

Technical Annex

Scientific description of the project

Title: Quality and Integrity of Organic Eggs, Chicken Meat and Pork

Acronym: QEMP

Duration: 3.0 yr From: 1.1.2007 to: 31.12.2009

Participating scientists:

(Titles, names and brief institutional affiliations of scientists in the project. Head of project is written in bold, participants responsible for work packages are underlined).

Head of Research Unit, John Hermansen, Dept. of Agroecology, Danish Institute of Agricultural Sciences (WP1 & WP3)

Senior scientist, Marianne Hammershøj, Dept. of Food Science, Danish Institute of Agricultural Sciences (WP2)

Senior Scientist, Sanna Steinfeldt, Dept. of Animal Health, Welfare and Nutrition, Danish Institute of Agricultural Sciences

Head of Sensory Lab, Judith Henning, Dept. of Food Science, The Royal Veterinary and Agricultural University

Ph.D. student, Klaus Horsted, Dept. of Agroecology, Danish Institute of Agricultural Sciences

Senior Scientist, Hanne Lindhard Pedersen, Dept. of Horticulture, Danish Institute of Agricultural Sciences

Professor, Anders Hans Karlsson, Dept. Of Food Science, The Royal Veterinary and Agricultural University

Scientist, Anne Grete Kongsted, Dept. of Agroecology, Danish Institute of Agricultural Sciences (WP4)

Project manager, Chris Claudi-Magnussen, Danish Meat Research Institute

Head of Sensory Lab, Camilla Bejerholm, Dept. of Pork and Beef Quality, Danish Meat Research Institute

Head of Chemical Lab., Kirsten Jensen, Dept. of Measurement and Chemical Analyses, Danish Meat Research Institute

Scientist, Bent Hindrup Andersen, Dept. Of Agricultural Engineering, Danish Institute of Agricultural Sciences

Scientist, Helle Frank Jensen, Dept. Of Agricultural Engineering, Danish Institute of Agricultural Sciences

Associate Professor Allan Roepstorff, Danish Centre for Experimental Parasitology, Dept. of Veterinary Pathobiology, The Royal Veterinary and Agricultural University (WP 5)

Scientist Maria Langkjær, Danish Centre for Experimental Parasitology, Dept. of Veterinary Pathobiology, The Royal Veterinary and Agricultural University

Scientist Annette Nygaard Jensen, Dept. of Microbiological Food Safety, Danish Institute for Food and Veterinary Research.

Scientist Lars Mølbak, Dept. of Veterinary Diagnostics and Research, Danish Institute for Food and Veterinary Research.

Senior scientist Tim K. Jensen, Dept. of Veterinary Diagnostics and Research, Danish Institute for Food and Veterinary Research.

Senior Scientist Laurits Lydehøj Hansen, Dept. of Food Science, Danish Institute of Agricultural Sciences (WP 6)

Head of Section Dorte Lau Baggesen, Dept. of Microbiological Food Safety, Danish Institute for Food and Veterinary Research.

Associate Professor Derek V. Byrne, Sensory Science, Dept. of Food Science, The Royal Veterinary and Agricultural University

Professor Stig Milan Thamsborg, Danish Centre for Experimental Parasitology, Dept. of Veterinary Pathobiology, The Royal Veterinary and Agricultural University

English summary (1 page, suitable for publication):

The organic pig and poultry production of today in Denmark is typically characterized by 1) compromises with regard to animal welfare issues e.g. environments that restrict the animals possibility of performing natural behaviour, 2) the use of specialised genotypes not necessarily well-suited for outdoor conditions nor of a particular gastronomic quality, 3) a heavy price competition with egg, chicken meat and pork products produced in conventional farming, and 4) little or no objective quality differences compared with conventional products. These constraints may be the reason for the current low production and consumption of organic chicken meat and pork and call for new ways of production.

Thus, it is a key challenge to establish the knowledge base for development of new organic products which have a high credibility, a high eating quality, and – not least – have a particular appearance in the final presentation for the consumers, hereby making them recognize the products as organic and in consequence be willing to pay a premium price. The establishment of such knowledge is the basic idea of this project

The work is organized into six work packages including a work package concerning coordination and stakeholder contact (WP1).

WP 2 investigates different ways of obtaining high and differentiable quality of organic eggs in relation to genotype of hen and the inclusion of home-grown forage in the diet. A particular emphasis is put on types of forage that contains carotenoids or fructans and thereby may have an impact on the egg appearance, flavour and shell quality. Furthermore, new crops rich in protein and especially methionine that can be cultivated organically in the Danish climate are to be included in feed for laying hens and digestibility, egg production and egg quality is examined.

WP 3 focuses on integrated chicken meat and apple production. The impact of including broilers in a fruit plantation on infestations of pests- especially the apple sawfly- is assessed. The right timing of the inclusion of broilers is considered and the prospect of using slow growing broiler genotypes with high chicken meat qualities is investigated by sensory assessment and by the muscle characteristics.

WP4 investigates strategies for a diversified pork production. The prospect of producing new products based on small entire male pigs, large female pigs and sows slaughtered after first litter are assessed. The effect of using genotypes with superior meat characteristics is investigated and the strategies take offset in systems where the pigs perform a considerable foraging on standing crops, including crops which are expected to reduce the risk for boar taint and/or impact positively on other meat quality characteristics.

WP5 focus on the intestinal health of piglets born under free range conditions. Of particular interest is whether fructan rich feedstuffs (FRF) may limit parasite and zoonotic infections and post-weaning diarrhoea, which are common problems in organic pig herds. DNA typing methods will be used to increase the knowledge of how to use and support the natural intestinal microflora by changes in feed nutrition and bioactive feed components.

The emphasis of WP6 is to avoid castration of male piglets, practiced at present to reduce the development of the off-odour and flavour known as Boar taint, due to animal welfare and ethical considerations. Work package 6 investigates whether it is possible to avoid boar taint in entire male and also in female pigs by feeding the animals FRF for a short period just before slaughtering at normal slaughter weights. It is hypothesized that this may improve the sensory properties of pork from entire male as well as female pigs via a reduction in the development of Boar taint related off-odours and flavours and thus, remove the need for castration, thereby enhancing animal welfare. Furthermore, the prebiotic effects of inulin and fructo-oligosaccharides mean that chirory diets may help to reduce the level of pathogenic bacteria as e.g. *Campylobacter*.

These activities as a whole are expected to create a foundation for proposing new production strategies for organic pigs and poultry, which at the same time comply with the organic ideals of integrated production strategies and the consumers' expectations and demands to organic products.

A.0 Introduction, state of the art and objectives of the project (max. 3 pages):

The organic pig and poultry production of today in Denmark is typically characterized by 1) compromises with regard to animal welfare issues e.g. environments that restrict the animals possibility of performing natural behaviour, 2) the use of specialised genotypes not necessarily well-suited for outdoor conditions nor of a particular gastronomic quality, 3) a heavy price competition with egg, chicken meat and pork products produced in conventional farming, and 4) little or no objective quality differences compared with conventional products. These constraints may be the reason for the current low production and consumption of organic chicken meat and pork and call for new ways of production. This demand is enhanced by the potential difficulties in the present systems, when 100% organic feeds are to be implemented in future.

It is hypothesized that systems could be developed in which there is a more coherent relation between the animal behavioural needs and health and the use of the outdoor area i.e. the functional integrity of the livestock. Such systems may at the same time form the basis for more diverse organic production of high quality products, distinct from conventional products, and which to a higher degree comply with consumer expectations. A number of issues related to animal feeding and husbandry, however, need to be addressed in detail in order to elucidate such systems.

1. *Genotype-, feed- and product quality interactions*

Pigs

In the UK, the organic pig producers are encouraged to use traditional breeds instead of the more improved genotypes (Soil Association, 2000) and traditional breeds like the British Saddleback are well represented in organic pig farms (Kelly et al., 2001). In Denmark there has been no similar interest in the use of traditional breeds and the most common genotypes are crossbreeds of Duroc and the highly specialised white breeds Landrace and Large white (pers. comm., Serup 2005). The traditional breeds are generally considered as more suited for the outdoor production because of their hardiness, less sensitiveness to extreme weather situations and good mother abilities (Guy & Edwards, 2002; Edwards, 2004). Although it remains to be verified, they might also be able to retrieve a higher proportion of their energy need from fibre rich feed (Hirt et al., 2001; Kelly et al., 2001). This would undoubtedly be an advantageous characteristic in a pork production based on pigs integrated in the cropping system.

In addition traditional breeds have been associated with a higher proportion of red muscle fibres, which may improve flavour and increase tenderness (Rahelic & Puce, 1981; Whittemore, 1993). Accordingly, in three English comparisons studies, the traditional breeds Tamworth (Warriss et al., 1996) and Berkshire (NPPC, 1994; 1995 cf. Ellis et al., 1999), respectively, were superior regarding eating quality (tenderness, juiciness, and flavour). In a Danish pilot test, the traditional Danish black and white breed was associated with darker meat and more crispy fat (Bak, 2004). Hence, the use of traditional genotypes might be a way to produce meat products, which in e.g. flavour and appearance differ from conventionally produced products.

Boar taint is a large problem in all types of pork production not only restricted to entire male pigs. (Gibis, 1995; Hansen et al., 1994, 1995; Byrne & Hansen, 2005). If not castrated, 5-10% of Danish entire male pigs (100 kg) have > 0.25 ppm skatole in backfat (Hansen-Møller and Kjeldsen, 1998; Udesen, 1998) and are then classified as boar tainted, having a markedly reduced value. However, even values of > 0.15 ppm enhance the off-odour in both sex (Gibis, 1995; Gibis *et al.*, 1998; Godt *et al.*, 1996). The most common preventive measure is to castrate male pigs through physical removal of the testicles during the first week of life. The farmers usually carry this out without anaesthetics, and it may occasionally result in wound infections. It is expected that routine castration of piglets will be forbidden in the EU in the near future on grounds of animal welfare (Gun *et al.*, 2004). Of critical importance in this respect are the results of previous DARCOF II studies (Hansen et al., 2006; Byrne & Hansen, 2005) which have demonstrated that as low as 5 to 10% crude or dried chicory in feed reduces skatole in the blood and backfat of entire male pigs significantly after 7 and 14 days of feeding, resulting in a significant reduction in perceived boar taint and thus an improvement in the flavour and taste of meat produced. A comparable result has also been obtained for female pigs, but fed 25% crude chicory. Decreased skatole concentrations and increased eating quality have also been demonstrated by feeding 25% lupins to female and castrated male pigs during the whole fattening period (Hansen & Claudi-Magnussen, 2003, 2004; Claudi-Magnussen & Hansen, 2005). The question, however, remains whether effects on boar taint and other sensory characteristics of female and entire male pigs can be obtained when used only in the last period before slaughtering (1 and 2 weeks).

Poultry

Present genotypes used in organic egg production are mainly bred to fit the conventional systems, and have high nutrient requirements in order to maintain a high production. Behavioural problems with feather pecking and cannibalism in free-range systems are common, and known to be closely related to genotype (Albentosa et al., 2003; Kjaer & Sørensen, 2002). However, other genotypes exist that differ in behaviour, nutrient requirement, and which are more suited to free-range organic systems, e.g. the Hellevad-hen, which have been used by few organic egg producers in Denmark in recent years with positive experiences on behaviour and production or the "Swedish hen", which is selected for >25 generations on a diet of low protein and a.a.s (Elwinger et al. 2004). It is well-known that both genotype and diet can affect egg quality parameters such as shell strength (Al-Bustany & Elwinger, 1987; Grizzle et al., 1992), albumen dry matter, protein and water content (Shafer et al., 1998; Prochaska et al., 1996; Hammershoj &

Steenfeldt, 2005), yolk colour (Hammershoj, 1995; Furuse et al., 1994) and egg flavour (Tserveni-Gousi, 2001; Hammershoj, 1996; Cave et al., 1992). Apparently, the eggshell quality of Hellevad-hens is lower than other breeds (www.eksperimenter.dk). Recent results show that serum calcium levels of laying hens increases when fed inulin or oligofructose extracted from chicory, which significantly improves egg shell percentage and shell strength (Chen & Chen, 2004). Hence, it is essential to compose organic egg layer diets corresponding to the nutrient requirement of the individual genotype.

Foraging material containing xanthophylls, e.g. maize silage and carrots, increases the yellow and red intensity of yolk colour (Sikder et al., 1998; Zia et al., 1994; Hammershoj & Steenfeldt, 2005). Chung et al. (2004) found that lutein – a nonprovitamin A carotenoid being protective against age-related macular degeneration (vision-loss) – from hen eggs increased lutein in serum of humans more than twice as efficiently as spinach and pure lutein. Also, different foraging material may influence the sensory characteristics of eggs e.g. basil (*Ocimum basilicum* L.) (Narahari, 2003) and thyme (*Thymus vulgaris* L.) (Tserveni-Gousi, 2001) and thereby add positive flavour quality to organic eggs. These are options that may be included in a strategy for diversified products of organic eggs.

2. Nutrient supply and available amino acid sources for monogastrics

Supplying poultry and growing pigs with appropriate amounts of protein and amino acids (a.a.s.) is expected to become difficult regarding feed formulation with the use of 100% organic feed. In particular, the sulphur containing a.a.s will be a critical issue. Besides effects on production, dietary imbalances may stress the laying hens initiating unwanted behaviour as feather pecking (Ambrosen & Petersen, 1997; McKeegan et al., 2001). In organic egg-production the essential a.a.s methionine and cystine are mainly supplied with soya beans, sunflower cake, potato protein concentrate or fishmeal, and at present, the majority of these are imported raw materials. Rapeseeds have a high content of sulphur a.a.s, but its usage in diets for brown layers is limited due to the risk for fish taint in the eggs (Hammershoj, 1996).

Ideally, a high proportion of the feedstuffs should be produced locally, and the interest in growing a larger part of protein sources nationally has increased by organic poultry and pig producers. Especially, certain species of lupin (*Lupinus spp.*) are important for enhanced availability of organic grown protein. Due to high protein content, lupin is at present included in both layer and pig diets as supplement to imported soya beans and sunflower cake. However, like most legume proteins, the content of the sulphur containing a.a.s is low (Pettersen, 2000). More climate-robust soya beans species as well as the crop quinoa (*Chenopodium quinoa*) are potential as new cultivars in organic farming in Denmark due to a fine balanced a.a. composition, especially regarding content of methionine, which however may vary for different varieties (Dini et al., 1992; Ruales & Nair, 1992). There is a need to explore the effects of such protein and a.a.s. sources.

3. Intestinal health in the young animals (piglets).

Gastrointestinal nematodes have a particular high impact in many organic herds (Roepstorff *et al.* 1992; Carstensen *et al.*, 2002) due to, amongst others, survival of infective eggs in the soil for many years (Burden *et al.* 1987; Mejer, 2004). New results have demonstrated that piglets become massively infected already during their first week of life when born on contaminated pastures (Roepstorff *et al.*, unpublished), causing a significantly lower body weight at weaning (Mejer *et al.*, 1999). Several studies by researchers of the present project group have shown that use of fructan rich feedstuffs (FRF) for pigs may limit parasite infections. Thus, inulin as well as fresh and dried chicory roots can reduce the establishment and depress egg production of gastrointestinal nematodes. I.e. worm burdens have been reduced with 97% (*Oesophagostomum dentatum*, Petkevicius *et al.*, 2003) or 66% (*Trichuris suis*, Petkevicius *et al.*, in prep.). Recently, a DARCOF II project has also demonstrated a marked effect of crude chicory on *Ascaris suum* (Mejer *et al.*, unpublished). Very little, however, is known whether similar effect may be present in the very young pig under the relevant field conditions coinciding with a possible effect on post-weaning diarrhoea (see below).

The gastrointestinal tract of pigs is densely populated with bacteria and the composition of the intestinal microbiota has important influence on the pigs' gastro-intestinal health and growth performance. The succession of microbes in the gastrointestinal tract is most marked in early development, where the shift from milk to solid feed at weaning implies major changes in the gut ecosystem (Kelly 1990; Tannock *et al.* 1990). The development of molecular methods has provided culture independent means to characterize complex bacterial communities (Pryde *et al.* 1999; Leser *et al.* 2002). These DNA typing methods allow a monitoring of the changes in the composition of the gastrointestinal flora over time and describe the predominant groups of bacteria related to the different management strategies or level of observed robustness. An understanding of the dynamics of the gut ecosystem will allow us to optimize the organic management and feeding strategies. While some bacterial infections are most common in conventional indoor swine production, other bacteria such as *Brachyspira hyodysenteriae* (swine dysentery), have more impact in organic herds due to difficulties of control without group medication. Therefore, it is very interesting that a DARCOF II-study has demonstrated a remarkable effect of chicory (mixed in an organically produced diet) on swine dysentery: 94% of *B.hyodysenteriae* inoculated pigs developed clinical disease when fed a control diet, while clinical disease was absent in all pigs fed dried chicory, and in the latter it was even not possible to demonstrate *B.hyodysenteriae* in the excreta, while all control pigs excreted bacteria (Thomsen *et al.*, unpublished).

