

ANIMAL SCIENCE

Master Thesis Projects

Topics for Master Thesis Projects available in 2015-2016

Department of Animal Science

Aarhus University



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Preface

This catalogue of master thesis projects available in 2015-2016 at the Department of Animal Science, Aarhus University, is considered to inspire and help you selecting a topic for your master thesis project. The catalogue is intended for students of the Master's Degree Programmes in Agrobiolology, in Sustainable Animal Nutrition and Feeding (EM-SANF), in Organic Agriculture and Food Systems (EUR-Organic), in Biology and for other animal science related master degree students who would like to do their master thesis project at Aarhus University. Read more about Agrobiolology and the other animal science related Master Degree programmes at <http://kandidat.au.dk/en/agrobiolology/>

A number of project proposals are presented in detail, together with contact addresses and other practical information. However, the catalogue is not exhaustive on the possibilities and should also be read as an inspiration on topic areas and supervisors. Therefore, you should feel free to contact us with your own ideas and to ask for further possibilities. You may also find inspiration and possible supervisors to contact at the Department website: <http://anis.au.dk/en/>

This catalogue also lists a few animal science related projects from the sister departments Agroecology (<http://agro.au.dk/en/>) and Food (<http://food.au.dk/en/>). You will find more projects and information at the mentioned sites.

During your thesis work you will be associated to a research group. Please note that the Department of Animal Science is situated at AU Foulum about one hour's drive from Campus Aarhus. There are student housing possibilities at AU Foulum and in Viborg which is close by and with regular bus connections. You can find maps at <http://www.au.dk/en/about/organisation/find-au/buildingmap/>

If you are an international student looking for exchange possibilities at Aarhus University you will find more information at <http://www.au.dk/en/exchange/welcome/> and <http://www.au.dk/en/internationalcentre/students/>

Thesis types offered for students at the MSc Agrobiolology programme

Thesis 30 ECTS credits

Theoretical thesis based on literature studies and/or analysis of issued and edited data sets.

Thesis 45 ECTS credits

Experimental thesis in which the student is responsible for collection and analysis of original raw data. The quality of the data collection, analysis and editing must be included in the overall assessment.

Thesis 60 ECTS credits

Experimental thesis in which the student is responsible for planning of trial design and methods as well as collection and analysis of original raw data. The quality and independence of own trial design, planning of data mining from original data bases or the development of new theories must be included in the overall assessment. The quality of the data collection, analysis and editing must also be included in the overall assessment.

When you have decided on a master thesis subject, a master thesis contract has to be signed, where the conditions and time schedule are described. Contract forms for students enrolled at Aarhus University and further details on requirements can be found here:

<http://studerende.au.dk/en/studies/subject-portals/agroecology-food-and-environment/special-information-for-masters-degree-students/masters-thesis-and-open-projects/>

Guidelines for the MSc Thesis Research Proposal

The Research Proposal

Broad agreement exists on the basic scientific standards that apply for a scientific study. Above all, the scientific standards that apply (and thus must be met) are the following:

The thesis must be theory-based.

The research must be verifiable.

The research must be in principle replicable.

To make sure that your research is complying with these rules, you should start by making a research proposal attending to these standards. A proposal consists of the following parts:

Problem statement: This gives the motivation for the selection of the topic and a clear description of the problem field, finally resulting in a concise problem statement. This part includes a review of the theoretical and empirical literature, which is most relevant to the topic and ensures that the topic has not already been exhausted by other researchers.

Theoretical framework: This part gives the background of your topic and leads up to your research questions/hypotheses. Which information is already known from the literature? The theory acts as a base for further investigation and comparison with the (future) results. You must indicate which concepts are important to be looked at in answering the research questions.

Research objective(s) and research questions/hypotheses: This clearly states the scientific objectives of the research. It is important that the objectives of the research are strictly related to the research topic. Subsequently, the research objective(s) should be translated into research questions/hypotheses. These are the questions that need to be tested and/or answered in order to fulfill the research objective(s).

Methodology: In this part of the proposal it should be explained how the theory and research questions can be examined and answered empirically. The function of the methodology part within the research proposal (and later in the thesis report) is to specify reliability, validity and replicability of the research.

You need to consider the following points when setting up a sound methodological framework:

Identify **the character of the thesis work**. For instance: is it an explorative, or comparative, or experimental study?

Design **the data collection**. This step requires arguing about, and providing an answer to, the following questions:

What is seen as data and from which sources of information do you obtain these data?

What are the criteria for determining and delineating the sources of information?

What methods are employed to derive the data from the sources of information? Is the case of experimental work: what is the experimental design, which factors do you explicitly test for, how many replicates do you have, etc.?

Which instruments will be used? It is important to think about the instruments you need far in advance, because not all equipment is available, or it can be in use elsewhere.

Design **the data analysis**: It should be pointed out that the description of the methods is necessary for data collection as well as for data analysis. How can the data be processed? Which statistical tests can be applied given the employed data collection methods or experimental design? Note that it is important to think about data analysis before you start to collect data. Certain analyses require certain data formats and experimental set-up.

Working plan and time schedule: The research proposal finally should be completed by a comprehensive working plan, indicating the necessary steps in carrying out the research, as well as their logical order in time, specification of milestones and quarterly status presentations – all to ensure that the workload is realistic and the thesis work is progressing in a sound way.

In some cases you need a **financial plan**. The general necessity of financial means to carry out the thesis work needs to be discussed and agreed between student and supervisor before the actual thesis work starts.

Guidelines for writing the Thesis Report

The thesis report (max. 100 normal pages), should be written in Danish or English with a summary in English. A normal page for written submissions is 2400 type units (i.e. characters plus spaces). To calculate normal pages, text is included, but not the front page, table of contents, bibliography, appendix, figures, tables and models.

Writing style: The thesis report should be written in an academic writing style. An academic writing style is in its essence short, clear and unambiguous. You use the terminology of the discipline. When you propose a hypothesis or theory, it must be substantiated. You bring documentation for any methods and postulates in terms of reference to scientific, peer reviewed research (scientific journal papers) or in terms of data. You discuss your actual results in relation to the applied methods and relevant peer reviewed research. You conclude on you hypothesis and on your actual results.

Referencing: It is very important that you give proper references when making statements from the literature. References acknowledge the work of others, and provide the reader with information on the sources that you used. Plagiarism is not acceptable and in serious cases students risk to be expelled from the university.

