)

Fecal shedding of foodborne pathogens in rabbits at slaughter and estimating microbiological carcass contamination (1.08.05)

Genetische Untersuchungen zur Migration zweier Vogelgrippevektoren: Reiher- und Tafelgrippe (1.08.07)

Nachweis der Freiheit (Seronegativität, Abwesenheit von klinischen Fällen) von Equine Infektiöser Anämie (EIA) in einheimischen und importierten Pferden in der Schweiz (1.08.08)

Blaufuken- und Zoonosevektoren (Culicoides spp.): Definition von Parametern, welche vektorfreie Perioden und Gebiete in der Schweiz bestimmen (1.08.10)

Nachweis des kontagiösen Subtyps von Staphylococcus aureus in Tankmilch und dessen klinische Anwendung (1.08.14)

Optimierung der BVD-Eradikation in der Schweiz (1.08.15)

Wirksamkeit der Bekämpfungsmaßnahmen der BVD-Eradikation in der Schweiz (1.08.18)

Antikörper- und Antigenprävalenz von Pestiviren (Bovine Virusdiarrhoe und Border Disease) bei Neuweltkameliden in der Schweiz (1.08.20)

Untersuchung von Nebenwirkungen der BT-Impfung in den Betrieben der Bestandesbetreuung der Wiederkäuerklinik der Universität Bern (1.08.21)

Toggenburg-Orbivirus (TOV): epidemiologische Abklärungen zu den serologisch BT-positiven Fällen speziell im Tessin, Virusnachweis in Feldproben und Virusanzucht auf Zellkulturen sowie Etablierung einer TOV-Diagnostik (1.09.01)

Kleinhirnige Bewegungen von Stockenten (Anas platyrhynchos) im Winter (1.09.02)

Wissenschaftliche Begleitstudie zur Impfkampagne gegen die Blauzungenkrankheit in der Schweiz 2008/09 (1.09.04)

Epidemiologische Untersuchungen über die Ansteckung von Rindern durch mit Border Disease-Virus infizierte Schafe auf Alpweiden (1.09.06)

Seroprävalenz von Hepatitis-E-Virus in Haus- und Wildschweinen in der Schweiz (1.12.02)

Latent zoonoses

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Mathematische Modelle für Infektionskrankheiten: Validierung der Simulation von Tollwutimpfkampagnen und ihr Potenzial für die Schweiz (1.08.03)

Toxoplasma gondii: sources of infection in Switzerland (=meat versus cat=) (1.08.04)

Tracing and quantitative detection of Campylobacter jejuni (1.08.12)

Chlamydien beim Wildwiederkäuer – Erregerreservoir für domestizierte Wiederkäuer und Mensch? (1.08.18)

Campylobacter beim Geflügel: Prüfung einer neuen Glykan-basierten Campylobacter-Vakzine mit doppelter Spezifität (1.10.05)

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Transmissible spongiform encephalopathies

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Wirtschaftliche Beurteilung von Überwachungsprogrammen, die Teil des nationalen Kontrollplans der Schweiz sind (1.08.09)
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Aktuelle Fragen in der Legehennenhaltung: Sitzstangen (2.06.04)
Forschungsprojekte zur Legehennen- und Kaninchenhaltung im Rahmen des PostDoc (2.06.05)
Forschungsprojekt zum Einfluss der Nestposition auf das Verhalten von Legehennen in Vollenhaltungen im Hinblick auf die praktische Prüfung der Aufstellungssysteme BOLEG TERRACE und VOLETAGE VITA (2.07.03)
Evaluation der für die Tiergerechtigkeit von Gruppenlegenestern entscheidenden Nestegenschaften (2.08.02)
Auswirkungen farbiger Stallbeleuchtung auf das Verhalten von Legehennen (2.10.02)

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Vererbung der Subaortenstenose beim Neufundländer (2.09.08)

Rabbit farming
Reduktion der Häufigkeit agonistischer Auseinandersetzungen der Häsinnen und der negativen Folgen in Züchtkaninchengruppen (2.05.09)
Untersuchungen zur Wasser- und Futteraufnahme beim Zweigkaninchen unter verschiedenen praxisrelevanten Fütterungs- und Tränkeregimes (2.09.07)

Horse husbandry
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Gentestentwicklung zur Eradikation der Caroli-Leberfibrose (CLF) beim Freiberger Pferd (2.10.06)

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Einfluss von Weidegang und von verschiedenen Bodenarten im Laufbereich auf die Klaugesundheit und das Verhalten von Milchkühen im Lauftall (2.04.06)
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Tierschutzrelevante Aspekte beim AMS: Belastung von Tieren mit langen Zwischenmelzzeit- en und/oder mangelhaften Melkovorgängen (2.06.02)
Haltung von Eringer-Kühen in Lauftällen und Auslauf in der Anbindehaltung: Spezifische Vorgaben für den Stallbau und das Management (2.06.03)
Kastration beim Kalb jünger als eine Woche: Evaluation neu entwickelter Gummiringe mit größerer Spannkraft (2.07.02)
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Einfluss von Entmistungsanlagen auf das Verhalten und die Gesundheit bei Milchkühen im Lauftällen (2.08.03)
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Steigerung des Wohlergehens von Schweinen durch positive Antizipation (2.07.09)
Online data and electronic document
ARAMIS database

The ARAMIS information system contains information on research, development and evaluation projects of the Swiss Federal Administration. It aims to provide interested parties with information about research work funded or carried out by the State, to improve coordination and create transparency. The website www.aramis.admin.ch is part of a comprehensive information system operated by the Federal Administration.

ARAMIS has a search engine which can be used to search for all public projects contained in the ARAMIS database. To carry out a quick search, a term or, if known, the project number (e.g. 2.09.03) can be entered in the search field “Project search”.

Clicking on the navigation point “Project search” in the left-hand menu bar opens a detailed search form for structured search queries.

Data sheets of completed projects

The electronic document “Datasheets 2008 – 2011” is available on the FVO website. The PDF lists the data sheets of all projects completed in this period. The individual projects on the list are connected by a hyperlink to the ARAMIS database. www.fvo.admin.ch > The FVO > Research.