Due to the prebiotic effect of inulin and fructo-oligosaccharides (FOS) present in chicory, a diet based on chicory may help to reduce the level of pathogenic bacteria as e.g. *Campylobacter* (Saavedra 1995). In general, the type and

coarseness of diet strongly influences the composition of the intestinal flora and thereby the ability to prevent proliferating of pathogens in the lower part of the gastrointestinal tract through antagonistic activities like competitive exclusion and colonization resistance (Hansen 2004; Mikkelsen *et al.* 2004; Naughton *et al.* 2001; Nisbet 2002). The prevalence of *Campylobacter* spp. infections in organic outdoor pigs, 8-13 weeks of age, has been found to be 100% with an excretion level ranging from 10^3 - 10^7 CFU per g (FØJØII.10 SaCaFree). Within this age interval there was seen no significant change in the excretion level over time. A decrease in the number of *Campylobacter* spp. with age has been reported for conventional slaughter pigs (Weijtens *et al.* 1993) but even if this is the case also in organic pigs, there is still a non-negligible level of *Campylobacter* at the time of slaughter. Thus, a further reduction in the *Campylobacter* excretion levels e.g. through feeding strategy, would be important from a food safety aspect. Approximate 94% of human cases of campylobacteriosis in Denmark are due to *C. jejuni*, which was found in ca. one third of organic pigs in a previous DARCOF II study (Jensen *et al.* 2005; Nielsen *et al.* 1997).

4. Prospects and constraints of diversified production and products

The project "Better welfare in organic pig production" included production and usefulness of small entire male pigs. Chefs and consumers were asked about their opinion of small male pigs or heavier female pigs as basis for new dishes and were presented for new pork cuttings of small male pigs (Claudi-Magnussen, 2003; Bech & Søndergård, 2004). The outcome of the study was positive consumer and chef experiences regarding the use of small male pigs in the kitchen, but it was necessary to keep a low live weight <45 kg to minimise risk of boar taint and to enhance the differences in characteristics of the pork compared with traditional pork. Thus, this strategy represents a possibility for development. However objective quality assessments are required. As production costs of small pigs may exceed consumer willingness to pay, strategies that reduce the costs of new organic pig products are needed. It is hypothesized that small male pigs reared litter-wise and produced together with heavier female pigs, also with particular characteristics, might be an appropriate strategy to develop the organic pig production. Inclusion of particular feeds that reduces risks of boar taint and enhance the eating quality may support such a strategy.

Combined poultry and fruit production also represents a possible synergy to be explored in more detail. Infestations of insects, e.g. the apple sawfly (*Hoplocampa testudinea*), often cause big losses in organic apple production and the preventive or curative measures in organic production are very limited. The inclusion of poultry in a fruit plantation may significantly reduce the abundance of pests (Clark & Gage, 1996; Pedersen *et al.*, 2002; 2004). Probably, the timing of the activity of the poultry with the life cycle of the insects is essential to obtain full effect. The timing, however, also needs to support a high quality bird to be raised. Horsted *et al.* (2004; 2005) observed in a pilot-study carried out in a fruit plantation that the breast meat tenderness in a normal growing broiler type (I657) decreased with growing age, whereas breast meat tenderness of genotypes Light Sussex and New Hampshire increased with growing age. Also, taste and flavour characteristics were improved with increasing age, particularly for male chickens. This underline the perspective in matching the orchard's 'requirements' in terms of effects on insect populations and the resulting fruit quality with strategies for organic chicken meat production based on slower growing genotypes that have considerable foraging activity, hence, distinct and high meat as well as fruit qualities are produced.

Objectives and expected achievements

The overall objective is to establish new methods of production of organic eggs, chicken meat and pork which support the health of the animals and which can form the basis for new high quality products differing in characteristics from conventional products. The specific objectives are to investigate:

- which feeding stuff and feeding strategies that may be used in order to obtain specific quality characteristics in eggs and pork as well as covering the nutritional needs of the livestock in a situation with 100% organic feed,
- how integrated chicken meat and fruit productions can be established with the aim to lower the risks of pests in apple plantations,
- which strategies for slaughtering age of pigs and chickens of different genotypes that can be introduced in order to obtain new high quality products as basis for convenience food,
- how an improved health of the intestine in piglets can be supported under free range condition through use of fructan rich feedstuffs and how this can influence the occurrence of parasite and zoonotic infections and post-weaning diarrhoea caused by *E. coli* and *L. intracellularis*,
- how final feeding – 1 and 2 weeks before slaughter - with fructan rich feedstuffs (dried chicory and lupine) decrease boar taint and improve sensory eating quality of both female and entire male pigs and influences *Campylobacter* populations.

These activities are expected to give the basis for proposing new production strategies for organic pig and poultry, which at the same time comply with the organic ideals of integrated production strategies and the consumers' expectations and demands to organic products.

A.1 Technical content of the research activity

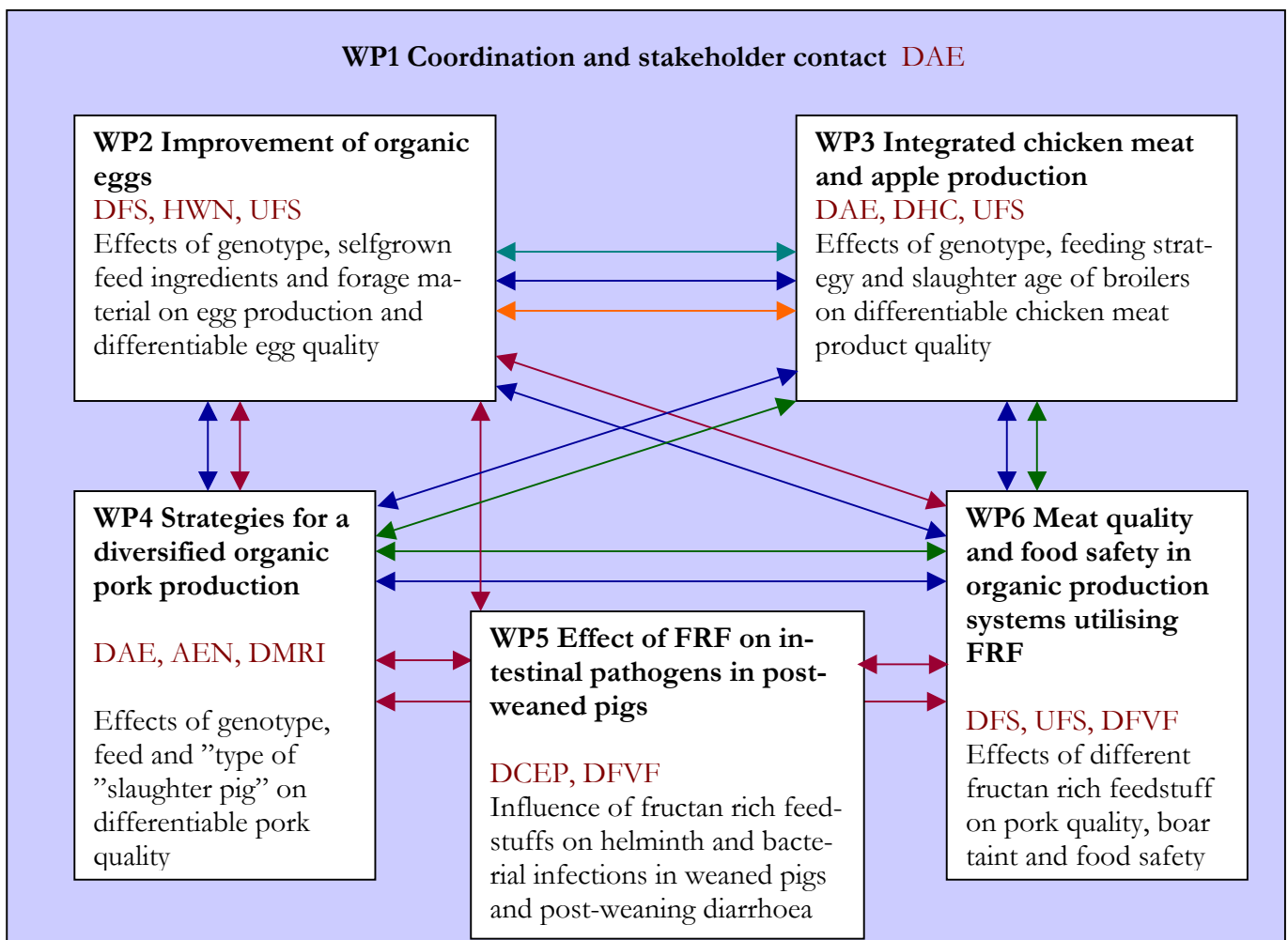
The work is organized into six work packages as indicated in the pert diagram. The work is co-ordinated in WP1, which also has the responsibility of including stakeholder views in the work. WP's 2-6 focuses on production strategy for organic eggs, chicken meat, and pork, respectively.

Major interactions between WP's are related to sharing of methodology and background knowledge on biological effects of different feed components. Cross cutting issues are:

- **New protein sources:** Background information and production of new protein sources is shared among WP's 2 and 3.
- **Fructan rich feedstuffs (FRF):** Production of knowledge of expected effects of FRF are shared among WP's 2, 4, 5 and 6.
- **Poultry genotype:** The use of male chicken in WP3 is co-ordinated with the selected egg producing genotypes in WP2
- **Sensory properties:** Knowledge on methods of sensory assessments is shared among WP's 2, 3, 4 and 6
- **Meat quality:** Various parameters of chicken meat and pork are objectives of WP's 3, 4 and 6.

These cross cuttings are illustrated in the following pert diagram by the respective coloured arrows.

Pert diagram



*Participating partners in each WP are given by their ID's.

Work Package list

WP No.	WP title	Responsible scientist	Budget DKK	Start	End	Deliverable No.
1	Coordination and stakeholder contact	John Hermansen	200.000	01.01.07	31.12.09	D1.1-D1.2
2	Improvement of organic eggs	Marianne Hammershøj	3.050.000	01.01.07	31.12.09	D2.1-D2.11
3	Integrated chicken meat and apple production	John Hermansen	2.692.708	01.01.07	31.12.09	D3.1-D3.9
4	Strategies for a diversified organic pork production	Anne Grete Kongsted	3.107.900	01.01.07	31.12.09	D4.1-D4.11
5	Effect of FRF on intestinal pathogens in post-weaned pigs	Allan Roepstorff	1.521.656	01.01.07	31.12.07	D5.1-D5.4
6	Meat quality and food safety in organic production systems utilising FRF	Laurits Lydehøj Hansen	1.449.847	01.01.07	01.07.08	D6.1-D6.5
Total			12.022.111			

(Please give month and year for start and end)

Deliverables list

Deliverable No	Deliverable title	Lead scientist	Delivery date	Allocated scientific person months	Type of deliverable
D1.1	Mandatory yearly reporting to FOEJO	John Hermansen	10/20xx	0.5	R
D1.2	National conference	John Hermansen	12/2009	1	O
D 2.1	Newsletter on background for the project issues on organic egg production	Marianne Hammershøj	10/2007	0.5	O
D. 2.2	Newsletter on preliminary results of the main experiment of organic egg production	Sanna Steinfeldt	10/2008	0.5	O
D 2.3	Presentation of organic egg quality and sensory evaluation at WPSA Poultry Congress	Marianne Hammershøj	08/2009	2	C
D 2.4	Newsletter on organic egg production affected by forage material	Sanna Steinfeldt	06/2009	1	O
D2.5	Paper on feed conversion, egg production & quality related to diets, genotypes & forage material	Marianne Hammershøj	12/2009	6	S
D2.6	Paper on nutritional value of experimental diets	Sanna Steinfeldt	12/2009	5	S
D2.7	Report giving recommendations for organic egg production based on the project	Marianne Hammershøj	09/2009	3	R
D2.8	Paper on choice feeding	Sanna Steinfeldt	12/2009	5	S
D2.9	Paper on egg yolk colour related to carotenoids in different carrot varieties used as forage material	Marianne Hammershøj	12/2009	4	S
D2.10	Newsletter on overall project results to increase the quality and integrity of organic eggs	Marianne Hammershøj	10/2009	1	O
D2.11	Presentation at national conference on organic production of eggs, chicken meat and pork	Marianne Hammershøj	12/2009	2	C
D3.1	Newsletter regarding broiler results	Klaus Horsted	02/2008	1	O
D3.2	Newsletter regarding pests infestation	Hanne Lindhard Petersen	03/2008	1	O
D3.3	Paper on broiler results (growth ect.)	Klaus Horsted	01/2009	6	S
D3.4	Newsletter sensory results for broilers	Judith Henning	05/2009	1	O
D3.5	Paper on sensory quality	Anders Hans Karlsson	08/2009	4	S
D3.6	Newsletter on fruit quality	Hanne Lindhard Petersen	05/2009	0.5	O
D3.7	Paper on effects of broilers on insects and fruit quality	Hanne Lindhard Petersen	12/2009	4	S
D3.8	Report proposing strategies for integrated production	John Hermansen	12/2009	3	R
D3.9	National conference	John Hermansen	10/2009	3	C

Deliverables list (continued)

Deliverable No	Deliverable title	Lead scientist	Delivery date	Allocated scientific person months	Type of deliverable
D4.1	Newsletter presenting preliminary results of the main experimental activities with emphasis on the effect of genotype on the meat quality of entire male pigs, female pigs and first parity sows	Chris Claudi-Magnussen	10/2008	1	O
D4.2	Newsletter presenting the preliminary results of the main experimental activities with emphasis on the effect of genotype and feeding strategy on daily gain and feed conversion in female pigs and first parity sows	Anne Grete Kongsted	10/2008	1	O
D4.3	Paper on the effect of genotype and feeding strategy on daily gain and feed conversion in female slaughter pigs integrated in an organic cropping system	Anne Grete Kongsted	12/2009	4	S
D4.4	Paper on the effect of genotype on daily gain and feed conversion in first parity sows integrated in an organic cropping system	Anne Grete Kongsted	12/2009	4	S
D4.5	Paper on the effect of genotype on meat quality of entire male pigs slaughtered at a low weight	Chris Claudi-Magnussen	12/2009	4	S
D4.6	Paper on the effect of genotype, feeding strategy and slaughter weight on meat quality of female slaughter pigs integrated in an organic cropping system	Chris Claudi-Magnussen	12/2009	4	S
D4.7	Paper on the effect of genotype on meat quality of first parity sows integrated in an organic cropping system	Chris Claudi-Magnussen	12/2009	3	S
D4.8	Paper concerning nutrient and energy efficiency in integrated organic pig production systems	Anne Grete Kongsted	12/2009	4	S
D4.9	Report giving recommendations for a diversified organic pork production based on the results of the project and the experiences learned	Bent Hindrup Andersen	12/2009	3	R
D4.10	Presentation at national conference on organic egg, poultry meat and pork production	Anne Grete Kongsted	12/2009	3	C
D4.11	Newsletter presenting overall results of WP4	Anne Grete Kongsted	12/2009	2	O

Deliverables list (continued)

Deliverable No	Deliverable title	Lead scientist	Delivery date	Allocated scientific person months	Type of deliverable
D5.1	Newsletter with preliminary results of the effect of FRF on helminth infections and post-weaning diarrhoea	Maria Langkjær	06/2007	1	O
D5.2	International publication on the potential use of FRF to decrease helminth infections at weaning	Maria Langkjær	09/2007	3	S
D5.3	International publication on the effect of FRF on <i>Campylobacter</i>	Allan Roepstorff	09/2007	4	S
D5.4	International publication on the effect of FRF on post-weaning diarrhoea	Allan Roepstorff	12/2007	5	S
D6.1	Report on the effect of final feeding FRF on boar taint and meat quality in entire and female pigs	Laurits Lydehøj Hansen	06/2007	1	R
D6.2	Report on the impact of feeding treatments on odour, flavour, taste and aftertaste characteristics in the meat samples is elucidated	Derek Byrne	12/2007	3	R
D6.3	International publication on the effect of final feeding FRF on boar taint and meat quality in entire and female pigs	Laurits Lydehøj Hansen	03/2008	5	S
D.6.4	International publication on the effect of FRF on <i>Campylobacter</i> populations in pre-slaughter pigs (06/2007)	Dorte Lau Baggesen	06/2007	3	S
D.6.5	International publication on the effect of FRF on intestinal bacterial community in pre-slaughter pigs (10/2007)	Dorte Lau Baggesen	12/2007	3	S

(The nature of the deliverables must be indicated by S = publication in scientific journal with peer review; P = publication in journals without peer review; R = reports; C = presentation at meetings and congresses or O = other types of deliverables, e.g., prototypes, models, websites, etc.).