Plagiarism

Plagiarism is using another person's text as your own without making precise source references. Plagiarism is considered a very serious offense because it is a theft of another person's work and because you are assessed on work that in actual fact is not yours. You avoid plagiarism by always making a precise source reference when you use other people's work – this applies to quotations, reproductions, interpretations, translations, figures, illustrations, etc. When you produce a text, it must appear clearly which is the result of your own ideas and which passages are a result of your processing of other people's knowledge.

You must be aware that it is your responsibility: If you plagiarise, the consequences may be quite serious.

Suggested structure of the report

- **Front page:** This is the cover of your thesis. It should mention the title of the research, the name of the author, the name of the master's degree programme, year and date. The front page also needs to carry the logo of the university.
- **Title page:** This page must be in the strict format. The title page contains the following elements:
 - Title of the thesis research
 - Your full name (including all initials)
 - Student registration number
 - Name of the master's degree programme
 - ECTS of the thesis (60, 45 or 30)
 - Year and date of submission
 - Title, name and department of the supervisor(s)
 - A copyright statement – to be discussed
 - The proper logo of the university

- **Preface:** Less than one page.
- **Table of content:** Gives an overview of the chapter structure of the thesis with their respective page numbers. It should also include the summary and possible annexes.
- **Abstract:** Maximum of 250 words that describes the research for the general public.
- **Summary:** Provides a short (1-2 pages) but comprehensive summary of all chapters, i.e. the research objectives, the methods used, the most important results and conclusions.
- **Introduction:** This part includes the problem statement, the scientific objectives as well as the research questions/hypotheses that you have formulated in your proposal. You can also give a characterization of the type of work and a short outline of the structure of the subsequent chapters can complete it.
- **Background/Theoretical Framework:** This section provides a focused review of the theoretical and empirical literature which forms the basis of your work. The section substantiates the research questions/hypotheses of your work. The theoretical framework may be completed by a conceptual model, in which the relations of the relevant concepts of the applied theories are presented. Note that this framework may also be part of the introduction instead of being presented as a separate chapter.
- **Methods:** This part reports on the used information sources, as well as the applied methods and instruments for data collection and statistical data analysis. In contrast to the research proposal - where this section is presenting the ambitions/plan - you must present the situation as it has actually worked (incl. problems that occurred) in the final thesis report. In the case of fieldwork, you should describe the area and sites in which the research was carried out. When you have done experimental work, you should give all relevant details of the followed procedure (protocol). This enables others to evaluate your work, and to reproduce it if needed.
- **Results:** In this section the results should be presented in the most objective and comprehensive manner. Mixing results with subjective interpretation and discussion must be avoided. The challenge is to structure the results in such a way, that the research questions are addressed as best. Where appropriate, the findings should be illustrated or summarized with tables and figures including a statistical data analysis. In any case tables and figures must be drawn in such a way that they can be read on their own, independent from the surrounding text. Do not forget to include measurement units and an explanation of abbreviations. References to tables and figures should be made in the text (e.g., see table 1; cf. figure 2). Note that table captions are given above the table, whereas figure captions are placed below the figure.
- **Discussion:** The discussion section links your own findings, as presented in the result section, with those of others. What do your results mean and imply? The challenge here is to argue for and against the findings and the related theoretical concepts. Literature references are therefore again a requisite in this section. Furthermore, you must discuss your findings in the background of the scientific objective(s) and the research question(s), as well as in the light of the chosen theoretical framework. Last but not least, it should also not be forgotten to discuss to what extent the findings might have been influenced by the chosen methods.

- **Conclusions:** This section brings together the most important findings and consequences of your research. The conclusion must state the answer your work provided to the research questions and/or hypothesis you posed
- **Implications or Perspectives:** These conclusions normally touch on three aspects: a.) The scientific objective and the research questions (results); b.) Hints for future research on this topic (theoretical framework and methods); c.) Practical application of the results (consequences in management and policy), however, this last part might also be a separate section named 'Implications' or 'Perspectives'.
- **Bibliography:** In this section a list of all referred literature should be given, sorted in alphabetical order. The style for the different types of publications (articles in journals, books, chapters in books etc.) should be consistent, e.g. according to the [Harvard style](#), see also the [Harvard online referencing tutorial](#).
When you refer to information on the Internet you should give the complete web-address, as well as the date on which the information has last been accessed, e.g.:

Ministry of LNV (2002): Forestry on paper. Public brochure, downloadable at <http://www.minlnv.nl/morepaper.pdf>. Information derived on June 15, 2002.

Royall, C.P., B.L.Thiel, and A. Donald. 2001. Radiation damage of water in environmental scanning electron microscopy. *Journal of microscopy* [online]. 204(3), [Accessed 17 March 2009], pp.185-195. Available from: <http://0-www3.interscience.wiley.com.wam.leeds.ac.uk/>.

- **Annex/Appendix:** This is optional and the content of the annex/appendix is not evaluated, thus all important and relevant information must be given within the frame of the thesis and its main sections. The annex could include supplementary information about protocols, observations, calculations, etc. This could mean for example: the inclusion of the original data, further detailed statistical analysis, etc. Note that also the annex pages should be numbered consistently with the general text.

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Crossbreeding as a tool to enhance production performance and carcass value of dairy bull calves

Main subject area

Animal health and welfare/organic agriculture.

Animal nutrition and health/beef production /organic beef production.

Department and supervisor

Department of Animal Science

Faculty of Science and Technology

Aarhus University

Homepage: <http://anis.au.dk>

Mogens Vestergaard, head of research unit

Email: mogens.vestergaard@agrsci.dk

Phone: +45 8715 7843

Project start

As soon as possible.

Physical location of project and students work

Department of Animal Science, AU Foulum, DK-8830 Tjele.

Theoretical thesis based on analyses of existing data and literature study.

Short project description

The main subject area is beef production based on dairy bull calves and calves arising from crosses between a dairy breed and a beef breed. Recordings from designed experiments include feed intake recording, performance, carcass quality and animal health. A recent experiment showed improved performance of crossbreds in an intensive feeding system slaughtered at 8 months of age but will they fit into existing beef production concepts? (MSc-project A). Data from a recent organic beef production experiments also with crossbreds slaughtered at 17 months of age are available (MSc-project B).

Additional information

Datasets are available in Excel and SAS-files. Some literature is also available.

Estimation of day-to-day variation in feed intake of bull calves and its relation to ration composition, health and performance.

Main subject area

Animal health and welfare.

Animal nutrition and health/beef production.

Department and supervisor

Department of Animal Science

Faculty of Science and Technology

Aarhus University

Homepage: <http://anis.au.dk>

Mogens Vestergaard, head of research unit

Email: mogens.vestergaard@agrsci.dk

Phone: +45 8715 7843

Project start

As soon as possible.

Physical location of the project and students work

Department of Animal Science, AU Foulum, DK-8830 Tjele.

Theoretical thesis based on analyses of existing data and literature study.

Short project description

The main subject area is beef production based on dairy bull calves, feed intake recording, performance, and animal health. To investigate the influence of ration composition, e.g., total mixed rations vs. pelleted concentrate feeding, on the feed intake patterns. The aim is to estimate the variation in feed intake between days and within days in growing young bulls and relate the findings to disease recordings/veterinary treatments, performance of animals and health with a long term perspective of minimizing feeding-related stress on rumen function and animal health. (MSc-project).

Additional information

Datasets are available in Excel and SAS-files.

Production performance and slaughter- and carcass quality of heavy Holstein Friesian young bulls

Main subject area

Animal health and welfare.

Animal nutrition/beef production/product quality.

Department and supervisor

Department of Animal Science

Faculty of Science and Technology

Aarhus University

Homepage: <http://anis.au.dk>

Mogens Vestergaard, head of research unit

Email: mogens.vestergaard@agrsci.dk

Phone: +45 8715 7843

Project start

As soon as possible.

Physical location of the project and students work

Department of Animal Science, AU Foulum, DK-8830 Tjele.

Theoretical thesis based on analyses of existing data and literature study.

Short project description

Three groups of bull calves were raised on different feeding regimes varying in concentrate/roughage ratio and with or without a compensatory growth period. Even though maize silage (up to 90 % of the ration) was used as roughage and animals were housed indoor this dataset represents interesting aspects also in relation to organic farming and animal welfare. Initial slaughter groups allow for quantitative estimation of accretion rates in body and carcass. Experimental data including health recordings, performance, carcass and meat quality and rumen wall conditions are available for further analyses. There will be basis for an international manuscript (MSc-project).

Additional information

Datasets are available in Excel and SAS-files.

Pig nutrition and physiology in reducing the environmental load and improve production and health - field of research

Main subject area

Animal health and welfare, pig nutrition and physiology.

Department and supervisor

Department of Animal Science, Foulum

Assoc. professor Jan Værum Nørgaard, janvnoergaard@anis.au.dk

Prof. Hanne Damgaard Poulsen, hdp@anis.au.dk

Assist. professor Karoline Blaabjerg, karoline.blaabjerg@anis.au.dk

Project start

Physical location of project and students work

Department of Animal Science, Foulum.

Short project description

The aim of our research, and the research going on at the section of Animal Nutrition and Environmental Impact, is to optimize feeding to reduce the excretion of nutrients and to improve animal production and health. We have several ongoing projects, which may be of interest for you as a part of your thesis, or there might be planned projects in the near future, where your contribution would be valuable. Don't hesitate to ask if there is a possibility for you to write your thesis at Aarhus University, Foulum, within pig nutrition and physiology.

Additional information

30-45-60 ECTS as appropriate.

Nutritional quality of different protein sources for human and animal consumption

Main subject area

Animal health and welfare/monogastric nutrition.

Department and Supervisor

Department of Animal Science

Senior researcher Helle Nygaard Lærke, HelleN.Laerke@anis.au.dk

Senior researcher Søren Krogh Jensen, SorenKrogh.Jensen@anis.au.dk

Project start

Open.

Physical location of project and students work

Department of Animal Science, Foulum.

Short project description

Globally there is an increased demand for high quality protein for human and animal consumption, and the need for accurate determination of nutritional needs and quantity and quality of protein supply by food ingredients is more important than ever.

Several factors including interaction with other dietary components influence the nutritional quality of dietary proteins. Several ongoing research projects aim to evaluate the nutritional quality of vegetable and animal protein sources for human consumption using pigs and rats as experimental models.

The project will include a literature synthesis on dietary factors interacting with nutritional value of vegetable and animal protein, handling of data from recently performed animal experiments, supplementary laboratory analyses and possibility to participate in new animal experiments.

Additional information

30-45-60 ECTS. The MSc student will be affiliated to ongoing projects regarding evaluation of protein quality vegetable and animal protein sources for human consumption.

Recommended reading: <http://www.fao.org/ag/humannutrition/35978-02317b979a686a57aa4593304ffc17f06.pdf>.

Potential use of hemp in the Danish swine production

Main subject area

Animal science/animal nutrition and immunology/gastrointestinal health.

Department and Supervisor

Department of Animal Science (homepage: <http://agrsci.au.dk>)

Charlotte Lauridsen, head of research unit (Immunology and Microbiology)

Email: charlotte.lauridsen@anis.au.dk

Phone: +45 8715 8019

Project start

As soon as possible.

Physical location of the project and students work

Department of Animal Science, AU Foulum, DK-8830 Tjele.

Experimental thesis based on pig experiment and laboratory analyses.

Short project description

Cannabis in the form as industrial hemp contains bioactive substances, which may be of high relevance as a feed component in animal production, especially pigs and broilers. The leaf and seed part of the plant contains protein, carbohydrate and fatty acids of high nutritional value. Some of the challenges in the Danish pig production are the high piglet mortality and diseases such as diarrhea and gastric ulcer. In addition, the search for cheaper and/or alternative feed sources in the pig production makes hemp of special interest given the high biological value of the protein. Scientific results on other animal species have demonstrated therapeutic effects of cannabis probably due to the anti-inflammatory effects of the plant. American pig farmers have obtained surprising results on performance after feeding of leftover cannabis.

The aim of this thesis project is to:

- 1) Perform a literature synthesis of existing information on the potential biological effects of the cannabis (and cannabinoid substances)
- 2) Assist in the perform a feeding experiment with piglets and laboratory analysis with major focus on the gastrointestinal health and liveability of piglets
- 3) Describe potential use of cannabis in practical swine production.

Gastric ulcers in pigs (1)

Main subject area

Animal science/animal nutrition and immunology/gastrointestinal health.

Department and supervisor

Department of Animal Science (homepage: <http://agrsci.au.dk>)

Charlotte Lauridsen, head of research unit (Immunology and Microbiology)

Email: charlotte.lauridsen@anis.au.dk

Phone: +45 8715 8019

Project start

As soon as possible.