Milestones list

Milestone No	Milestone title	Lead scientist	Delivery date
M1.1	Kick-off meeting including all participants accomplished	John Hermansen	01/2007
M1.2	Project co-ordination meetings	John Hermansen	06/2007 04/2008 04/2009
M1.3	Stakeholder meetings arranged	John Hermansen	06/2007 04/2008
M1.4	Synthesis work prepared for the national conference	John Hermansen	08/2009
M 2.1	Crops and forage material for organic diets are harvested and/or bought	Sanna Steinfeldt	10/2007
M2.2	Hen genotypes for experiment are selected	Marianne Hammershøj	04/2007
M2.3	The analysis methods are set up	Marianne Hammershøj	12/2007
M2.4	Chemical analysis of feed ingredients and experimental diet formulation is ready	Sanna Steinfeldt	02/2008
M2.5	Two different hen genotypes are reared and ready for egg production	Sanna Steinfeldt	03/2008
M2.6	The main experiment on organic egg production is finished	Marianne Hammershøj	10/2008
M2.7	The sub-experiments with forage materials for egg laying hens are finished	Marianne Hammershøj	12/2008
M2.8	Analysis of feed, diets and eggs are done	Marianne Hammershøj	08/2009
M2.9	All data are collected, statistics are evaluated and reports are ready	Marianne Hammershøj	12/2009
M3.1	Poultry genotypes selected and reared and exp started at Fejø	Klaus Horsted	02/2007
M3.2	Protocol for slaughter procedure and quality assessment	Klaus Horsted	06/2007
M3.3	Broiler production results 1. year interpreted (preliminary)	Klaus Horsted	01/2008
M3.4	Sensory results 1. year interpreted (preliminary)	Judith Henning	02/2008
M3.5	Infestation data 1. year interpreted (preliminary)	Hanne Lindhard Pedersen	02/2008
M3.6	WP group meeting to reflect on findings and plan for year 2	John Hermansen	03/2008
M3.7	Trees and fruit quality assessed	Hanne Lindhard Pedersen	10/2008
M3.8	Carcasses for quality assessment ready	Klaus Horsted	10/2008
M3.9	Broiler production results 2. year interpreted (preliminary)	Klaus Horsted	01/2009
M3.10	Sensory results 1. year interpreted (preliminary)	Judith Henning	02/2009
M3.11	Infestation data 1. year interpreted (preliminary)	Hanne Lindhard Pedersen	02/2009
M3.12	Muscle characteristics assessed	Anders Hans Karlsson	02/2009

Milestones list (continued)

M3.13	WP group meeting for exchange of results prior to reporting	John Hermansen	03/2009
M3.14	Final assessment of trees and fruit quality	Hanne Lindhard Pedersen	08/2009
M3.15	WP group meeting for integrative evaluation of results	John Hermansen	10/2009
M4.1	Recruitment of the traditional genotype is carried out	Bent Hindrup Andersen	02/2007
M4.2	Experimental paddock (crops) established	Bent Hindrup Andersen	04/2007
M4.3	Pigs from the 1 st replicate are slaughtered	Chris Claudi-Magnussen	12/2007
M4.4	Production data from the 1 st replicate is analysed and interpreted (preliminary)	Anne Grete Kongsted	03/2008
M4.5	Assessment of the meat quality from the 1 st replicate is carried out and results are interpreted (preliminary)	Chris Claudi-Magnussen	04/2008
M4.6	Pigs from the 2 nd replicate are slaughtered and assessments of meat quality are carried out	Chris Claudi-Magnussen	04/2009
M4.7	All data are collected, analysed and interpreted	Anne Grete Kongsted	06/2009
M4.8	WP group meeting for discussion of results prior to reporting	Anne Grete Kongsted	06/2009
M4.9	Reports are ready	Anne Grete Kongsted	12/2009
M5.1	Completion and evaluation of parasitological analyses	Maria Langkjær	05/2007
M5.2	Completion and evaluation of <i>Campylobacter</i> analyses	Dorte Lau Baggesen	05/2007
M5.3	Completion and evaluation of bacteriological and pathological analyses	Tim K. Jensen	05/2007
M5.4	Completion and evaluation of intestinal bacterial communities	Lars Mølbak	06/2007
M5.5	Completion and evaluation of in situ hybridization of key organisms in tissue samples	Lars Mølbak	09/2007
M6.1	Sensory profiling of meat samples	Derek Byrne	03/2007
M6.2	Analysis of chemical measurements in relation to sensory	Laurits Lydehøj Hansen	08/2007
M.6.3	Completion and evaluation of <i>Campylobacter</i> analyses	Dorte Lau Baggesen	02/2007
M.6.4	Completion and evaluation of the T-RFLP analyses	Dorte Lau Baggesen	06/2007

WP No.: 1. Coordination and stakeholder contact

	Start date or starting event: 01/2006									
Partner id.	DAE -DIAS									
Person-months per participant	1.5									
Total PM VIP:	1.5									
Total PM:	1.5									

(Please give Institution or Department as partner id.)

Objectives: The overall objective is to ensure the planned progress in the project according to the application. Specific objectives are:

- to make sure that the relevant communication lines across WP's are established for mutual benefits of the findings in the entire project and that the sequence of activities in the WP's support each other in the planned way
- to ensure inputs to the project by the relevant stakeholders
- to stimulate to a comprehensive understanding of the practical implications of the findings of the project

Description of work:

Activity 1 – Project meetings and mandatory reporting.
 After a kick-off meeting, project meetings will be arranged twice during the first year and once in the following years for all participants. These meetings will focus on scientific questions in the project in order to facilitate synergy among the different scientific disciplines present in the project. In addition yearly meetings will be held with WP leaders as a preparation for the mandatory reporting to DARCOF.

Activity 2 – Stakeholder contact
 Two stakeholder meetings are planned throughout the project period. The stakeholders include participant from the food industry, primary producers and interests groups (NGO's). It is the idea to expose the (diverse) group of stake-holders to the (diverse) ideas and findings of the project in order to get dynamic feed backs on the activities proposed and maybe redirect some of the activities initially planned. Furthermore, it is the idea to facilitate exchange of view across sectors and interests group related to the present project.

Activity 3 – Finalizing the project
 The main outputs are delivered through the individual WP's. However, in order to facilitate a more comprehensive interpretation of the results and propose new production strategies an effort will be made at the end of the project period to synthesize the major findings. It is envisaged, that this may form the basis for a national conference.

Deliverables:
 D1.1 Mandatory yearly reporting to FOEJO
 D1.2 National conference

Milestones:
 M1.1 Kick-off meeting including all participants accomplished (01/2007)
 M1.2 Project co-ordination meetings (06/2007; 04/2008; 04/2009)
 M1.2 Stakeholder meetings arranged (02/2007; 04/2008)
 M1.3 Synthesis work prepared for the national conference (08/2009)

WP No.: 2. Improvement of organic eggs

	Start date or starting event: 01/2007					
Partner id.	DFS-DIAS	HWN-DIAS	UFS-RVAU			
Person-months per participant	18 VIP 6 TAP	12 VIP 7 TAP	1 VIP 3 TAP			
Total PM VIP:	31					
Total PM:	47					

(Please give Institution or Department as partner id.)

Objectives:
 The overall objective is to investigate different strategies for production of organic eggs of high and differentiable quality regarding appearance (yolk colour), sensory quality, shell strength and egg albumen protein content providing more convenient related egg products compared to conventional egg products. Specific objectives are:

- To study the effect of hen genotypes providing new properties in nutrient requirement, egg production, egg quality and “sustainable multiple purpose for egg and meat”
- To identify additional, new protein feed sources for organic laying hens in order to improve nutrient supply, in particular the a.a.s, when using diets with 100% organic feed
- To investigate how feeding strategies involving foraging material and use of outdoor area interacts with egg flavour and appearance

Description of work:

Activity 1: Selecting and rearing period of 2 different hen genotypes (2007-2008)
 The selection of two hen genotypes will be based on results obtained in earlier studies (FØJO-II and present literature) and from present recommendations from the production in Denmark, Sweden and UK. Characteristics such as protein/a.a. requirements, feather pecking behaviour and egg quality will be taken into consideration. The female chicks from two genotypes will be reared under similar conditions at Research Centre Foulum from day-old until 15 wk of age, where they are transferred to the out-door experimental unit. The male chicks from one genotype will be used as possible meat type in WP3. The chickens will be reared as under practical, organic conditions and will be given access to roughage from 8 weeks of age in order to adapt the birds to feed with a coarse structure.

Activity 2: Identifying protein crops and forage material and planning of diets (2007).
 Three experimental diets will be included in the main-experiment:
 1) based on organic ingredients used in practice, using raw material grown nationally (cereals, rapeseeds, peas, lupine, potato protein concentrate) and imported protein sources; soya beans and sunflower meal,
 2) based on organic raw materials grown exclusively in Denmark involving protein and a.a.s. sources as lupine, robust species of soya beans, and quinoa, protein and a.a. level aimed to be as in diet 1,
 3) based on raw materials as in diet 2 but protein and a.a. level lower than diets 1 and 2.
 Species of quinoa and soya bean will be selected and grown under organic conditions at the experimental station in Jyndevad, southern Denmark, during spring and summer 2006. Cultivation experiments with soya and quinoa have been performed in a pilot study. Two forage material combinations will be evaluated: 1) maize-silage together with carrots and 2) maize silage together with chicory roots (*Cichorium intybus L.*). Chicory roots are selected due their content of inulin and oligofructose, which are prebiotics that e.g. may improve calcium absorption by the hen and thereby egg shell quality (Chen & Chen, 2004). Organically grown maize-silage will be produced at the experimental station Bygholm and carrots bought at Tange gardening. Chicory roots are grown at Foulumgård.

Activity 3: Set-up of analysis methods and sensory panel training (2007-2008).
 The Gas Chromatography Mass Spectrometry (GCMS) method is previously applied on e.g. milk for analysis of aroma components. Initially, pre-treatment of eggs are established and “normal” levels of

specific aroma components of feed components, egg yolk and albumen are obtained.

The analysis of carotenoids will be performed by HPLC after extraction and hydrolysis of the lipid fraction, where lutein and other carotenoids can be separated.

Sensory analysis of eggs includes 4 training-sessions to develop a profiling vocabulary on basis of feed, foraging material and eggs. Following, the vocabulary is used in sensory analysis of experimental eggs.

Activity 4: Main-Experiment in out-door system (2008):

Conducting a long-term (6-7 months) 3 factor experiment with hen genotypes x diets x foraging material /outdoor area. Registration of feed intake, egg production and collection of eggs for analysis will be performed from 20 weeks of age until 50 weeks of age. Analysis of eggs will include sensory evaluation, aroma-components, shell strength, yolk colour, carotenoids, albumen protein concentration, gel texture etc. Totally, 48 separate houses with access to out-door area will be used and includes the treatments: 1) two different hen genotypes, 2) three different layer diets (see Activity 2) and 3) two different roughage combinations (given fresh each day), i.e. in total 12 treatments of 4 replicates each. One house with 30 hens and with a defined outdoor area represents one replicate. A cover of grass/weeds is established in the outdoor yard in 2007 and hens have access hereto at all hours during the day.

Activity 5: Evaluation of nutritional value of organic layer diets (2008).

All raw ingredients used in the diets as well as the three produced organic diets and the roughage will be analysed for chemical composition (dry matter, ash, protein, a.a.s, fat, starch, sugars, dietary fibres, selected minerals). In order to evaluate the nutritional value of the experimental diets a digestibility/balance experiment will be performed at the end of the experimental period. At 50 weeks of age 2 hens from each replicate per treatment will be moved to special designed battery cages for collection of excreta, which will be analysed for the same nutrients as in the feed.

Activity 6: SUB-EXPERIMENTS (2008): *Short term (up to 2 months) studies after 2 weeks "neutralisation" of hens from main experiment and dividing hens into:*

Choice feeding study: Applying choice feeding could be a valuable feeding strategy in order to cover possible different nutrient requirement of the individual birds (Ciszuk et al., 1998; Olver & Malan, 2000), as both activity level and the plumage quality of the birds in a flock can vary considerable. The purpose of this experiment is to study the possibility of using choice feeding to obtain more balanced diets for the laying hens in the organic egg-production. The hens are given the choice to compose their own diets by given access to various troughs with different cereals (given as whole seeds), a mixture of protein sources with vitamins and minerals included (milled, but with a coarse structure), calcium source and roughage. Production parameters are obtained, including separate registration of different kinds of feed, and eggs are analysed for shell quality and protein content of egg albumen.

Herb study: Taste and flavour of eggs depend on both feed and environment. In practice, the influence of negative flavour sources is avoided by reducing e.g. fish products and rapeseeds in diets. The purpose here is to study effects of dietary flavour compounds traditionally regarded as positive by humans on egg flavour in perspective to consumer preferences of organic eggs. Three treatments with feeding of basil, thyme and chicory leaves together with grass on the outdoor area will be compared with a control treatment of grass only. Feed and supplement consumption and egg production is registered, and eggs are analysed for yolk colour, sensory analysis and aroma-components by GCMS.

Carrot and kale study: In order to study the incorporation of carotenoids and especially lutein, different varieties of carrots (*Daucus carota*) with different carotenoid composition and content will be used as supplement feed for hens. The carotenoid content of carrot varieties ranges from 0.3-17 mg/100 g (Nicolle et al., 2004). Furthermore, kale (*Brassica oleraceae*) contains high levels of lutein and is a suitable crop in the Danish climate due to its cold-resistance. Treatments with carrot varieties and kale will be fed in 4 replicates to hens on a control feed with low level of pigments. Feed and supplement consumption and egg production is registered and eggs are collected and subjected to analysis of yolk colour, sensory analysis and analysis of carotenoids in feed, supplement and eggs.

Activity 7: Data analysis and final report (2008-2009)

Deliverables:

- D2.1 Newsletter on background for the project issues on organic egg production (10/2007)
- D2.2 Newsletter on preliminary results of the main experiment of organic egg production (10/2008)
- D2.3 Presentation of organic egg quality and sensory evaluation at WPSA Symposium (08/2009)
- D2.4 Newsletter on organic egg production affected by forage material (06/2009)
- D2.5 Paper on feed conversion, egg production & quality related to diets, genotypes & forage material (12/2009)
- D2.6 Paper on nutritional value of experimental diets (12/2009)
- D2.7 Report giving recommendations for organic egg production based on the project (09/2009)
- D2.8 Paper on choice feeding (12/2009)
- D2.9 Paper on egg yolk colour related to carotenoids in different carrot varieties used as forage material (12/2009)
- D2.10 Newsletter on overall project results to increase the quality and integrity of organic eggs (10/2009)
- D2.11 Presentation at national conference on organic production of eggs, chicken meat and pork (12/2009)

Milestones:

- M2.1 Crops and forage material for organic diets are harvested and/or bought (10/2007)
- M2.2 Hen genotypes for experiment are selected (04/2007)
- M2.3 The analysis methods are set up (12/2007)
- M2.4. Chemical analysis of feed ingredients and experimental diet formulation is ready (02/2008)
- M2.5 Two different hen genotypes are reared and ready for egg production (03/2008)
- M2.6 The main experiment on organic egg production is finished (10/2008)
- M2.7 The sub-experiments with forage materials for egg laying hens are finished (12/2008)
- M2.8 Analysis of eggs, diets, forage material and excreta are done (08/2009)
- M2.9 All data are collected, statistics are evaluated and reports are ready (12/2009)

WP No.: 3. Integrated broiler and apple production

	Start date or starting event: 01/2006								
Partner id.	DAE-DIAS	DHC-DIAS	UFS-RVAU						
Person-months per participant	15.0 VIP 5.5 TAP	4.7 VIP 9.9 TAP	3.5 VIP 4.0 TAP						
Total PM VIP:	23.2								
Total PM:	42.6								

(Please give Institution or Department as partner id.)

Objectives: The overall objective is to investigate if and how beneficial effects occur when poultry production are integrated in the fruit production with respect to effectiveness in pests fighting and prospect of producing distinct high meat and fruit qualities. Specific objectives are:

- To investigate the influence of combined broilers and apple production on infestations of pests especially apple sawflies on yield and inner and outer fruit quality.
- To investigate the importance of broiler genotype and feeding strategies on growth and meat quality and the interactions with age at slaughter
- To propose viable strategies for a differentiated broiler production based on integrated fruit-broiler production.