Physical location of the project and students work

Department of Animal Science, AU Foulum, DK-8830 Tjele.

Theoretical thesis based on literature study, however, experimental work can be included.

Short project description

Ulceration of the porcine stomach is a major problem for the swine industry and has also recently been brought up as a hot topic as described in the news. Stomach ulcers can lead to reduced daily growth of slaughter pigs and ultimately lead to increased mortality. Older research has focused on processing of feed as being one of the most predominant causes, however, the disease is multifactorial and factors such as **environmental changes, transportation, lack of access to straw, and crowding**, all commonly experienced by pigs in modern production systems, are potentially stressful events or conditions that were associated with increased occurrence of ulcerations.

The aim of this thesis project is to perform a literature synthesis of existing information on:

- 1) the potential risk factors for the development of gastric ulcer in swine,
- 2) to describe potential biomarkers for the development of these health changes,
- 3) to describe potential feeding strategies to overcome the problem, and, this part of the M.Sc. project could involve a pig experiment to be conducted in collaboration with PhD students/senior scientists.

Gastric ulcers in pigs (2)

Main subject area

Animal science/animal nutrition and immunology/gastrointestinal health.

Department and Supervisor

Department of Animal Science (homepage: <http://agrsci.au.dk>)

Charlotte Lauridsen, Head of research unit (Immunology and Microbiology)

Email: charlotte.lauridsen@anis.au.dk

Phone: +45 8715 1238

Project start

As soon as possible.

Physical location of the project and students work

Department of Animal Science, AU Foulum, DK-8830 Tjele.

Experimental thesis based on laboratory analyses of stomach biopsies and data analysis.

Short project description

Ulceration of the nonglandular esophageal region of the porcine stomach is a major problem for the swine industry. Stomach ulcers can lead to reduced daily growth of slaughter pigs and ultimately lead to increased mortality. Older research has focused on processing of feed as being one of the most predominant etiological factors, however, environmental changes, transportation, lack of access to straw, and crowding, all commonly experienced by pigs in modern production systems, are potentially stressful events or conditions that are associated with increased occurrence of pars esophageal ulcerations. The aim of this thesis is to study the inflammatory state in different regions of the stomach in relation to the absence or presence of ulcer and to the intragastric milieu. The laboratory work includes purification of RNA for gene expression studies by the qPCR method using relevant primers and probes.

Additional information

The master student should have a strong interest in laboratory work. The student will primarily be trained in purification of RNA and RT-qPCR, but other relevant techniques may be included in the project.

Characterization of metabolites and antinutritional compounds in forage legumes

Main supervisor

Senior scientist Søren Krogh Jensen, Department of Agricultural Science, Faculty of Science and Technology, Aarhus University

Email: skj@anis.au

Phone: +45 8715 8076

Physical location of the project

Blichers allé 20, 8830 Tjele.

Project start

August or September 2015.

Extent and type of project

60 ECTS master thesis.

Main subject area

The project is within the field of animal nutrition with collaboration to Department of Food Science.

Additional information

The study will be part of a large project on protein extraction from green materials in the interdisciplinary green protein platform at Aarhus University.

Short project description

An increasing world population demands increasing amounts of proteins. High quality feed proteins are increasingly becoming more and more expensive and extensive import of proteins from overseas is a challenge from a sustainable point of view, especially in relation to fulfil protein requirement for organic feed supplementation. Anti-nutritional factors (ANFs) in plant may reduce the bioavailability of the proteins. Thus in order to use forage proteins in feed for mono-gastrics consumption anti-nutritional factors (ANFs) factors needs to be characterized.

The project aim at developing new analytical methods for the analysis of ANF in forage legumes. Both a target and untargeted approach may be used and methodology based on LC-MS will be developed and used to reveal the effect of ANFs on the protein quality.

Metabolomics as a tool in nutrition studies

Main subject area

Animal health and welfare/animal science/human health.

Department and Supervisor

Department of Animal Science

Mette Skou Hedemann, Senior scientist

Email: Mette.Hedemann@anis.au.dk

Phone: +45 8715 8078

Project start

Any time.

Physical location of project and students work

Department of Animal Science, AU-Foulum, DK-8830 Tjele.

Short project description

Metabolomics is the detection of low molecular weight metabolites and their intermediates from biological samples (blood, urine, digesta, tissue etc.). The metabolome is made up of endogenous metabolites, products of the metabolism, metabolites originating from the microbial fermentation as well as exogenous metabolites originating from the feed, e.g. phytochemicals. Changes in the metabolome may thus reflect altered metabolic pathways or changes in the microflora or its activity.

In the Molecular Nutrition and Cell Biology group we have samples from several dietary intervention studies where metabolomics analyses are relevant.

Examples of studies and sample types:

- Plasma samples from a rat study where it was studied whether different bread types had preventive effects on the development of type 2 diabetes.
- Samples (urine, plasma, digesta) from a pig study where pigs were fed a diet low in enterolignans or a diet high in enterolignans without or with antibiotic treatment.
- Cloned pigs – what are the metabolic differences between a cloned and a “normal” Yucatan pig?

These are studies with a human health perspective but it is also possible to do experiments where the aim is studies on animal nutrition and health.

Additional information

The master's student should be interested in laboratory work as well as extensive data processing using various software tools as well as internet based databases.

We have samples for the study at hand.

How can we control lameness and hoof disorders in dairy cows?

Main subject area

Animal health and welfare.

Department and supervisor

Department of Animal Science

Senior scientist Peter Thomsen, ptt@anis.au.dk, tel. +45 87157834

Project start

Any time.

Physical location of project and students work

Research Centre Foulum (combined with herd visits and work from home).

Short project description

Hoof disorders and lameness are major problems in modern dairy production due to economic losses and decreased animal welfare. Would you like to address this 'hot topic' and do a thesis focusing on lameness/hoof disorders? I will be able to provide guidance/supervision, help with contact to herds and access to data from databases. The exact aim/area is not fixed, but will be decided together with you. Examples could be: 1) evaluation of risk factors for lameness/hoof disorders in Danish dairy herds based on information from a combination of herd visits, questionnaire surveys and existing data from databases, 2) an evaluation of barriers to lameness control: Why do farmers not invest more time/money in fighting lameness?, or 3) a small clinical trial testing the efficacy of some kind of prevention or treatment of one or more hoof disorders.

Are sows fit for transport?