Description of work:

A series of experiments will take place at Fejø experimental plantations in a large experimental orchard planted in spring 2000. The varieties ‘Discovery’ and ‘Topaz’ on rootstock M9 and planting distance of 3.25 x 1.2 m are established in 36 rows of 120 m, in total 1.4 ha orchard. Both varieties are recommended for organic production in Denmark. Drip irrigation is established. A split plot design will be used. In half of the main plots broilers will be inserted and the second half will be without chickens in preparation for examining the effect on fruit yield, fruit quality and the amount of insect pests. Each subplot containing broilers will be further subdivided regarding broiler genotypes and feeding strategy.

Activity 1- Effect on insects’ abundance and fruit quality

In each of two years 2007 and 2008 broilers are inserted in the plantation. Besides the experiments in 2007 and 2008 the effects on fruit yield and fruit quality are examined in 2009. Two treatments will be established in 4 replications: 1) Apples produced in combination with broilers, 2) Apple produced in monoculture.

Four main chicken runs with a width of 9 rows and lengths of 50 trees will be established (29 m x 60 m). Mechanical weeding in the tree row will be done mechanically just before the insertion of the broilers and continued after the slaughtering of broilers.

Tree growth characteristics (trunk diameter) and N-content in leaf samples will be assessed (to monitor nitrogen availability and uptake by trees). The number of flower cluster, fruit yield, fruit size, and fruit colour will be recorded after grading. Skin damage caused by pest and diseases will be evaluated on an appropriate sub-sample of fruit harvested from trees. Monitoring of pest and disease populations of apple scab, powdery mildew and fruit tree canker incidence (cankers are removed and the number of infections per tree is noted) will be assessed. The fruit quality evaluated as firmness, sugar content and maturity will be assessed on sub samples.

White sticky traps (Rebell bianco®) will be placed in the test area with one trap in each plot, from late April to beginning of June. The sticky traps will be changed weekly. In June the drop of fruitless due to sawfly from trees in the centre of the plots will be investigated weekly.

Activity 2 – Investigating genotype x feeding strategy x age at slaughter interactions related to growth and sensory qualities of broiler meat

The activity takes the departure from the results of Horsted et al (2004), who across genotypes found an improved flavour of the breast meat with increasing age at slaughter (120 days vs. 91 days) and that the tenderness was affected by a genotype x slaughter-age interaction. A late maturing genotype (New Hampshire) showed improved tenderness at increasing age in opposition to a normal growing genotype. Besides effects of maturity among genotypes these effects may be caused by differences in foraging behaviour, which in turn may be affected by the complementary feed.

In each of two years, each of the 4 main chicken runs (Activity 1) is further divided into 4 subplots differing in broiler genotypes (normal and slow grower) and two different feeding strategies (normal vs. low protein). Each subplot will contain 40 birds. Feed intake (supplementary feed) and growth are recorded. Actual intake of vegetation, worms etc. are estimated according to the methods developed by K Horsted in the PhD project 'Strategies for increased foraging in organic layers'.

The broilers in each subplot are slaughtered at 2 different ages, examined for salmonella by cloacae samples at the day of slaughter and prepared for meat quality tests. Breast meat and drumsticks will be evaluated in relation to sensory quality (texture, flavour and smell), meat colour and content of E-vitamin. The profiling of the meat quality will be made by a trained panel at the Sensory Laboratory at the Royal Veterinary and Agricultural University in Copenhagen (same Lab as in WP 2). To support the understanding of the sensory quality, water holding capacity and shear force will be measured. In addition studies on the ultra structure in muscles and connective tissue by confocal and nano microscopy will be performed to get insight in genotype and age variation related to these characteristics.

Activity 3 – Propose appropriate strategies for management of poultry in orchards

The knowledge achieved in activity 1-2 will be synthesized to propose appropriate strategies of managing poultry in orchards in different situations.

Deliverables:

- D3.1 Newsletter regarding broiler results
- D3.2 Newsletter regarding pests infestation
- D3.3 Paper on broiler results (growth etc)
- D3.4 Newsletter sensory results for broilers
- D3.5 Paper on sensory quality
- D3.6 Newsletter on fruit quality
- D3.7 Paper on effects of broilers on insects and fruit quality
- D3.8 Report proposing strategies for integrated production
- D3.9 National conference

Milestones:

- M3.1 Poultry genotypes selected and reared and exp started at Fejø (02/2007)
- M3.2 Protocol for slaughter procedure and quality assessment (06/2007)
- M3.3 Broiler production results 1. year interpreted (preliminary) (01/2008)
- M3.4 Sensory results 1. year interpreted (preliminary) (02/2008)
- M3.5 Infestation data 1. year interpreted (preliminary) (02/2008)
- M3.6 WP group meeting to reflect on findings and plan for year 2 (03/2008)
- M3.7 Trees and fruit quality assessed (10/2008)
- M3.8 Carcasses for quality assessment ready (10/2008)
- M3.9 Broiler production results 2. year interpreted (preliminary) (01/2009)
- M3.10 Sensory results 1. year interpreted (preliminary) (02/2009)
- M3.11 Infestation data 1. year interpreted (preliminary) (02/2009)

M3.12 Muscle characteristics assessed (02/2009)

M3.13 WP group meeting for exchange of results prior to reporting (03/2009)

M3.14 Final assessment of trees and fruit quality (08/2009)

M3.15 WP group meeting for integrative evaluation of results (10/2009)

WP No.: 4. Strategies for a diversified organic pork production

	Start date or starting event: 01/2007								
Partner id.	DAE-DIAS	AEN-DIAS	DMRI						
Person-months per participant	16 VIP 5.6 TAP	12.5 VIP	4.7 VIP 8.4 TAP						
Total PM VIP:	33.2								
Total PM:	47.2								

(Please give Institution or Department as partner id.)

Objectives: The overall objective is to identify appropriate strategies for a diversified organic pork production with superior sensory quality characteristics based on pigs foraging in the cropping systems. Three different “types” of slaughter pigs will be investigated: Entire male pigs slaughtered before sexual maturity, female pigs slaughtered at more than 100 kg live weight, and sows slaughtered after weaning of the first litter. Specific objectives are:

- To investigate how the performance, health and meat quality of entire male pigs, slaughtered at a low live weight, are affected by genotype
- To investigate how the performance, health and meat quality of female growing pigs are affected by genotype and feeding strategy
- To investigate how the performance, health and meat quality of first parity sows are affected by genotype

Description of work:

Activity 1- Establishment of the theoretical basis

The selection of genotypes, level and composition of concentrates, age at slaughter, crop mixtures, meat products and other product specific quality traits will be based on results obtained in previous studies (literature review) combined with experiences from organic pig production practice in Denmark and abroad (e.g. UK and Sweden). Regarding the composition of the concentrated feed (especially with respect to selection of protein sources to ensure appropriate amino acid supply), experiences from WP 2 will be taken into account. In addition, the concentrates will be composed to minimise the risk of boar taint (e.g. by inclusion of lupine (FOEJO, 2004)). Subsequent, practical preparations like e.g. sowing of paddocks; recruitment and rearing of animals (of two different genotypes) will be executed.

Activity 2 – Experimental activities at Rugballegård – the organic experimental station

Pork from traditional breeds is associated with improved tenderness and flavour (Warriss et al., 1996; Ellis et al., 1999). However, the growth performance and the lean contents of traditional breeds are relative low (Ellis et al., 1999) and, therefore, the costs of production are higher compared to more modern genotypes. The hypothesis is that this is less evident in systems based on pigs integrated in the cropping system, because traditional breeds are believed to be able to retrieve a larger proportion of their energy need by foraging as suggested by Hirt et al. (2001) and Kelly et al. (2001) and, at the same time more suited for extreme outdoor conditions due to their hardiness (Guy & Edwards, 2002; Edwards, 2004).

The experimental set-up is based on seasonal outdoor production of pork. The sows farrow outside in huts in April. Each hut is placed in a cropping system with a sequence of different crop mixtures, including chicory, which have been associated with positive effects regarding boar taint (Jensen et al., 1997) and the colour in pig meat (Rosenvold et al., 1999; 2000). Eighteen sows (six of a modern breed mated with a modern boar genotype, six of a traditional breed mated with a modern boar genotype and finally six of the same traditional breed but mated with a traditional boar genotype) farrow in separate pens. The three genotypes are expected to differ markedly in growth and quality characteristics. The piglets are weaned at minimum seven weeks of age and grow up litter-wise with access to the cropping system. To benefit from the welfare (Groot et al., 2001), productivity (Ruis et al., 2002) and meat quality (EU, 2004) related advantages of avoiding mixing of unfamiliar pigs, the pigs are not moved or mixed before slaughtering. The first parity sow is moved to another cropping system at weaning.

The following treatments will be included in 2 replicates (18 sows in each of two farrowing seasons, that is a total of 36 litters) (preliminary):

- Three different genotypes of entire male pigs slaughtered at approximately 40-50 kg live weight
- Three different genotypes of female pigs fed two different levels of concentrates after 40-50 kg live weight
- Two different genotypes of first parity sows slaughtered a few weeks after weaning.

Activity 3 – Meat quality assessment

To determine the effect of genotype, level of concentrates and weight at slaughter on product quality, an objective assessment of the product quality of pork from the treatments in activity 2 will be made. These include for all three “types” of slaughter pigs e.g. (preliminary): Sensory profile (flavour, odour, tenderness, colour), intramuscular fat content, fatty acid composition, skatole concentration in back fat, and amount of valuable cuts. Further, for entire male pigs, assessment of androstenone concentrations in back fat will be carried out.

Activity 4 – Proposals of appropriate strategies for a diversified organic pork production

The knowledge obtained in activity 1, 2 and 3 is synthesised to propose appropriate strategies for a diversified organic pork production.

Deliverables:

- D4.1 Newsletter presenting preliminary results of the main experimental activities with emphasis on the effect of genotype on the meat quality of entire male pigs slaughtered at a low weight
- D4.2 Newsletter presenting preliminary results of the main experimental activities with emphasis on the effect of genotype and feeding strategy on daily gain and feed conversion in female pigs and first parity sows
- D4.3 Paper on the effect of genotype and feeding strategy on daily gain and feed conversion in female slaughter pigs integrated in an organic cropping system
- D4.4 Paper on the effect of genotype on daily gain and feed conversion in first parity sows integrated in an organic cropping system
- D4.5 Paper on the effect of genotype on meat quality of entire male pigs slaughtered at a low weight
- D4.6 Paper on the effect of genotype feeding strategy and slaughter weight on meat quality of female slaughter pigs integrated in an organic cropping system
- D4.7 Paper on the effect of genotype on meat quality of first parity sows integrated in an organic cropping system
- D4.8 Paper concerning nutrient and energy efficiency in integrated organic pig production systems
- D4.9 Report giving recommendations for a diversified organic pork production based on the results of the project and the experiences learned
- D4.10 Presentation at national conference on organic egg, poultry meat and pork production
- D4.11 Newsletter presenting overall results of WP4

Milestones:

- M4.1 Recruitment of the traditional genotype is carried out (02/2007)
- M4.2 Experimental paddocks (crops) are established (04/2007)
- M4.3 Pigs from the 1st replicate are slaughtered (12/2007)
- M4.4 Production data from the 1st replicate is analysed and interpreted (preliminary) (03/2008)
- M4.5 Assessment of the meat quality from the 1st replicate is carried out and results are interpreted (preliminary) (04/2008)
- M4.6 Pigs from the 2nd replicate are slaughtered and assessments of meat quality are carried out (04/2009)
- M4.7 All data are collected and statistics are evaluated (06/2009)
- M4.8 WP group meeting for discussion of results prior to reporting (06/2009)
- M4.9 Reports are ready (12/2009)

WP No.: 5. Effect of fructan rich feedstuffs on intestinal pathogens in post-weaned pigs

	Start date or starting event: 01/ 2007					
Partner id.	DCEP KVL	DFVF				
Person-months per participant	6 VIP 5 TAP	7 VIP 8.8 TAP				
Total VIP:	12.0					
Total PM:	25.8					

(Please give Institution or Department as partner id.)

Objectives:

The overall objective is to investigate the influence of fructan rich feedstuffs (FRF) on experimental helminth infections in weaned pigs, post-weaning diarrhoea related to experimental challenge with *Escherichia coli* and on the presence of *Campylobacter*

- To investigate how FRF may be used to help eliminate helminth infections (*Ascaris suum* and *Trichuris suis*) around weaning, when pigs are moved from the farrowing paddocks to other facilities
- To investigate if and how FRF influence the incidence of post-weaning diarrhoea in pigs caused by *Escherichia coli*.
- To characterize the bacterial community
- To investigate if FRF may influence the presence of *Campylobacter*

Description of work:

The WP complement the work (the practical animal trial and the preparation of samples for analyses) that has already been carried out/is ongoing, financed by the DARCOF-project PRE-QEMP, which is a subproject of QEMP. The QEMP-part of the project encompasses all the laboratory analyses as well as data handling and writing up the deliverables.

Activity 1: Investigating the effect of FRF on natural helminth infections in weaned pigs

In the summer 2006, 9 litters of piglets have been born from sows that have been genotyped for intestinal fimbria-receptors on individual helminth free paddocks. All piglets were registered and weighed at birth. The male piglets were not be castrated. The piglets were offered a standard piglet diet from an early age. Half the piglets of each litter were challenged experimentally with *A. suum* and *T. suis* twice a week starting from 1-2 week of age and until weaning. Approximately 2 weeks before weaning half of the litters were be randomly selected and offered FRF mixed up in a standard grower diet, while the remaining litters were given the standard (control) diet. The FRF-diet and the control diet were composed so they were as identical as possible with respect to contents of proteins, minerals and vitamins. At weaning, the piglets were moved to new pastures, where they continued on either the FRF based diet or the control diet for 2 weeks. A smaller group of 10 piglets will neither be inoculated with parasites or *E.coli* (see activity 3) nor fed FRF – these piglets will serve as *E.coli* controls (see Activity 3). All piglets were/will be monitored closely with respect to growth and clinical signs. Due to a loss of several piglets due to farrowing fever, no piglets will be autopsied at week 7 as originally intended, but all piglets will be autopsied at week 9, 2 weeks after weaning to secure sufficient numbers of piglets in all experimental groups. Parameters to measure are faecal egg counts during the study, and liver white spots and intestinal worm burdens at slaughter.

Activity 2: Investigating the effect of FRF on post-weaning diarrhoea

The piglets used in Activity 2 will be challenged with *E. coli* after weaning at week 7. The piglets will be closely monitored for clinical signs of post-weaning diarrhoea. Faecal samples will be collected regularly for identification of bacteria and by scoring faecal consistency and degree of soiling during the post-weaning period. Intestinal pathology like gross and microscopical lesions will be compared in the piglets at slaughter. Parameters to measure are incidence of infection, faecal consistency and pathology at slaughter.

Activity 3: Investigating the effect of FRF on the presence of *Campylobacter*

Bacteriological culturing and a species-specific real-time PCR method will be used to monitor possible changes in *Campylobacter* populations (reduction of excretion level) due to the potential prebiotic effect of FRF in diet (Jensen et al. 2005). Faecal samples will be collected in 2006 from the litters used in Activity 2 when the pigs are 4, 7 and 9 weeks old.

Activity 4: Characterization of intestinal bacterial communities

The molecular technique 'Terminal Restriction Fragment Length Polymorphisms' (T-RFLP) will be used to characterise and compare the bacterial communities in the colons of the pigs to increase the fundamental knowledge on how to use and support the natural intestinal microflora in preventing intestinal disease by addition of bioactive feed components (FRF-diet). Intestinal tissue samples for T-RFLP analyses will be collected from the litters used in Activity 2. *In situ* hybridization of tissue sections will be used to verify the results obtained with the T-RFLP analyses and to elucidate the spatial and quantitative distribution of key microorganisms.