Main subject area

Animal health and welfare.

Department and supervisor

Dept. Animal Science, Research Group for Animal Behaviour and Stress Biology

Mette S. Herskin

MetteS.Herskin@anis.au.dk; tel. 50502969

Project start

During 2015 or 2016.

Physical location of project and students work

Research Centre Foulum, data collection in private farms.

Short project description

Danish sows are slaughtered after finishing the production period. This project aims to gain new knowledge about the fitness for transport of sows – can they cope with the demands put on them during transport and lairage – and how can we check this before deciding to transport them?

Additional information

The project is part of a large on-going research project, and involved ethological as well as clinical data.

Animal behaviour – several projects will be possible within this area

Main subject area

Animal health and welfare.

Department and supervisor

At the research group for Animal Behaviour and Stress Biology, we are several potential supervisors, who will welcome new master students. If you are interested in a thesis focusing on animal behaviour, and wish to be part of a group of researchers committed to animal behaviour and stress biology – but with individual focus areas within this research area – you are welcome to contact Tina Albertsen, Tina.Albertsen@anis.au.dk; 87157901 and she will connect you with a relevant researcher, or you may contact the researcher directly.

Project start

Spring 2015 and onwards.

Physical location of project and students work

Most of the projects are located at Research Center Foulum near Viborg, but some would require data collection on private farms, and some in other locations.

Specific research areas/key words for the different supervisors within the study of animal behaviour (in alphabetic order)

- Heidi Andersen (HeidiMai-Lis.Andersen@anis.au.dk): pig housing, pig production, pig behaviour
- Janne W. Christensen (JanneWinther.Christensen@anis.au.dk): horses, social behaviour, learning and training, fear reactions and habituation
- Mette Herskin (MetteS.Herskin@anis.au.dk): pigs, cattle, animal pain, sickness behavior, animal transportation, shoulder ulcers, tail docking, animal models, umbilical hernia
- Margit Bak Jensen (MargitBak.Jensen@anis.au.dk): calf housing, calf feeding, dairy cows, rooting materials
- Lene Juul Pedersen (Lene.JuulPedersen@anis.au.dk): piglet mortality, loose housing, sow production, farrowing
- Jens Malmkvist (Jens Malmkvist@anis.au.dk): mink, pigs, early young survival, fear, stress responses, abnormal behaviour such as stereotypies, fur-chewing, maternal-offspring interactions influence on offspring later behaviour, aggression and male reproductive performance in mink.
- Lene Munksgaard (Lene.Munksgaard@anis.au.dk): animal welfare, cattle, timebudgets, automatic recording of behaviour, behavioural needs, housing and management of cattle
- Anja Brinch Riber (Anja.Riber@anis.au.dk): effects of early experiences and housing on development of behaviour and welfare, cannibalism, feather pecking, leg problems, welfare assessment in broiler and laying hen production
- Karen Thodberg (Karen.Thodberg@anis.au.dk): dogs, pigs, companion animals, tail biting, tail docking, therapy animals, human-animal interactions

Do dairy calves of good mothers perform more play behaviour?

Main subject area

Ethology.

Department and supervisor

Senior Scientist Margit Bak Jensen

Email: MargitBak.Jensen@agrsci.dk

87157941

Project start

2015.

Physical location of project and students work

At AU, Foulum.

Short project description

Play behaviour is suggested to indicate good animal welfare. The project investigates the hypothesis that the more maternal care a newborn calf receives, the more play behaviour the calf performs. Based on existing recordings of dairy cows and their calves (video recordings of behavior the first 3 days of life), this hypothesis is tested.

Additional information

At least one ethology course is mandatory.

Tail biting and tail damage in pigs

Main subject area

Animal health and welfare – Animal Behaviour and Stress Biology.

Supervisors

Main supervisor:

Senior Researcher Lene Juul Pedersen

lene.juulpedersen@anis.au.dk

+45 87157907

Co-supervisor:

PhD student Mona Lilian Vestbjerg Larsen

mona@anis.au.dk

+45 51507927

Project start

Flexible (from April 2015 and onwards).

Physical location of project and students work

Department of Animal Science, AU-Foulum, DK-8830 Tjele.

Short project description

Tail biting is a major problem within the modern pig production and is usually partly prevented through tail docking. However, tail docking is no longer allowed to be performed on a routine basis, and we therefore need to search for alternative preventive methods. Currently, it seems most promising to develop a predictive tool where pigs' behaviour is monitored. This tool has the purpose to predict tail damage to ensure that preventive measures can be applied in proper time. To develop such a tool, we need information on which behaviours we can consider predictive of tail damage, how they can be measured and how we afterwards can prevent the predicted tail damage.

The student will be a part of a larger project involving a PhD student, a Post Doc and multiple senior researchers. The above describes the overall aim of the project which will be covered by the already involved staff. However, much research still need to be done within the field of tail biting and tail damage, and the student will have free will to decide exactly what he/she will be looking at; as long as it can be done within the already prepared project framework. Examples of possible subjects to be looking at are:

- 1) The temporal development of tail biting (from weaning to slaughter)
- 2) Differences between docked and undocked pigs
- 3) How tail posture relates to activity level, handling etc.

The student will also have the opportunity to join in on the work in the stable.

Please contact us if you think this sounds interesting and you want more information.

The behaviour of dogs during different types of dog-assisted visits in nursing homes (Adfærd hos besøgshunde)

Main subject area

Animal health and welfare – animal behaviour.

Department and Supervisor

Department of Animal Science

Senior Scientist Karen Thodberg

Karen.thodberg@anis.au.dk

Tel. 8715 7938

Project start

Projects will be available from august 2015 until the start of 2017.

Physical location of project and students work

The project will be conducted in nursing homes in the Viborg-Randers-Aarhus area.

Short project description

The use of visiting dog in nursing homes has become widespread in Denmark. These visits are conducted in very different ways, and little is known about how these different dog-assisted activities affect the dogs.

In this project the student will assist during experimental dog visits, and study the behaviour of dogs during visits with either a high or a low activity level.

Additional information

Students with at least one ethology course will be preferred.

The function of an unknown cell type in chicken blood

Main subject area

Animal science/chicken health/disease protection.

Department and Supervisor

Department of Animal Science

Tina Dalgaard MSc, PhD

E-mail: tina.dalgaard@anis.au.dk

Phone: +45 87 15 80 52

Project start

Project start and ECTS content flexible.