Deliverables:

- D5.1 Newsletter with preliminary results of the effect of FRF on helminth infections and post-weaning diarrhoea (06/2007)
- D5.2 International publication on the potential use of FRF to decrease helminth infections at weaning (09/2007)
- D5.3 International publication on the effect of FRF on *Campylobacter* (09/2007)
- D5.4 International publication on the effect of FRF on post-weaning diarrhoea (12/2007)

Milestones:

- M5.1 Completion and evaluation of parasitological analyses (05/2007)
- M5.2 Completion and evaluation of *Campylobacter* analyses (05/2007)
- M5.3 Completion and evaluation of bacteriological and pathological analyses (05/2007)
- M5.4 Completion and evaluation of intestinal bacterial communities (06/2007)
- M5.5 Completion and evaluation of in situ hybridization of key organisms in tissue samples (09/2007)

WP No.: 6. Meat quality and food safety in organic production systems utilising fructan rich feedstuffs

	Start date or starting event:								01/2007
Partner id.	DFS - DIAS	UFS - RVAU	DFVF						
Person-months per participant	6 VIP 1 TAP	5 VIP	6 VIP 4 TAP						
Total PM VIP:	17								
Total PM:	21								

Objectives:

- To test in groups of separate sex the effect of final feeding with FRFs on sensory eating quality of female and entire male pigs
- To investigate the effect of FRF on the presence of *Campylobacter* in pre-slaughter pigs
- To investigate the effect of FRF on the intestinal bacterial communities in pre-slaughter pigs

Description of work:

The work complements the work carried out in the project PRE-QEMP, in which the major animal experimental activities was carried out.

Task 6.1 In addition to the chemical analyses, expert sensory profiling will be carried out to describe the sensory characteristics of cooked samples of *M. longissimus dorsi* with emphasis on boar taint and overall meat taste and freshness in both female and entire male pigs as we need to know the short time effect of dried chicory and lupin on boar taint problems and sensory eating quality of both female and entire male pigs. (UFS-RVAU, DFS-DIAS)

Task 6.2 Bacteriological culturing and a species-specific real-time PCR method will be used to monitor possible changes in *Campylobacter* populations (e.g. reduction of excretion level) due to the potential prebiotic effect of FRF in diet (Jensen et al 2005). Faecal samples was collected from the pigs used in PRE-QEMP, before change of diet and 1 and 2 weeks prior to slaughter.

Task 6.3 The molecular technique Terminal Restriction Fragment Length Polymorphisms (T-RFLP) will be used to characterize and compare the bacterial communities in the colons of pre-slaughter pigs with and without FRF in diet. Intestinal tissue samples for T-RFLP analyses was collected from the pigs used in PRE-QEMP. The results will be compared to the results of Task 6.2.

Deliverables:

- D6.1 Report on the effect of FRF on boar taint and meat quality in female and entire male pigs (06/2007)
- D6.2 Report on the impact of feeding treatments on odour, flavour, taste and aftertaste characteristics in the meat samples is elucidated (12/2007)
- D6.3 International publication on the effect of final feeding FRF on boar taint and meat quality in female and entire male pigs (03/2008)
- D.6.4 International publication on the effect of FRF on *Campylobacter* populations in pre-slaughter pigs (06/2007)
- D.6.5 International publication on the effect of FRF on intestinal bacterial community in pre-slaughter pigs (12/2007)

Milestones:

- M6.1 Termination of the experiment on final feeding with FRF replicates 1 and 2 (12/2006)
- M6.2 Sensory profiling of meat samples (01/2007)
- M6.3 Analysis of chemical measurements in relation to sensory profiling (06/2007)
- M.6.4 Completion and evaluation of *Campylobacter* analyses (02/2007)
- M.6.5 Completion and evaluation of the T-RFLP analyses (06/2007)

A.3 Project resources and budget overview

(Short description, max. 1 page, of partners, key competences and management of the project. Overview of budget according to tables given below)

The tasks of the project are divided among 9 partners, each participating in one or more WP's.

From the Danish Institute of Agricultural Sciences (DIAS) the partners hold key competences within scientific areas of

- **farming systems**, especially the relation between agricultural production and environmental impact and the development of organic production systems (DAE)
- **food science**, especially within the fields of how egg production affects different shell egg qualities, and usage of hen eggs as food ingredient and quality aspects hereof (DFS),
- **boar taint and meat quality**, especially the relation between chemical boar taint analysis, meat quality, and sensory evaluation of female and entire male pigs fed fructan rich feed short time before slaughter (DFS),
- **animal nutrition**, especially with basis in poultry feed and nutrient requirements (HWN),
- **agricultural engineering**, especially the formation of new free-range agricultural production systems (AEN),
- **horticulture**, especially the fruit production and pest management (DHC).

From the Royal Agricultural and Veterinary University (RVAU) the key competences of the partners are

- **meat science**, especially muscle physiology and resulting meat quality (UFS),
- **sensory science**, especially the use of sensory evaluation as objective analysis to describe food quality (UFS),
- **boar taint and sensory science**, especially the ability to describe the sensory effects of feeding fructan rich diets for a short time before slaughter on entire male and female pork and to determine the causal and predictive relationships between chemical boar taint analysis, meat quality, and sensory evaluation assessments (UFS),
- **parasitology**, especially specialist knowledge on helminths of livestock with emphasis on population biology, epidemiology, diagnostics and sustainable control in all domestic species as well as dietary control of helminth infections (DCEP).
-

From the Danish Meat Research Institute (DMRI) the partner holds key competences in

- **meat quality**, especially the slaughter of animals, specific cuttings and relation to eating quality and convenience

From the Danish Institute for Food and Veterinary Research (DFVF) the partner holds key competences in

- **veterinary medicine, infection biology, diagnostic procedures** (bacteriology, pathology, histopathology, gene-technology) in relation to detection and description of infection caused by veterinary and zoonotic pathogens in pigs and other domestic animals.

The management of the project is maintained in a separate work package (WP1) and described in detail herein.

Table for scientific person month allocated on WP's and partners

Partner WP	1 DAE DIAS	2 DFS DIAS	3 HWN DIAS	4 AEN DIAS	5 DHC DIAS	6 UFS RVAU	7 DCEP RVAU	8 DMRI	9 DFVF	Total
WP1	1.5									1.5
WP2		18	12			1.0				31
WP3	15.0				4.7	3.5				23.2
WP4	16.0			12.5				4.7		33.2
WP5							6		7	13
WP6		6				5.0			6	17
Total	32.5	24	12	12.5	4.7	9.5	6	4.7	13	118.9

(Please give Institution or Department as partner id.)

Table for breakdown of total budget on partners and different cost categories (DKK)

Participating institution	Responsible scientist	Salaries		Equip-ment	Operational expenses	Total budget DKK
		Acade-mic	Techn. adm.			
DAE, DIAS	J. Hermansen	1.539.550	389.750	0	572.500	3.002.160*
DFS, DIAS	M. Hammershøj	1.092.544	257.100	0	214.000	1.888.373*
HWN, DIAS	S. Steinfeldt	575.500	229.100	0	312.000	1.340.000*
AEN, DIAS	B. Hindrup Andersen	470.000	0	0	280.000	900.000*
DHC, DIAS	H. Lindhard Pedersen	260.245	308.220	0	144.600	999.558
UFS, RVAU	A. H. Karlsson	459.400	215.400	0	213.094	1.065.476*
DCEP, RVAU	A. Roepstorff	179.736	169.210		251.084	720.036
DMRI	C. Claudi-Magnussen	218.000	185.400	0	180.000	700.080*
DFVF	D. Lau Baggesen	525.000	320.000		327.000	1.406.400

*** Financial contributions from places of work:**

DAE additional contribution of 754.959 DKK

DFS additional contribution of 304.200 DKK

HWN additional contribution of 304.200 DKK

AEN additional contribution of 86.400 DKK

UFS additional contribution of 120.000 DKK

DMRI additional contribution of 171.388 DKK

Total additional contributions of 1.741.147 DKK

A.4. Dissemination of scientific results

Please enclose information on:

- Planned education of scientists including Ph.D. and post-docs
Bachelor and master students will be involved as when appropriate.
- Stays abroad, guest researchers etc.
- Communication of results. Publication strategy, contributions to national or international workshops etc.

With reference to the list of deliverables it is the aim to publish 19 international reviewed papers, 1 national paper, 9 reports, 14 newsletters and 4 contributions to conferences. This is regarded as a

minimum, and where and when appropriated results will be published. Furthermore, it is planned to arrange a national conference in the end of year 2009 based on results from the project.

A.5. Scientific collaborations

Please enclose information on:

- Collaboration with other research institutes (national and international collaborative partners etc. please include a brief description of the collaborative scheme)

Marianne Hammershøj is participating in Management Committee of EU-Cost Action 923 “Multidisciplinary Hen Egg Research” which gathers scientists within EU to develop future common research on egg and egg product quality.

- Co-ordination with other projects (relations with other projects within the same field, which have been granted public funding)

There is a close co-operation with the established SOAR Ph.D.- project ‘Strategies for increased foraging in organic layers’ which is hold by Klaus Horsted and with Hans Ranvig (KVL), Sanna Steinfeldt, and John E. Hermansen as supervisors. In this project methods are established to estimate nutrient intake by foraging of hens.

Consumer confidence and perception of the concepts for organic, outdoor pig productions developed in this project will to some extent be evaluated through the project “Balancing microbiological safety against other food quality parameters” (Qualysafe), financed by DFFE (“Fremtidens fødevareresektor”).

- Collaboration with private business partners or networks (names, titles)

A group of stakeholders representing the chain from organic primary producers to consumers are formed for contribution of opinions, transforming research into practice, etc. however without authority to make decisions within the project. Meetings with research group and stakeholders are planned throughout the project period according to WP1.

The following persons has agreed to be stakeholders of QEMP:

Fie Graugaard, Chairman of the pig committee, Organic National Association (Økologisk Landsforening, Frederiksgade 72, DK-8000 Århus C
Private address: Resenbrovej 29, Voel, DK-8600 Silkeborg. Phone: +45 8685 3672

Flemming Pedersen, Product development manager, HEDEGAARD *foods*, Glerupvej 5, DK-9560 Hadsund. Phone: +45 9857 3055, Fax 98 57 30 95, mailto: flemming.p@hedegaard-food.dk

Flemming Haugaard, Farmer of organic eggs, Ingebølvej 15, DK-6392 Bolderslev.
Phone : +45 7464 6695

Henrik Bækstrøm Lauritsen, Quality Assurance Manager, Danish Bacon and Meat Council, Axelborg, Axeltorv 3, DK-1609 København V. Phone: +45 3311 6050; mailto: hbl@danskeslagterier.dk

Jette Søholm Petersen, National Poultry Advisor, The National Poultry Advisory Centre, Skejby, Udkærvej 15, DK-8200 Århus N. Phone: 8740 5381, Mailto: jtp@landscentret.dk

Pernille Fraas Johnsen, The Danish Animal Welfare Society, Alhambravej 15, DK-1826 Frederiksberg C. Tlf.: +45 3328 7016, mailto: pfj@dyrenes-beskyttelse.dk

Tom Krog Nielsen, Export consultant, Organic Denmark, The Organic Service Centre, (Økologisk Landscenter), Frederiksgade 72, DK-8000 Aarhus C
Mailto: info@organic-denmark.com

Tove Serup, Advisor, The Danish Agricultural Advisory Service, Udkærvej 15, DK-8200 Århus N
Phone: +45 8740 5364; mailto: tos@landscentret.dk

A.6 Other issues

(E.g. special considerations concerning conducting of experiments in relation to principles of organic food and farming).

A.7 References

- Albentosa, M.J., Kjaer, J.B., & Nicol, C.J. (2003). Strain and age differences in behaviour, fear response and pecking tendency in laying hens, *Br. Poult. Sci.*, **44**, 333-344.
- Al-Bustany, Z. & Elwinger, K. (1987). Shell and interior quality and chemical composition of eggs from hens of different strains and ages fed different dietary lysine levels, *Acta Agric. Scand.*, **37**, 175-187.
- Ambrosen, T. & Petersen, V. E. (1997). The influence of protein level in the diet on cannibalism and quality of plumage of layers. *Poult. Sci.* **76**, 559-563.
- Andersen, B. H., Jensen, H.F., Møller, H.B., Andersen, L. & Mikkelsen, G.H. (2000). Concept for ecological pig production in one-unit pens in twelve-sided climate tents. Design and layout. In: Ecological Animal Husbandry in the Nordic Countries. Proceedings of NJF Seminar, 303, 65-75.
- Bak, B., (2004). De danske landsvin og landracesvin før, nu og i fremtiden. *Nordiske Genbank Husdyr (NGH-nytt)*, **2**, 4-5.
- Bech, A. & Søndergård, H. (2004). Forbrugeropfattelser af økologisk svinekød og kød fra økologisk ungsvin. Rapport fra gruppeinterview gennemført for Danmarks Jordbrugsforskning og Svineudvalget i Økologisk Landsforening. 33 pp
- Byrne, D.V. and Hansen, L.L. (2005). Sensory profiling and chemical investigations of the eating quality of male and female pork in relation to the influence of bioactive feeding: Part I. crude chicory. *In preparation*.
- Carstensen, L., Vaarst, M., Roepstorff, A., 2002. Endoparasite infections in Danish organic swine herds. *Veterinary Parasitology* 106: 253-264.
- Cave, N.A., Poste, L.M., Butler, G., Farnworth, E.E., & Burrows, V.D. (1992). Effect of dietary level of naked oats (*Avena nuda*) on internal and sensory quality of eggs and on yolk lipid composition, *Can. J. Anim. Sci.*, **72**, 147-153.
- Chen, Y.C & Chen T.C. (2004). Mineral utilization in layers as influenced by dietary oligofructose and inulin. *Int. J. Poultry Sci.*, **3**, 442-445.
- Chung, H.Y., Rasmussen, H.M., & Johnson, E.J. (2004). Lutein bioavailability is higher from lutein-enriched eggs than from supplements and spinach in men, *J. Nutr.*, **134**, 1887-1893.
- Cizuk, P., Charpentier, L. & Hult, E. (1998). Free choice of feed for ecological hens. Fakta Jordbruk. SLU publications, Box 7075, 750 07 Uppsala.
- Clark, M.S. & Gage, S.H. 1996. Effects of free-range chickens and geese on insect pests and weeds in an agro-ecosystem. *Am. J. Altern. Agric.*, **11**, 39-47.
- Claudi-Magnussen, C. (2003). Bedre velfærd ved hold af økologiske svin – Screening af spisekvalitet af små hangrise og store sogrise. Slagteriernes Forskningsinstitut , 19 pp
- Claudi-Magnussen, C. & Hansen, L.L. (2005). FØJO-projekt II-7 Svinefodring - næringsstofudnyttelse, produktkvalitet og sundhed (OrganicPigFeed). Work Package 3. Produktkvalitet. Slutrapport. Roskilde: Slagteriernes Forskningsinstitut.
- Dini, A., Rastrelli, L., Saturnino, P., & Schettino, O. (1992). A compositional study of *Chenopodium quinoa* seeds, *Nahrung*, **36**, 400-404.
- Edwards, S.A., (2004). Product quality attributes associated with outdoor pig production. *Livestock Production Science*. In press.
- Ellis, M., McKeith, F.K., & Miller, K.D. (1999). The effects of genetic and nutritional factors on pork quality – review. *Asian-Aus. J. Anim. Sci.*, **12**. 261-270.
- Elwinger, K., Tauson, R. & Lagerkvist, G. (2004). Klarar våra hönor KRAV:s 100-procentregel? *Forskningsnytt*, **3**, 16-17.
- EU (2004). Opinion of the Scientific Panel on Animal Health and Welfare on a request from the Commission related to welfare aspects of the castration of piglets, *The EFSA J.*, **91**, 1-18.
- FOEJO (2004). FØJO II. Foder og fodringsstrategier i økologisk svineproduktion. www.foejo.dk/forskning/foejoi/ii.html
- Furuse, M., Nakajima, S., Miyagawa, S., Nakagawa, J., & Okumura, J. (1994). Feeding behavior, abdominal fat and laying performance in laying hens given diets containing red pepper, *Jap. Poult. Sci.*, **31**, 45-52.
- Gasztonyi, M.N., Daood, H., Takacs-Hajos, M., & Biacs, P. (2001). Comparison of red beet (*Beta vulgaris* var *conditiva*) varieties on the basis of their pigment components, *J. Sci. Food Agric.*, **81**, 932-933.
- Gibis, M., 1995. Einfluß der Substanzen Indol und Skatol auf die Schweinefleischqualität. Thesis. Universität Hohenheim. 181pp.
- Gibis, M., Hilmes, C., & Fischer, A., 1998. Off-flavour in pork caused by skatole. *Fleischwirtschaft* 78: 727-730.
- Godt, J., Kristensen, K., Poulsen, C. S., Juhl, H. J., & Bech, A. C. 1996. A consumer study of Danish entire male pigs. *Fleischwirtschaft*, 76(5), 518-520.
- Groot, J. de, Ruis, M.A.W., Scholten, J.W., Koolhaas, J.M. & Boersma, W.J.A. (2001). Long-term effects of social stress on anti-viral immunity in pigs. *Phys. Behav.*, **73**, 145-158.
- Grizzle, J., Iheanacho, M., Saxton, A., & Broaden, J. (1992). Nutritional and environmental factors involved in egg shell quality of laying hens, *Brit. Poult. Sci.*, **33**, 781-794.
- Guy, J.H. & Edwards, S.A., 2002. Consequences for meat quality of producing pork under organic standards. *Pig News and Information*, 23: 75N-80N.
- Hammershoj, M. (1995). Effects of dietary fish oil with natural content of carotenoids on fatty acid composition, n-3 fatty acid content, yolk colour and egg quality of hen eggs, *Arch. für Geflügelk.*, **59**, 189-197.
- Hammershoj, M. (1996). The effect of rapeseed in feed for brown-egg layers on TMA taint and other egg quality traits, *Forskningsrapport fra Statens Husdyrbrugsforsøg*, **45**, 1-30 (In Danish).
- Hammershoj, M. & Steinfeldt, S. (2005). Effect of blue lupin (*Lupinus angustifolius*) in organic layer diets and supplementation with foraging material on layer performance and some egg quality parameters, *Poultry Science*, **84**, 723- 733.
- Hansen, L. L. & Claudi-Magnussen, C., 2003. Effect of Lupine and Protein level for Growing-Finishing Pigs on Skatole in Backfat (Pig off-odour) of Female and Castrated male pigs. EAAP Working Group "Production and Utilisation of Meat from Entire Male Pigs", Dublin, Ireland, 13-14 November 2003, 4 pp.