Physical location of project and students work

Department of Animal Science, AU-Foulum, DK-8830 Tjele.

Short project description

Project subject: Functional characterization of chicken CD4+CD8+ double positive cells.

Background: Chicken T lymphocytes are essential for adaptive immune responses in the chicken. The cell population comprise CD4+ T helper cells and CD8+ cytotoxic T cells. In several species mature T cells expressing both CD4 and CD8 have also been described. Phenotypic studies of this double positive population (DP) have been performed in the chicken but thorough functional characterization is lacking. In other species, DPs are defined as part of the memory T cells pool increasing with age and antigen contact. In this project we will address if this is also the case in the chicken.

Aim: The aim of the project is to perform detailed functional analyses of chicken DPs in order to elucidate activation status, proliferative capacity and cytokine production potential of these cells.

Methods: The student will study chicken lymphocytes from peripheral blood and spleen ex-vivo. Different activation strategies will be applied and phenotype, proliferation and cytokine production will be addressed by flow cytometry analyses.

Additional information

The master student will be attached to a group of scientists, post docs, and PhD-students and their experimental work in on-going projects. The student will primarily be trained in cell culture and flow cytometry but other relevant techniques like RT-qPCR and ELISA may be included in the project.

A new method to study immunological communication in chickens

Main subject area

Animal science/chicken health/disease protection.

Department and Supervisor

Department of Animal Science

Tina Dalgaard MSc, PhD

Email: tina.dalgaard@anis.au.dk

Tel: 87 15 80 52

Project start

Project start and ECTS content flexible.

Physical location of project and students work

Department of Animal Science, AU-Foulum, 8803 Tjele.

Short project description

Project subject: Validation of an ELISPOT assay for detection of avian interferon gamma.

Background: Interferon gamma is an important cytokine in adaptive immunity. Production of interferon gamma can be assessed by numerous methods but the ELISPOT technique provides both qualitative (type of immune protein) and quantitative (number of responding cells) information in a simple and inexpensive way. When established the method will be used for monitoring avian immune responses in experimental vaccination/infection studies.

Aim: To establish and validate an ELISPOT assay for detection of avian interferon gamma as a parameter for T cell mediated immunity.

Methods: The student will coat a polymer membrane in micro plates with capture antibody and add cells of interest stimulated with specific antigen or mitogen. After culture, produced interferon gamma will be visualized on the membrane with a detection antibody. The assessment of interferon gamma production under different conditions by ELISPOT will be compared with interferon gamma detection by other methods e.g. intracellular staining and flow cytometry. If time allows it, the assay will be applied to samples from an experimental infection.

Additional information

The master student will be attached to a group of scientists, post docs, and PhD-students and their experimental work in on-going projects. The student will primarily be trained in cell culture and the ELISPOT technique but other relevant techniques like ELISA and flow cytometry can be included in the project.

Comparison of “immunocompetence” in three commercial chicken lines

Main subject area

Animal science/chicken health/robustness/disease resistance.

Department and Supervisor

Department of Animal Science

Tina Dalgaard MSc, PhD

Email: tina.dalgaard@anis.au.dk

Tel: +45 87 15 80 52

Project start

Project start and ECTS content flexible.

Physical location of project and students work

Department of Animal Science, AU-Foulum, DK-8830 Tjele.

Short project description

Several components in chicken blood act as natural disease protection molecules. Especially, the opsonins are important for the early/immediate immune responses to infection. The project aim is to establish a method to study the “opsonin potential” of chicken serum and investigate if opsonin potential correlates with general robustness. Samples are available from a large experiment where three commercial chicken lines were compared.

Additional information

The master student will be linked to a group of scientists, postdocs, and PhD-students and their experimental work in on-going projects. The student will be trained in cell culture, flow cytometry, and ELISA.

Natural disease protection in chickens

Main subject area

Animal Science/chicken health/natural disease protection.

Department and Supervisor

Department of Animal Science

Helle Juul-Madsen, Senior Scientist

E-mail: Helle.JuulMadsen@anis.au.dk

Tina Dalgaard MSc, PhD

Email: tina.dalgaard@anis.au.dk

Project start

Project start and ECTS content flexible.

Physical location of project and students work

Department of Animal Science, AU-Foulum, DK-8830 Tjele.

Short project description

Project subject: Study of chicken Mannose-Binding Lectin (MBL) expression in different tissues of two chickens lines selectively bred for high or low MBL serum concentration.

Background: Mannose-Binding Lectin (MBL) is an important innate factor in disease protection and MBL has a high affinity for binding to mannose and other sugar residues present on the cell wall of bacteria, viruses and parasites. MBL is an acute phase protein and mainly secreted by hepatic cells. Results from our lab using chickens selected for high or low serum MBL concentration have shown that low amount of circulating MBL is associated with increased disease severity after infection. These results confirm that chicken MBL, as proven in mammals, plays a major role in disease resistance. In other species extra-hepatic production of MBL has been reported. Only little information is available on MBL transcription in local chicken tissues.

Aims: To determine MBL gene expression in selected tissues from chickens with high or low MBL serum concentration.

Research plan: The student will purify RNA from the sampled tissues – we are particular interested in the intestine during the first week of life. MBL gene expression will be analysed by qPCR. If possible the student will also study cytokines and hormones with modulatory effects of MBL gene transcription in an in vitro model.

Additional information

The master student will be linked to a group of scientists, postdocs, and PhD-students and their experimental work in on-going projects. The student will be trained in bacterial cultures, virus cultures, flow cytometry, and ELISA.

Metabolomics on blood and feces from fish fed with different quality of feed

Main supervisor

Associate Prof. Trine Kastrup Dalsgaard, Department of Food Science, Aarhus Faculty of Science and Technology, Aarhus University

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Phone: +45 8715 7998

Homepage: <http://pure.au.dk/portal/da/trine.dalsgaard@food.au.dk>

Physical location of the project

Blichers allé 20, 8830 Tjele.

Project start

August or September 2015.

Extent and type of project

45 or 60 ECTS master thesis.

Main subject area

The project is within the field of metabolomics.

Additional information

The study will be part of a bigger project "New physicochemical and technological approach for High Quality and Sustainable Fish Feed production – ExiPro" a collaboration between Biomar, DTU-aqua, KU and AU. A post doc is linked to the project.

Short project description

Aquaculture is one of the fastest growing sectors worldwide and counts for 49% of all fish for human consumption. The sector is increasing by 8-10% each year and it is estimated that in 2030 62% of the fish worldwide will come from aquaculture (Food and Agricultural Organization of the United Nations, Fisheries and Aquaculture Statistics and Information Service, 2014). An increasing world population demands increasing amounts of proteins. Expensive proteins like fish proteins could be complemented partly by plant proteins and still fulfil the need for indispensable amino acids, and thereby help to produce fish for human consumption to fulfil the needs of proteins to feed the world. To understand how the fish metabolize different types and quality of proteins the metabolic profile can be followed and correlated to the growth and utilization of the feed.

The project aims at developing a tool to understand the relation between fish feed composition and quality and the growth performance of the fish. A metabolomics methodology based on GC-MS metabolomics will be developed and used to reveal the effect of proteins on the metabolome of the fish. The results combined with multivariate data analysis will clarify the impact of fish feed composition and quality on the metabolite profile of the fish.

Cattle feeding, nutrition and physiology in relation to emissions, efficiency and product quality

Main subject area

Animal Science, cattle nutrition and physiology.

Department and Supervisor

Department of Animal Science, AU-Foulum.

Senior Scientist Martin Riis Weisbjerg, Martin.Weisbjerg@agrsci.dk

Senior Scientist Peter Lund, Peter.lund@agrsci.dk

Assoc. Prof. Jakob Sehested, Jakob.sehested@agrsci.dk

Project start

To be decided in agreement with supervisor.

Physical location of project and students work

Department of Animal Science, Foulum.

Short project description

The aim of cattle research at the section of Animal Nutrition and Environmental Impact is to optimize feeding and nutrition to reduce greenhouse gas emissions, environmental impact and to improve animal production, product quality and health. We have several ongoing projects, which may be of interest for you as a part of your thesis, or there might be planned projects in the near future, where your contribution would be valuable. Don't hesitate to ask if there is a possibility for you to write your thesis at Aarhus University, Foulum, within cattle nutrition and physiology.

Additional information

30-45-60 ECTS as appropriate. The MSc student is invited as a co-author on the outcoming scientific paper.

Effect of pelletising protein rich feedstuffs on small intestinal amino acid absorption in dairy cows

Main subject area

Animal health and welfare

Ruminant nutrition

Department and Supervisor

Department of Animal Science, AU-Foulum

Assistant professor Mogens Larsen

Mogens.Larsen@agrsci.dk

+45 8718 7983

Project start

October/November 2014.

Physical location of project and students work

Department of Animal Science, AU-Foulum.

Short project description

The effect of processing on absorption of amino acids to the blood from the small intestinal lumen is not well described. Recent experiments have shown that the periparturient dairy cows benefit greatly from a substantially increase in protein supply. An easy way to allocate the extra protein is via concentrates in some sort of automatic concentrate feeders. Hence, it is important to know the effect of processing on true absorption of amino acids from protein rich feedstuffs.

The main task in the project will be to participate in the conduction of the experimental work with 6 dairy cows. The cows will be implanted with permanent catheters in an artery, hepatic portal vein, and the hepatic vein. Blood was sampled from these catheters will be analysed for amino acids. This allows calculation of absorption from the digestive tract and liver metabolism. Cows will be fed 3 different types of concentrates in replicated 3 x 3 Latin square design.

The preferred thesis format is: literature review, article draft, and general discussion. The article draft is supposed to be published later in peer reviewed journals.

Additional information

It will be advantageous to have great interest in ruminant nutrition and good flair for animal work as well as data handling and statistics.

Liver metabolism of ketone bodies in periparturient dairy cows

Main subject area

Animal health and welfare/ruminant nutrition.

Department and Supervisor

Department of Animal Science, AU-Foulum

Assistant professor Mogens Larsen

Mogens.Larsen@agrsci.dk

+45 8718 7983

Project start

Any time.

Physical location of project and students work

Department of Animal Science, AU-Foulum.

Short project description

Ketone bodies are important nutrients in dairy cows and especially during periods with high mobilisation of adipose tissue. Ketone bodies originate from two metabolic pathways: 1) metabolism of absorbed butyrate from the rumen, and 2) from the breakdown of non-esterified fatty acids mobilised from the adipose tissues. In the postpartum cow, mobilisation from adipose tissue is an important energy source, where ketone bodies become water soluble nutrients originating from water insoluble non-esterified fatty acids. Sugar rich diets increase the absorption of butyrate from ruminal fermentation. Hence, feeding fodder beets to postpartum dairy cows may increase the risk of ketosis in postpartum transition cows as the greater butyrate production in the rumen also will contribute to formation of ketone bodies.

The main task in the project will be to work with data from an experiment conducted with 9 dairy cows from 2 weeks before to 4 weeks after calving. The cows had permanent catheters in an artery, hepatic portal vein, and the hepatic vein. Blood was sampled from these catheters and has been analysed for acetate, propionate, butyrate, and ketone bodies. This allows calculation of absorption from the digestive tract and liver metabolism of these nutrients. From the day of calving cows were subjected to three treatments: NaOH wheat rich diet, fodder beet rich diet, or lucerne silage rich diet.

The preferred thesis format is: literature review, article draft, and general discussion. The article draft is supposed to be published later in peer reviewed journals.

Additional information

It will be advantageous to have good flair for data handling and statistics.

Effect of level of ruminal starch digestion on ruminal environment, fibre digestion, and microbial protein synthesis

Main subject area

Animal health and welfare/ruminant nutrition.

Department and Supervisor

Department of Animal Science, AU-Foulum

Senior scientist Martin R. Weisbjerg

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+45 8715 8046

Assistant professor Mogens Larsen

Mogens.Larsen@agrsci.dk

+45 8718 7983

Project start

Any time.

Physical location of project and students work

Department of Animal Science, AU-Foulum.

Short project description

High ruminal starch fermentation has often been associated with high acid loads inducing low pH and consequently suboptimal conditions for the cellulolytic bacteria fermenting fibre (NDF) in the rumen of the feed.

The project will comprise

- Statistical analysis of a dataset containing ruminal digestibilities of fibre and starch as well as measures of microbial protein synthesis, ruminal environment (pH and concentrations of volatile fatty acids (VFA) from 4 *in vivo* experiments conducted previously.
- Writing of thesis in the format of literature review, paper draft, and general discussion. The paper draft is supposed to be published later in peer reviewed journals.

Additional information

It will be advantageous to have good flair for data handling and statistics.