- Hansen, L. L. & Claudi-Magnussen, C., 2004. Feeding with lupines reduces the amount of skatole in organic pigs. *DAR-COFenews*, Newsletter from Danish Research Centre for Organic Farming (December 2004 No. 4).
- Hansen, L.L.; Jensen, M.T.; Mejer, H.; Roepstorff, A.; Thamsborg, S.M.; Byrne, D.V.; Karlsson, A.; Hansen-Møller, J.; Tuomola, M., 2006. Influence of chicory roots (*Cichorium intybus* L.) on boar taint in entire male and female pigs. *Animal Science*, 82(3), 359-368.
- Hansen, L. L., Larsen, A. E., & Hansen-Møller, J., 1995. Influence of keeping pigs heavily fouled with faeces plus urine on skatole and indole concentration (boar taint) in subcutaneous fat. *Acta Agriculturae Scandinavica* 45(3): 178-185.
- Hansen, L. L., Larsen, A. E., Jensen, B. B., Hansen-Møller, J., & Barton-Gade, P., 1994. Influence of stocking rate and faeces deposition in the pen at different temperatures on skatole concentration (boar taint) in subcutaneous fat. *Animal Production* 59(1): 99-110.
- Hansen-Møller, J. and N. Kjeldsen. 1998. Introduction to Danish research on boar taint. In: W. K. e. Jensen (Ed.) Skatole and boar taint. pp. 13-20. Danish Meat Research Institute, Roskilde..
- Hirt, H., Bestmann, M., Nauta, W., Philipps, L. & Spoolder, H., (2001). Breeding for health and welfare. Proceedings of a workshop of the Network on Animal Health and Welfare in Organic Agriculture, Wageningen.
- Horsted, K., Henning, J. & H.L., Pedersen, B. (2004). Kyllinger fra frugtplantager smager godt. *Økologisk Jordbrug*, 2. April, p. 10.
- Horsted, K., Henning, J., Hermansen, J.E. (2005). Growth and sensory characteristics of organic reared broilers in orchards with broilers differing in genotype, sex and age at slaughter. Submitted to *Brit. Poult. Sci.*
- Jensen, M.T., Jensen, B.B., Laue, A., Agergaard, N. & Bibby, B.M. (1997). Effect of various carbohydrate sources on the production of skatole in the hind gut of pigs and skatole concentration in blood plasma. In: Bonneau, M., Lundström, K., Malmfors, B., Boar taint in entire male pigs, Stockholm, Sweden, 1-3 October 1997: 80-83.
- Kelly, H.R.C., Browning, H.M., Martins, A.P., Pearce, G.P., Stopes, C. & Edwards, S.A., (2001). Breeding and feeding pigs for organic production. Proceedings of a workshop of the Network on Animal Health and Welfare in Organic Agriculture, Wageningen.
- Kelly, D. 1990. Effect of creep feeding on structural and functional changes of the gut of early weaned pigs. *Res. Vet. Sci.* 48, 350-356
- Kjaer, J.B. & Sørensen, P. (2002). Feather pecking and cannibalism in free-range laying hens as affected by genotype, dietary level of methionine+cystine, light intensity during rearing and age at first access to the range area, *Appl. Anim. Behav. Sci.*, 76, 21-39.
- Leser, T.D., Lindecrone, R.H., Jensen, T.K., Jensen, B.B. & Møller, K. 2000. Changes in bacterial community structure in the colon of pigs fed different experimental diets and after infection with *Brachyspira hyodysenteriae*. *Applied and Environmental Microbiology* 66: 3290-3296.
- McKeegan, D. E. F., C. J. Savory, M. G. MacLeod & M. A. Mitchell. (2001). Development of pecking damage in layer pullets in relation to dietary protein source. *Br. Poult. Sci.* 42, 33-42.
- Mejer, H., Thamsborg, S. M., Roepstorff, A., Eriksen, L., 1999. Økologiske grise får mange indvoldsorm – men hvad betyder de for grisene? *Forskningsnytt, om økologisk landbrug i Norden*, 8, 15-17.
- Mejer, H. 2004. Pløjning virker mod nogen indvoldsorm (2004). *Økologisk jordbrug* 315, 10. Online at <http://orgprints.org/00003228/>.
- Mikkelsen, LL, Naughton, P.J., Hedemand, M.S., M, Jensen, BB. 2003. Effects of physical properties of feed on microbial ecology and survival of *Salmonella enterica* serovar Typhimurium in the pig gastrointestinal tract. *Appl. Environ. Microbiol.* 70 (6), 3485-3492
- Narahari, D. (2003). Production of health promoting functional eggs. *Proceedings of Xth European Symposium on the Quality of Eggs and Egg Products, vol. III*, Saint-Brieuc, 23-26 september 2003, 260-266.
- Naughton, PJ, Mikkelsen, LL, Jensen, BB. 2001. Effect of nondigestible Oligosaccharides on *Salmonella enterica* serovar Typhimurium and non-pathogenic *Escherichia coli* in the pig small intestine in vitro. *Appl. Environ. Microbiol.* 67, 3391-3395.
- Nicolle, C., Simon, G., Rock, E., Amouroux, P., & Remesy, C. (2004). Genetic variability influences carotenoid, vitamin, phenolic, and mineral content in white, yellow, purple, orange, and dark-orange carrot cultivars, *J. Am. Soc. Hort. Sci.*, 129, 523-529.
- Nielsen, E.M., Engberg, J. and Madsen, M. (1997) Distribution of serotypes of *Campylobacter jejuni* and *C. coli* from Danish patients, poultry, cattle and swine. *FEMS Immunology and Medical Microbiology* 19, 47-56.
- Nisbet, D. 2002. Defined competitive exclusion cultures in the prevention of enteropathogen colonisation in poultry and swine. *Antonie Van Leeuwenhoek*;81(1-4):481-6.
- NPPC, (1994). Pork quality: Genetic evaluation summary. National Pork Producers Council, Des Moines, IA.
- NPPC, (1995). Pork quality: Genetic evaluation summary. National Pork Producers Council, Des Moines, IA.
- Olver, M. D. & Malan, D. D. (2000). The effect of choice feeding from 7 weeks of age on the production characteristics of laying hens. *South Afr. J. Anim. Sci.*, 30, 110-114.
- Pedersen, H.L., Olsen, A., Horsted, K., Pedersen, B. & Hermansen, J. (2002). Combined production of broilers and fruit. NJF-seminar no. 346., organic production of fruit and berries. Årselv 22. oktober 2002.
- Pedersen, H.L., Olsen, A., Horsted, K., Korsgaard, M. & Pedersen, B. (2004). Combined production of broilers and fruits. ECO-FRU-VIT. 11th International Conference on Cultivation technique and Phytopathological problems in Organic Fruit-Growing, 131-136.
- Petkevičius, S., Bach Knudsen, K.E., Murrell, K.D., Wachmann, H., 2003. The effect of inulin and sugar beet fibre on *Oesophagostomum dentatum* infection in pigs. *Parasitology* 127: 61-68.
- Petterson, D. S. (2000). The use of lupins in feeding systems. Review. *Asian-Aus. J. Anim. Sci.*, 13, 861-882.

- Prochaska, J.F., Carey, J.B., & Shafer, D.J. (1996). The effect of L-lysine intake on egg component yield and composition in laying hens, *Poult. Sci.*, **75**, 1268-1277.
- Pryde, S.E., Richardson, A.J., Stewart, C.S., Flint, H.J. 1999. Molecular analysis of the microbial diversity present in the colonic wall, colonic lumen, and the cecal lumen in a pig. *Appl. Environ. Microbiol.* 765(12) 5372-5377
- Rahelic, S. & Puce, S. (1981). Fiber types in Longissimus dorsi from wild and highly selected pig breeds. *Meat Sci.*, **5**, 439-450.
- Roepstorff, A., Jørgensen, R.J., Nansen, P., Henriksen, S.A., Skovgaard Petersen, J., Andreassen, M., 1992. Parasitter hos økologiske svin. Rapport over projekt finansieret af Jordbrugsdirektoratet under Landbrugsministeriet. Landsudvalget for Svin, Danske Slagterier. Copenhagen. pp. 36.
- Rosenvold, K., Lærke, H.N., Jensen, S.K., Karlsson, A.H. & Andersen, H.J. (1999). Regulation of ultimate pH and drip loss in pork meat through feed regulated muscle glycogen stores at the time of slaughter. Temamøde torsdag d. 9. december, Status og visioner i koordineret dansk kødforskning. Intern report no. 126: 67-71.
- Rosenvold, K., Petersen, J.S., Lærke, H.N., Jensen, S.K., Therkildsen, M., Karlsson, A.H., Møller, H.S. & Andersen, H.J. (2000). Muscle glycogen stores and meat quality as affected by strategic finishing feeding of slaughter pigs. *J. Anim. Sci.*, **79**, 382-391.
- Ruales, J. & Nair, B.M. (1992). Nutritional quality of protein in quinoa (*Chenopodium quinoa* Willd) seeds, *Plant Foods Hum. Nutr.*, **42**, 1-11.
- Ruis, M.A.W., te Brake, J.H.A., Engel, B., Buist, W.G., Blokhuis, H.J. & Koolhaas, J.M. (2002). Implications of coping characteristics and social status for welfare and production of paired growing gilts. *Appl. Anim. Behav. Sci.* **75**, 207-231.
- Saavedra J.M. 1995. Microbes to fight microbes: a not so novel approach to controlling diarrheal disease. *J Pediatr Gastroenterol Nutr.* 21(2):125-9.
- Serup, T. (2005). Personal communication. Advisor at the Danish Agricultural Advisory Service, Aarhus, Denmark.
- Shafer, D.J., Carey, J.B., Prochaska, J.F., & Sams, A.R. (1998). Dietary methionine intake effects on egg components yield, composition, functionality, and texture profile analysis, *Poult. Sci.*, **77**, 1056-1062.
- Sikder, A.C., Chowdhury, S.D., Rashid, M.H., Sarker, A.K., & Das, S.C. (1998). Use of dried carrot meal (DCM) in laying hen diet for egg yolk pigmentation, *Asian-Aus. J. Anim. Sci.*, **11**, 239-244.
- Soil Association (2000). Standards for Organic Livestock Production. Soil Association, Bristol, UK.
- Tannock, G., Fuller, R., Pedersen, K. 1990. Lactobacillus succession in the piglet digestive tract demonstrated by plasmid profiling. *Appl. Environ. Microbiol.* 56: 1310-1316
- Tserveni-Gousi, A.S. (2001). Sensory evaluation of eggs produced by laying hens fed diet containing flaxseed and thymus meal, *Archiv für Geflügelkunde*, **65**, 214-218.
- Udesen, F. 1998. Financial consequences of production of entire male pigs.(Chapter 13). In: W.Klinth Jensen.(Editor) Skatole and boar taint.ISBN 87-985837-1-9.Danish Meat Research Institute,Roskilde,Denmark,195-202.
- Warriss, P.D., Kestin, S.C., Brown, S.N., & Nute, G.R. (1996). The quality of pork from traditional pig breeds. *Meat Focus International* May-June, 179-782.
- Weijtens, M.J.B.M., Bijker, P.G.H., van der Plas, J., Urlings, H.A.P. and Biesheuvel, M.H. (1993) Prevalence of campylobacter in pigs during fattening; an epidemiological study. *Veterinary Quarterly* 15, 138-143.
- Whittemore, C., (1993). The science and practise of pig production. Longman Scientific and Technical. London, UK. 661 pp.
- Zia, R., Sakhawat, A., Ahn, A.D., & Shah, F.H. (1994). Utilisation of fruit and vegetable wastes in layers' diet, *J. Sci. Food Agric.*, **65**, 381-383.

A.8 Curriculum vitae

Name	John E. Hermansen	
Born	5 January 1950	
Education	1974	M.Sc. from the Royal Veterinary and Agricultural University
Employment	1997-present	Head of research unit 'Farming Systems' at Department of Agroecology, Danish Institute of Agricultural Sciences
	1992-1997:	Senior Scientist at Danish Institute of Animal Science
	1975-1992:	Scientist at Danish Institute of Animal Science
Role in project	Project leader	
Key qualifications	<p>The research of the farming system unit are directed towards farming systems orientated research based on a combination of case studies on commercial farms, and representation of important parameters in farm models. The goal is to identify developing possibilities for farms in relation to an improved balance between an efficient agricultural production and the environmental impact of production methods and paying a special attention to the satisfaction of the basic values of the farmer's family.</p> <p>Has been heading the research projects "Organic Pig Production Systems" and "Resource use, environmental impact and economy in organic pig production systems", financed by DARCOF I and II respectively. Currently also heading the development projects "New systems in organic poultry production", "The outdoor areas in organic poultry production", and "Complementary investigations on production of male pigs in organic production" all financed by DFFE.</p>	
Other activities	2004	Member of scientific committee of Sweden Research. Council for Forest and Agriculture in relation research programme "Organic Production" (also in 2000 and 1998).
	2000-2005	Member of WIAS (Wageningen Institute of Animal Science) scientific advisory board.
	1998-now	Section editor (Management and Health of Livestock Production Science).
Publications	<p>Hermansen, J.E., Strudsholm, K. & Horsted, K., 2004. Integration of organic animal production into land use with special reference to swine and poultry. <i>Livestock Production Science</i> 90, 11-26.</p> <p>Oksbjerg, N., Strudsholm, K., Lindahl, G. & Hermansen, J.E., 2004. Meat quality of fully and partly outdoor reared pigs in organic production. <i>Acta Agriculturae Scandinavica, Section A, Animal Science</i> (submitted).</p> <p>Hermansen, J.E., 2003. Organic livestock production systems and appropriate development in relation to public expectations. <i>Livestock Production Science</i> 80, 3-15.</p> <p>Jakobsen, K. and Hermansen, J.E. 2001. Organic farming - a challenge to nutritionists. <i>J.Anim.Feed Sciences</i>, 10, suppl. 1,</p> <p>Hermansen, J.E. & Jakobsen, K., 2004. Meat Production in Organic Farming: In: <i>Encyclopaedia of Meat Sciences</i>. Eds. W.K. Jensen, C. Devine and D. Dikeman, Elsevier, Oxford. Vol. 3, pp. 1046-1051.</p> <p>Hermansen, J.E. & Horsted, K., 2004. Organic poultry farming. 1st International Congress on Organic Animal Production and Food Safety. Pine Bay Holiday Resort, Kusadasi, Turkey. 271-284.</p> <p>Hermansen, J.E. & Kristensen, T., 2004. Integrated forage and livestock production. In: Hopkins, A., 2004. <i>Organic farming. Science and practice for profitable livestock and cropping</i>. BGS Occasional Symposium No 37, 61-72. ISBN 0 905944 844</p> <p>Hermansen, J.E., Moustsen, V.A. & Andersen, B.H., 2003. Development of organic pig production systems. In: Wiseman, J., Varley, M.A. & Kemp, B. (eds.), 2003. <i>Perspectives in pig science</i>. Nottingham University Press. ISBN 1-897676-19-0,</p> <p>Hermansen, J.E., Strudsholm, K & Horsted, K., 2003. Integration of organic animal production into land use with special reference to swine and poultry. IX World Conference on Animal Production. Porto Alegre - RS, Brasil. CD 14 pp.</p> <p>Hermansen, J.E., Thuen, E., (eds.) 2000. <i>Ecological Animal Husbandry in the Nordic Countries</i>. Proceedings from NJF-seminar No. 303 Horsens, Denmark 16-17 September 1999. DARCOF Report No. 2/2000.</p>	