Drying off individual quarters of lactating cows as a mastitis control strategy

Main subject area

Animal Health and Welfare

Epidemiology, Veterinary Science, Animal Science

Department and Supervisor

Institute of Animal Science, research group of Epidemiology and Management

Senior Advisor Torben Werner Bennedsgaard, Torbenw.bennedsgaard@agrsci.dk

Project start

Start in April or later. No later than September 2015

Physical location of project and students work

Based from AU Foulum, some farm visits

Short project description

Initially, a questionnaire based survey is conducted in altogether 100 Danish and German organic dairy farms (75 in DK, 25 in DE) on reasons for dry quarters and procedures for drying off individual quarters. On this basis, best practices for drying off quarters and subsequent surveillance are specified for major farm types.

A controlled within herd experiment is conducted in 6 commercial Danish organic dairy herds (including two different breeds) with automatic milking systems. In total 180 cows with subclinical mastitis (elevated somatic cell counts above a predefined threshold) are randomly allocated to one of three treatments: 1) Antibiotic treatment, 2) Drying off infected quarter (following the identified best practice), 3) No treatment (subject to the absence of clinical mastitis).

Repeated milk samples are taken prior to treatment, one month after treatment, at drying off

Repeated milk samples are taken prior to treatment, one month after treatment, at drying off and at calving. Quarter milk production and SCC in the current and subsequent lactation are recorded. Animal based welfare indicators (animal behaviour and clinical observations based on the Welfare Quality® protocol) focusing on animal pain and discomfort are collected for the experimental animals. Based on effects of treatment on cure rate, milk production in current and subsequent lactations and related effects, herd level consequences on production, economy and work load for relevant handling strategies are calculated using the dairy herd computer simulation model SimHerd (Østergaard et al. 2005) and data from WP2. Based on the results, recommendations on handling mild mastitis/sub clinical mastitis are developed for major farm types and breeds specified in WP2 and WP1 respectively.

Dry quarters in herds with automatic milking systems

Main subject area

Animal Health and Welfare

Epidemiology, Veterinary Science, Animal Science

Department and Supervisor

Institute of Animal Science, research group of Epidemiology and Management

Senior Advisor Torben Werner Bennedsgaard, Torbenw.bennedsgaard@agrsci.dk

Project start

Any time

Physical location of project and students work

Based from AU Foulum, some farm visits

Short project description

Research questions that can be addressed:

Why do AMS-herds have more cows with dry quarters

Which criteria do the AMS farmers use for drying off individual quarters

To what extend is the milk production affected

Fate of cows with dry quarters: culling or return of quarters in production in next lactation

Infection route of *Streptococcus agalactiae* in AMS-herds

Main subject area

Animal Health and Welfare

Epidemiology, Veterinary Science, Animal Science

Department and Supervisor

Institute of Animal Science, research group of Epidemiology and Management

Senior Advisor Torben Werner Bennedsgaard, Torbenw.benedsgaard@agrsci.dk. Tlph 87157824

Project start

Any time

Physical location of project and students work

Based from AU Foulum, some herd visits

Short project description

The project is expected to be a combination of analysis of available data and collection of samples and information from herds.

Some types of automatic milking systems (milking robots) have significantly higher prevalence of *Strept. agalactiae* than conventionally milked herds.

How are the bacteria transferred between cows – in the barn or in the robot?

Are there any differences in management in infected herds with high and low prevalence of the bacteria?

Foot rot in dairy cows, housing and climate

Main subject area

Animal Health and Welfare

Epidemiology, Veterinary Science, Animal Science

Department and Supervisor

Institute of Animal Science, research group of Epidemiology and Management

Senior Advisor Torben Werner Bennedsgaard, Torbenw.bennedsgaard@agrsci.dk

Project start

Any time

Physical location of project and students work

Based from AU Foulum, some herd visits

Short project description

The incidence of foot rot varies greatly between years and between herds. Preliminary analysis shows that this might be related to the climate in individual years.

Possible research questions:

Which herd types have the highest incidence of treatment for foot rot (e.g. loose housing, organic, grazing etc.)?

How are the relations herd types and climatic data?

Eventually study of cases from herds with repeated or single cases of foot rot related to the results of the data analysis.

Coagulase negative staphylococci (CNS) as mastitis bacteria

Main subject area

Animal Health and Welfare

Epidemiology, Veterinary Science, Animal Science

Department and Supervisor

Institute of Animal Science, research group of Epidemiology and Management

Senior Advisor Torben Werner Bennedsgaard, Torbenw.bennedsgaard@agrsci.dk

Project start

Any time

Physical location of project and students work

Based from AU Foulum, some herd visits

Short project description

In some herds CNS seems to cause clinical mastitis and/or high somatic cell counts despite generally being seen as a minor pathogen.

Relevant research questions:

Which CNS species cause the problems?

Severity of cases?

Is treatment effective?

Do clinical cases start as chronic mild infections?

Identification of herd specific reservoirs for transfer between cows

The project will be based on a combination of existing data and collection of new data.

Treatment of mastitis – selection of antibiotics

Main subject area

Animal Health and Welfare

Epidemiology, Veterinary Science, Animal Science

Department and Supervisor

Institute of Animal Science, research group of Epidemiology and Management

Senior Advisor Torben Werner Bennedsgaard, Torbenw.bennedsgaard@agrsci.dk

Project start

Any time

Physical location of project and students work

Based from AU Foulum

Short project description

30% of Danish cows are treated for mastitis every year. The recommendation is to use narrow spectrum antibiotics which is followed in a majority of herds.

Why do some Danish dairy herds choose not to use narrow spectrum antibiotics as the drug of choice?

Do these herds use resistance testing and does the testing confirm the need for broad spectrum antibiotics?

The project will be a combination of analysis of existing data, herd visits and interview/questionnaires to farmers.

Drying off of dairy cows

Main subject area

Animal Health and Welfare

Epidemiology, Veterinary Science, Animal Science

Department and Supervisor

Institute of Animal Science, research group of Epidemiology and Management

Senior Advisor Torben Werner Bennedsgaard, Torbenw.bennedsgaard@agrsci.dk

Project start

Any time

Physical location of project and students work

Based from AU Foulum

Short project description

The project will focus on procedures for drying off cows and the use and effects of treatments

Reduction in feeding and milking

Use of culture or PCR of milk samples

Use of antibiotics and / or teat sealants and the effect of these actions on somatic cell count in the following lactation