Name	Marianne Hammershøj
Born	7 August 1966
Education	1992 M.Sc. (Food Science) from the Royal Veterinary and Agricultural University, Copenhagen 2001 Ph.D. (Food Science), from the Royal Veterinary and Agricultural University, Copenhagen
Employment	2004-present Senior Scientist, Dept. of Food Science, DIAS 2000-2004 Research Scientist, Dept. of Food Science, DIAS 1997-2000 Ph.D.-student at Dept. of Dairy and Food Science, The Royal Veterinary- and Agricultural University, Copenhagen, and Wageningen Agricultural University, Dept. of Food Technology and Nutritional Science, The Netherlands
Role in project	1993-1997 Research Scientist at Danish Institute of Animal Science Responsible of WP2: Improvement of organic eggs
Research area	Food quality research of mainly eggs and egg products. Investigation of effects of hen egg production, hen age, egg storage conditions, protein composition, structure and egg product processing on physical, chemical and functional egg quality properties.
Other activities	1993-present Danish representative in World Poultry Science Association Working group "Egg Quality". 2000-present Member of Nordic Rheology Society. 2002-present Danish representative in Management Committee of EU Cost Action 923 "Multidisciplinary Hen Egg Research".
Recent Publications	Hammershøj, M., Nording, J.A., Rasmussen, H. C., Carstens, J. H. & Pedersen, H. 2006. Dry-pasteurisation of egg albumen powder in a fluidised bed. I. Effect on microbiology, physical and chemical parameters. <i>Int. J. Food Sci. Tech.</i> , 41 , 3, 249-261. Hammershøj, M., Rasmussen, H.C., Carstens, J. H. & Pedersen, H. 2006. Dry-pasteurisation of egg albumen powder in a fluidised bed. II. Effect on functional properties: gelation and foaming. <i>Int. J. Food Sci. Tech.</i> , 41 , 3, 263-274. Hammershøj, M. & Kidmose, U. 2006. Coloured carrot varieties as forage material for egg layers. <i>Book of Abstracts, XII European Poultry Conference, 10-14 September 2006, World's Poultry Science Journal</i> , 62 , suppl., 168. Hammershøj, M., & Steinfeldt S. 2005. Effect of Blue Lupin (<i>Lupinus angustifolius</i>) in Organic Layer Diets and Supplementation with Foraging Material on Egg Production and Some Egg Quality Parameters. <i>Poultry Sci.</i> , 84 , 4, 723-733. Hammershøj, M., Peters, L. V. & Andersen, H. J. 2004. The significance of critical processing steps in the production of dried egg albumen powder on gel textural and foaming properties. <i>J. Sci. Food Agric.</i> , 84 , 9, 1039-1048. Hammershøj, M., Larsen, L. B., Andersen, A. B. & Qvist, K. B. 2002. Storage of shell eggs influences the albumen gelling properties. <i>Food Sci. Tech.</i> , 35 , 1, 62-69. Hammershøj, M. & Qvist, K. B. 2001. Importance of hen age and egg storage time for egg albumen foaming. <i>Food Sci. Techn.</i> , 34 , 2, 118-120. Hammershøj, M., Larsen, L. B., Ipsen, R. H. & Qvist, K. B. 2001. Effect of hen egg production and protein composition on textural properties of egg albumen gels. <i>J. Text. Stud.</i> , 32 , 2, 105-129. Hammershøj, M. 2000. Functional properties of egg albumen. Rheology and protein composition in relation to hen egg production. Ph.D.-Thesis, DIAS, 227 pp. ISBN 87-88976-48-3. Hammershøj, M., Prins, A. & Qvist, K.B. 1999. Influence of pH on Surface Properties of Egg Albumen Solutions in Relation to Foaming Behaviour. <i>J. Sci. Food Agric.</i> , 79 , 859-868. Hammershøj, M. & Kjær, J. B. 1999. Phase feeding for laying hens: Effect of protein and essential amino acids on egg quality and production. <i>Acta Agric. Scand., sect. A. Animal Sci.</i> , 49 , 31-41

Name	Anne Grete Kongsted	
Born	15 September 1972	
Education	1999	M.Sc. (agric.) from the Royal Vet. And Agricultural University
	2004	Ph.D. in Pig Production from the Royal Vet. And Agricultural University
Employment	1999-2000	Research assistant at Dept. of Agricultural Systems (now Dept. of Agroecology), Danish Institute of Agricultural Sciences (DIAS)
	2000-2004	Ph.D. student at Dept. of Agroecology, DIAS
	2001	Advisor at the Danish Bacon and Meat Council, Dept. of Pig Housing and Production Systems (leave from Ph.D. study)
	2004-	Scientist at Dept. of Agroecology, DIAS
Research abroad	Two month as a Ph.D.-student working with Dr. N. Soede in the Dept. of Animal Science at the Wageningen University	
Role in project	Responsible for WP4: Strategies for diversified organic pig production	
Main research projects	1999-2000	Outdoor pig production
	1999-2000	Health- and animal welfare- promoting pig production systems
	2000-2004	The reproduction performance of group-housed sows (Ph.D. project)
Recent publications	<p>Kongsted, A.G., 2005. Effect of energy intake on pregnancy rate and litter size with particular reference to group housed non-lactating sows – a review. <i>Livestock Production Science</i> (in press).</p> <p>Kongsted, A.G., 2004. Stress and fear as possible mediators of reproduction problems in group housed sows: A review. <i>Acta Agric. Scand., Sect. A, Animal Sci.</i> 54: 58-66.</p> <p>Kongsted, A.G. 2004. Reproduction performances and conditions of group-housed non-lactating sows. Ph.D. Thesis. The Royal Veterinary and Agricultural University, Copenhagen. November 2004.</p> <p>Kongsted, A.G. & Hermansen, J.E. 2004. Organic pig production – With particular reference to Danish production conditions. Submitted to <i>Pig News and Information</i>.</p> <p>Kongsted, A.G., Larsen, V.A., Kristensen, I.S., 2000. Frilandssohold. Resultater fra gårdstudier - 1998. DJF rapport Husdyrbrug nr. 15. 100 pp.</p> <p>Kongsted, A.G., Larsen, V.A., 1999. Pattegrisedødelighed i frilandssohold. DJF-rapport Husdyrbrug nr. 11, Forskningscenter Foulum. 56 pp.</p> <p>Larsen, V.A., Kongsted, A.G., 2001. Frilandssohold. Produktion, foderforbrug, udsætningsårsager og græsdække. DJF rapport nr. 30 - husdyrbrug. Juli 2001. Pp. 46.</p> <p>Hermansen, J.E., Kongsted, A.G., 2000. Økologisk regelsæt vedrørende svin. I: Analyse af det økologiske regelsæt vedrørende husdyrsundhed og husdyrvelfærd. FØJO, p 29-50.</p> <p>Hermansen, J.E., Andersen, B.H., Bak, S., Giersing, M., Kongsted, A.G., Lauritsen, H.B., Møller, F., Nørgaard, N.H., Tvedegaard, N., 2000. Forskellige systemers forventede produktionsmæssige, økonomiske og miljømæssige resultater. I: Hermansen, J.E (red.) Økologisk svineproduktion. Udfordringer, muligheder og begrænsninger. FØJO-rapport nr. 8 2000. P 17- 46</p>	

Name	Klaus Horsted	
Education	1999	M.Sc. (agric.) from the Royal Vet. And Agricultural University
Employment	2001-2003	Research assistant at Dept. of Agricultural Systems, Danish Institute of Agricultural Sciences
	2003-	Ph.D.-student in organic poultry production
Role in project	Participant in WP3: Integrated chicken meat and apple production	
Main research projects	2001-2003	Outdoor poultry production
	2001-2003	Development of new systems in organic poultry production
	2003-	Increased foraging of organic layers (Ph.D. project)
Recent publications	<p>Horsted, K., Henning, J., Hermansen, J.E., 2005. Growth and sensory characteristics of organic reared broilers in orchards with broilers differing in genotype, sex and age at slaughter. Submitted to British Poultry Science.</p> <p>Horsted, K., Henning, J., Lindhard, H. & Pedersen, B., 2004. Kyllinger fra frugtplantager smager godt. Økologisk Jordbrug 24(310), 10.</p> <p>Horsted, K., 2002. Bedre udeliv til økologisk fjerkræ. Økologisk Jordbrug 22(279), 6.</p> <p>Henning, J., Jensen, M.N., Horsted, K., Nielsen, L.P., Jensen, R., Martens, M. & Bredie, W.L.P., 2004. Sensor quality of old genotype broilers used in ecological pest control in orchards. European conference on Sensory Science of Food and Beverages. Poster No. P18.</p> <p>Hermansen, J.E. & Horsted, K., 2004. Organic poultry farming. 1st International Congress on Organic Animal Production and Food Safety. Pine Bay Holiday Resort, Kusadasi, Turkey. 271-284.</p> <p>Hermansen, J.E., Strudsholm, K. & Horsted, K., 2004. Integration of organic animal production into land use with special reference to swine and poultry. Livestock Production Science 90, 11-26.</p> <p>Pedersen, H.L., Olsen, A., Horsted, K., Korsgaard, M. & Pedersen, B., 2004. Combined production of broilers and fruits. ECO-FRU-VIT. 11th International Conference on Cultivation technique and Phytopathological problems in Organic Fruit-Growing, 131-136.</p> <p>Andersen, B.H., Forkman, B. & Horsted, K., 2002. Development of concept for housing of ecological poultry in climate tents. Proc. 14th IFOAM Organic World Cong., Victoria, Canada. ISBN 0-9695851-5-2, p. 77.</p> <p>Pedersen, H.L., Olsen, A., Horsted, K., Pedersen, B. & Hermansen, J., 2002. Combined production of broilers and fruit. NJF-seminar no. 346., organic production of fruit and berries. Årselv 22. oktober 2002.</p>	

Name	Sanna Steinfeldt
Born	24 February 1959
Education	1988 M.Sc., Aarhus University, Denmark. 1995 Ph.D., The Royal Veterinary- and Agricultural University, Copenhagen.
Employment	2000-present Senior Scientist, DIAS, Dep. of Animal Nutrition and Physiology: From 2005: Dep. Of Animal Health, Welfare and Nutrition 1995-2000 Research Scientist, DIAS, Dep. of Nutrition (1995-1997), Dep. of Animal Nutrition and Physiology (1997-2000). 1991-1995 Ph.D. student, The Danish Research Academy. Dealing with different aspects of nutrition in broiler chickens, especially related to the effect of fibre content on digestibility and intestinal parameters. 1991 Dep. of Animal Nutrition and Physiology, Wageningen Agricultural University, The Netherlands. In connection with the Ph.D. education. 1989-1991 Research Scientist, National Institute of Animal Science, Dep. of Poultry and Rabbits.
Role in project	Participating scientist of WP2: Improvement of organic eggs
Research area	Research is mainly concentrated on nutrition and physiology in monogastric animals, primarily poultry, studying the nutritional value of different feed ingredients/diets involving parameters as nutrient digestibility, intestinal viscosity and passage rate, and effect on productivity. The correlation between different diets and the microbial activity, and the effect on morphology of the epithelium are investigated in some studies. Supplementation with exogenous enzymes is used to investigate possible improvements of the nutritional value of different diets, and reduced excretion of nutrients. Has been heading the research project "Improvements in nutrition and health on organic egg-production" financed by DFFE (2001-2004).
Other activities	1991-present Danish member of the European Working group Nr. 2 (Poultry nutrition) under WPSA (World's Poultry Science Association).
Recent Publications	Steenfeldt, S., Kjaer J.B. & Engberg, R. M. (200x). The Effect of Feeding Silages or Carrots as Supplements to Laying Hens on Production Performance, Nutrient Digestibilities, Gut Microflora and Feather Pecking Behaviour. <i>Submitted British Poultry Science 06, 2006</i> Hammershøj, M., & Steinfeldt S, (2005). Effect of Blue Lupin (<i>Lupinus angustifolius</i>) in Organic Layer Diets and Supplementation with Foraging Material on Egg Production and Some Egg Quality Parameters. <i>Poultry Sci.</i> , 84, 4, 723-733. Engberg, R.M., Hedemann, M.S., Steinfeldt, S. & Jensen, B.B., (2004). Influence of whole wheat and xylanase on broiler performance and microbial composition and activity in the digestive tract. <i>Poultry Sci.</i> 83, 925-938. Steenfeldt, S. (2004). Næringsværdien af lupin, nøgen havre, samt grovfoder. Bilag Økologikongres 2004: Vision og virkelighed, Odense, DK, pp. 177-178. Steenfeldt, S., Gonzales, E. and Bach Knudsen, K.E. (2003). Effects of inclusion with blue lupin (<i>Lupinus angustifolius</i>) in broiler diets and enzyme supplementation on production performance, digestibility and AME. <i>Animal Feed Science and Technology</i> , 110: 185-200. Steenfeldt, S., (2003). Wheat Quality - a continuing important issue in poultry nutrition - Results from broiler studies in Denmark. Proceedings from the 14th European Symposium on Poultry Nutrition, Lillehammer, Norway, august 10-14, 333-341. (invited paper). Steenfeldt, S. (2001). The dietary effect of different wheat cultivars for broiler chickens. <i>British Poultry Science</i> , 42: 616-630. Steenfeldt, S. and Pettersson, D.R. (2001). Improvements in nutrient digestibility and performance of broiler chickens fed a wheat- and rye-based diet supplemented with enzymes. <i>Journal of Animal and Feed Sciences</i> , 10: 143-157.

Name	Hanne Lindhard Pedersen	
Born	8 June 1961.	
Education	1987	M.Sc. from the Royal Veterinary and Agricultural University
	1996	Ph.D. in Pomology from the Royal Vet. And Agricultural University
Employment	2003-present	Senior scientist at research unit for Fruit, Nursery and breeding, at Department of Horticulture, Danish Institute of Agricultural Sciences.
	1997-2003	Head of research unit: Fruit and Berries at Department of Horticulture Danish Institute of Agricultural Sciences
	1987-1997	Scientist at Danish Institute of plant Science.
Research abroad	Visiting scientist in 6 months at HortResearch, Lincoln, New Zealand. 1994-1995. Visiting scientist 4 month at HortResearch, Nelson, New Zealand 1999-2000.	
Role in project	Responsible for fruit related research in WP3.	
Other activities	2004-present	Chair of the session on perennial crops of the Int. Scientific Conference on Organic Farming in Adelaide, Australia. ISOFAR.
	2003-present	Participate in the EU, specific targeted research project: REPCO: Replacement of copper fungicides in organic production of grape-vine and apple in Europe.
	2004-present	Participate in EU-integrated project in framework 6: QualitylowinputFood.
Publications	<p>Kühn B. F. and <u>Lindhard Pedersen H.</u> Cover crops and mulching effects on yield and fruit quality in unsprayed organic apple production, submitted.</p> <p><u>Lindhard Pedersen, H.</u>, A. Olsen , K. Horsted, M. Korsgaard and B. Pedersen. 2004. Combined production of broilers and fruits. ECO-FRU-VIT. 11th International Conference on Cultivation technique and Phytopathological problems in Organic Fruit-Growing. 131-136.</p> <p><u>Lindhard Pedersen H.</u> and B. Pedersen, 2004. Soil treatments and rootstocks for organic apple production. ECO-FRU-VIT. 11th International Conference on Cultivation technique and Phytopathological problems in Organic Fruit-Growing. 137-143.</p> <p><u>Lindhard Pedersen H.</u> and Torben Toldam-Andersen. 2004. Yield reduction in Black currants due to infections of American Gooseberry Mildew. Acta Hort , 649. Euro Berry Symposim-Cost 836 Final Workshop</p> <p>Toldam-Andersen, T., Braun, P. and <u>Pedersen, H. L.</u> 2004. The effects of mildew infections on the carbon balance of young leaves of black currant (<i>Ribes nigrum</i> L.). Acta hort, 649. Euro Berry Symposim-Cost 836 Final Workshop.</p> <p><u>H. Lindhard Pedersen, A. Olsen, M. Korsgaard, and B. Pedersen,</u> Fejø Forsøgsplantage. 2004. Broilers reduce the apple sawfly population in organic apple growing. DAR-COFenews.</p> <p><u>Lindhard Pedersen H.</u> Olsen A., Korsgaard og Pedersen B. 2004. Kyllinger reduserte antall epleveps. Grobladet, 14, nr. 58. s.10-11.</p> <p>Klaus Horsted, Judith Henning, <u>Hanne Lindhard</u> og Birgitte Pedersen. 2004. Kyllinger fra Frugtplantager smager godt. Økologisk Jordbrug. 2. april s. 10.</p> <p>Kühn B. F., Toldam Andersen T. and <u>Lindhard Pedersen H.</u> 2003. Evaluation of 14 old unsprayed apple varieties. Biological Agriculture and Horticulture, 20, 301-310.</p> <p><u>Lindhard Pedersen,H.</u> Olsen A., Horsted K, Pedersen B. and John Hermansen. 2002 Combined production of broilers and fruit. NJF seminar 2002.</p> <p><u>Lindhard Pedersen H.</u> and Bertelsen M. 2002. Alleyway groundcover management and scab resistand apple varieties. ECO-FRU-VIT. 10th International Conference on Cultivation technique and Phytopathological problems in Organic Fruit-Growing and Viticulture. P. 16-21.</p> <p>Daugaard, H., K. Thorup-Kristensen, L. Petersen, B. Leonhard, <u>H. Lindhard</u>, M. Korsgaard, B. Rasmussen, J. Solvang, O. B. Hansen og J. Jensen 2001. Vurdering af økologisk produktion i gartneri og frugtavl. Rapport til Kirsten Jensen Udvalget. 103 pp.</p>	

Name	Chris Claudi-Magnussen	
Born	13th October 1955	
Education	1983	M.Sc. (biology) from University of Copenhagen, Denmark
	1992	Ph.D. in classification and payment of pigs from the Royal Veterinary and Agricultural University, Copenhagen, Denmark
Employment	1984	Grønlands Fiskeri- og Havundersøgelser
	1986-	Danish Meat Research Institute
Role in project	Responsible for activity 3 Meat quality assessment in WP4	
Main research projects	1994-1997	Sensory Calibration (Nordic collaboration project)
	1995-1999	EU Boar taint (European collaboration project)
	1998-2001	Pork Flavour (Nordic collaboration project)
	1998-2001	Organic Pig Production (Danish collaboration project)
	2001-2004	SUSPORKQUAL (European collaboration project)
	2003-	New Fat Sources for Pigs (Danish collaboration project)
Recent publications	<p>Claudi-Magnussen, C. 2004. Sensory profile of fresh pork. EU workshop. Sustainable Pork Production: Welfare, Quality, Nutrition and Consumer Attitudes. Copenhagen, June 17-18.</p> <p>Lindahl, G., Claudi-Magnussen, C., Heyer, A. and Lundström, K. 2004. Effect of breed and Strategic feeding on pork tenderness evaluated with instrumental and sensory analyses. 50th ICoMST 2004, Helsinki</p> <p>Hansen, L. L. & Claudi-Magnussen, C. 2003. Effect of Lupine and Protein Level For Growing-Finishing Pigs on Skatole in Backfat (Pig Off-Odour) of Female and Castrated Male Pigs. EAAP Working Group "Production and Utilisation of Meat from Entire Male Pigs" Dublin, Ireland, 13-14 November.</p> <p>Agerhem H., Bejerholm C., Claudi-Magnussen C. 2002. Pork Flavour: Sensory profiling of pork in Sweden and Denmark using the same methodology. 48th ICoMST, Roma.</p> <p>Claudi-Magnussen C., Jacobsen T., Haugen J-E., Bejerholm C., Støier, S., Agerhem, H., Martens, M., Bryhni, E. A. and Karlsson A. 2002. Pork Flavour: Correlation between sensory profile and volatile flavour components of cooked pork. 48th ICoMST, Roma.</p> <p>Bryhni, E. A., Claudi-Magnussen, C., Agerhem, H., Byrne, D. V., Johansson, M., Lea, P., Rødbotten, M. & Martens, M. 2002. Consumer perceptions of pork in Denmark, Norway and Sweden. Food Quality and Preference 13 pp 257-266.</p> <p>Bryhni, E.A., Byrne, D.V., Rødbotten, M., Møller, S., Claudi-Magnussen, C., Karlsson, A., Agerhem, H., Johansson, M., Martens, M. 2002. Consumer and sensory investigations in relation to physical/chemical aspects of cooked pork in Scandinavia. Meat Science 65, 737-748.</p> <p>Agerhem, H., Lea, P., Arnkværn Bryhni, E., Rødbotten, M., Claudi-Magnussen, C. & Johansson, M. 2000. Pork flavour – a nordic project, which aims to identify consumer responses to pork flavour. 46th ICoMST, Buenos Aires.</p> <p>C. Claudi-Magnussen, J. Søltøft-Jensen, & L. L. Hansen. 2000. Produktkvalitet (kap. 6) in: Hermansen, J.E. (red.) FØJO-rapport nr. 8/2000. Økologisk svineproduktion - udfordringer, muligheder og begrænsninger, 121-135. Forskningscenter for Økologisk Jordbrug.</p> <p>M. Bonneau, A. J. Kempster, R. Claus, C. Claudi-Magnussen, A. Diestre, E. Tornberg, P. Walstra, P. Chevillon, U. Weiler, G. L. Cook. 2000. An international study on the importance of androstenone and skatole for boar taint: I. Presentation of the programme and measurement of boar taint compounds with different analytical procedures. Meat Science 54 (2000) 251-259.</p> <p>P. Walstra, C. Claudi-Magnussen, P. Chevillon, G. von Seth, A. Diestre, K.R. Matthews, D.B. Homer, M. Bonneau. 1999. An international study on the importance of androstenone and skatole for boar taint: Levels of androstenone and skatole by country and season. Livestock Production Science 62 (1999) 15-28.</p>	

Name	Bent Hindrup Andersen
Born	7 August, 1943
Education	1969 Architect M.A.A., The Royal Academy of Fine Arts, Copenhagen
Employment	1972 Scientist, Danish Building Research Institute, Hørsholm 1969-1975 Teacher, The Royal Academy of Fine Arts, Copenhagen 1991 Scientist, Research Centre Bygholm, Horsens.
Role in project	Participating scientist in WP4: Strategies for diversified organic pig production
Research area	<p>Since 1986, BHA has been dealing with development of alternative systems for production of pigs, which is the most comprehensive branch of agricultural production and the greatest export article in Denmark. The development has resulted in the establishment of a concept for organic outdoor production of pigs.</p> <p>Since 1992, the concept was improved into a concept for organic pig production based on climate tents and controlled outdoor areas, where seashells are used as drain layer covered with deep bedding. The concept has been developed in accordance with a comprehensive view, so that reductions in e.g. nutrient losses will be obtained. The choice of materials will be made according to ecological principles. Last, but not least, animal welfare and health will be used as clues within the progress of development.</p> <p>In connection with his work, BHA has been granted the following awards:</p> <p>1992: Animal-lover of the Year. Nominated by the Danish Association for Animal Protection.</p> <p>1993: The Green Job Prize. Awarded by the county council of Vejle.</p> <p>1994: Hofmanns Gave. Prize paper.</p> <p>1997: Environment and Cultural prize. Awarded by the Danish Power Supply Association.</p> <p>1998: The ID-prize. Industrial design prize.</p>
Recent publications	<p>Andersen, B. H., Jensen, H.F., Møller, H.B., Andersen, L. & Mikkelsen, G.H. 2000. Concept for ecological pig production in one-unit pens in twelve-sided climate tents. Design and layout. In: Ecological Animal Husbandry in the Nordic Countries. Proceedings of NJF Seminar, 303, 65-75.</p> <p>Andersen, B. H., Jensen, R & Frank, H., 2000. The one unit tent in organic pig production", 13th International IFOAM Scientific Conference, 28-31 August, Basel, 360.</p> <p>Møller, H.B., Sommer, S.G.& B.H.. Andersen, 2000. Nitrogen mass balance in deep litter during the pig fattening cycle and during composting, Journal of Agricultural Science, Cambridge 135: 287-296.</p>

Name	Anders Hans Karlsson
Born	22 July 1959
Employment	<p>2004- Professor and Head of Division Meat Science, permanent position, at the Dept. of Food Science, The Royal Veterinary and Agricultural University, Copenhagen, Denmark</p> <p>1998-2003 Head of Research Unit for Muscle biology and Meat Science, permanent position, at the Dept. of Food Science, Danish Institute of Agricultural Sciences</p> <p>1997-2003 Senior Research officer, permanent position, at the Dept. of Animal Product Quality, Danish Institute of Agricultural Sciences</p> <p>1995-1997 Assistant Professor, permanent position, Head of Educational Unit at SLU/Skara (a three year food science engineer programme), Dept. of Food Science, Swedish University of Agricultural Sciences (SLU), Uppsala, Sweden</p> <p>1993-1995 Research Officer, Department of Food Science, Swedish University of Agricultural Sciences (SLU), Uppsala, Sweden.</p>
Role in project	Responsible for WP3 meat quality research: Integrated chicken meat and apple production
Research area	<p>The scientific interests of AHK concern several biological and physical areas related to the understanding of the variation of the quality of meat. These areas could be summarised as physiological and biological conditions in skeletal muscle and the significance of energy metabolism and pH changes in muscle tissue <i>in vivo</i>, <i>peri mortem</i> and <i>post mortem</i> (including <i>peri rigor</i>). The focus of his research is especially on the understanding and how to measure and quantify water-holding and -binding capacity and texture of especially pork. His research program centres on three areas:</p> <ol style="list-style-type: none"> 1) Muscle physiology, - biology and - energy metabolism in relation to meat quality, 2) Genetic and environmental factors effecting phenotypic meat quality, 3) The use of Nuclear magnetic resonance (NMR) techniques in meat science
Recent publications	<p>Bertram, H.C., Andersen, H.J., <u>Karlsson, A.H.</u>, Horn, P., Hedegaard, J., Nørgaard, L. & Engelsen, S.B., 2003. Prediction of technological quality (cooking loss and Napole Yield) of pork based on fresh meat characteristics. <i>Meat Science</i>, 65, 707-712</p> <p>Bertram, H.C., Whittaker, A.K., Andersen, H.J. & <u>Karlsson, A.H.</u>, 2004. The use of simultaneous 1H & 31P magic angle spinning nuclear magnetic resonance measurements to characterize energy metabolism during the conversion of muscle to meat. <i>International Journal of Food Science and Technology</i>, 39, 661-670.</p> <p>Bertram, H.C., Whittaker, A.K., Andersen, H.J. & <u>Karlsson, A.H.</u>, 2003.. pH-dependence of the progression in NMR T2 relaxation times in post mortem muscle. <i>J. of Agricultural and Food Chemistry</i>, 51, 4072-4078</p> <p>Heckel, P., Young, J.F. & <u>Karlsson, A.H.</u>, 2003. Determination of water holding capacity in chicken muscles. Proc. XVIth European Symposium on the Quality of Poultry Meat. Bretagne, France.</p> <p>Therkildsen, M., Vestergaard, M., Busk, H., Jensen, M.T., Riis, B, <u>Karlsson, A.H.</u>, Kristensen, L., Ertbjerg, P. & Oksbjerg, N., 2004. Compensatory growth in slaughter pigs - in vitro muscle protein turnover at slaughter, circulating IGF-I, performance and carcass quality. <i>Livestock Production Science</i>, 88, 63-75.</p> <p>Young, J.F., <u>Karlsson, A.H.</u> & Henckel, P., 2004. Water holding capacity in chicken breast muscle is enhanced by pyruvate and reduced by creatine supplements. <i>Poultry Science</i>, 83, 400-405.</p> <p>Young, J.F., Stagsted, J., Jensen, S.K., <u>Karlsson, A.H.</u> & Henckel, P., 2003. Ascorbic/alpha-tocopherol and oregano supplements reduce stress-induced deterioration of chicken meat quality, <i>Poultry Science</i>, 82, 1343-1351</p>

Laurits Kristian Lydehøj Hansen

Born: 14th. February 1947 in Allerslev sogn.

Current position: Senior scientist, Dept. of Food Science, Danish Institute of Agricultural Sciences

Role in project: Responsible of WP6: Meat quality and food safety in organic production systems utilising fructan rich feedstuffs

Scientific Education.

Graduate: Cand. Agro. 1973 from The Royal Veterinary and Agricultural University, Copenhagen. Dept. of Animal Science (Pig Breeding and Feeding)

Special subject: Congenital inheritance in *Sus Scrofa*.

Philosophiae Doctor (Ph.D.) at the Department of Animal Science & Health, the Royal Veterinary & Agricultural University, Copenhagen, 1995. A dissertation for the Ph.D.-degree: "Influence of environment and genetics on boar taint (skatole) in females, castrates, and entire male pigs", 60 pp.

Senior Scientist 1st of April 1997 at the Danish Institute of Agricultural Sciences, Dept. of Food Science, Research Centre Foulum.

Field of work: My field of research is concentrated on the influence of feed and environmental conditions on meat and eating quality of pork and especially on flavour and aroma development in fresh and cooked meat. Flavour and aroma development can be influenced through the feed, the immediate environment and the heredity. My research is at present focused on the influence on meat and flavour quality of pork from entire male pigs by feeding alternative and bioactive feedstuffs such as chicory, acorn, lupin, Brussels sprouts, inulin, rape, sugar beet pulp, fermented feed and various types of roughage, such as clover grass and pea-whole crop silage, which is typically used in the organic pig production. Boar taint has proven to be influenced by a complex interaction between the environment, feed composition, feed additives and feed preparation as well as genetics. Particularly the interaction between entire males' social behaviour, sexual maturity and genetics as well as the question whether major genes influence a possible interaction between skatole and androstenon concentration in certain breeds are topics for further investigation. My Ph.D.-thesis (in Danish) is entitled "The influence of environmental factors and genotypes on boar taint (skatole) in sows, gilts and boars" and I am author/co-author of chapters in the book "Skatole and boar taint" published by the Danish Meat Research Institute, Roskilde (1998, ed. W. Klinth Jensen). The book gives a survey of the research performed within this area from 1990 till 1997 in Denmark.

References

- Hansen, L. L., Larsen, A. E., Jensen, B. B., Hansen-Møller, J., & Barton-Gade, P. (1994). Influence of stocking rate and faeces deposition in the pen at different temperatures on skatole concentration (boar taint) in subcutaneous fat. *Animal Production*, 59(1), 99-110.
- Hansen, L. L. (1995). Influence of environment and genetics on boar taint (skatole) in females, castrates and entire male pigs. Ph. D. thesis. Institute for Animal Production and Health. The Royal Veterinary and Agricultural University, Copenhagen, 60 pp.
- Hansen L. L. (1998). Influence of environmental factors and antibiotics on skatole in pigs (chapter 8). In: W. Klinth Jørgensen (Editor) Skatole and boar taint. ISBN 87-985837-1-9. Danish Meat Research Institute, Roskilde, Denmark, 137-150.
- Hansen, L. L., Agerhem, H., Rosenvold, K., & Jensen, M. T. (2002). Effect of Brussels sprouts and inulin/rape seed cake on the sensory profile of pork *M. longissimus dorsi*. *Meat Science*, 61 (4), 441-448.
- Hansen, L. L. & Claudi-Magnussen, C. 2003. Effect of Lupine and Protein Level For Growing-Finishing Pigs on Skatole in Backfat (Pig Off-Odour) of Female and Castrated Male Pigs. EAAP Working Group "Production and Utilisation of Meat from Entire Male Pigs" Dublin, Ireland, 13-14 November.
- Hansen, L. L., Claudi-Magnussen, C., Jensen, S. K., & Andersen, H. J. (2006). Effect of organic pig production systems on performance and meat quality. *Meat Science*, 74(4), 605-615.
- Hansen, L. L., Mejer, H., Thamsborg, S. M., Byrne, D. V., Roepstorff, A., Karlsson, A. H., Hansen-Møller, J., Jensen, M. T., & Tuomola, M. (2006). Influence of chicory roots (*Cichorium intybus* L.) on boar taint in entire male and female pigs. *Animal Science*, 82(3), 359-368.
- Jensen, M. T., & Hansen, L. L. (2006). Feeding with chicory roots reduces the amount of odorous compounds in colon and rectal contents of pigs. *Animal Science*, 82(3), 369-376.
- Roepstorff, A., Mejer, H., Thomsen, L. E., Byrne, D. V., Hansen, L. L., Bach Knudsen, K. E., & Møller, K. (2005). Cikorie-rødder forbedrer smag og lugt i økologisk svinekød. FØJOenyt, nr. 3, juni 2005. FØJOenyt, nr. 3, juni 2005.
- Danish Institute of Agricultural Science & The Royal Veterinary and Agricultural University (2003). Methodologies for improving the quality of meat, health status of animals and impact on environment. PCT/EP2004/050355.

Derek V. Byrne

Personal data:

Born: July 7th 1970, Cork, Ireland.

Present Position: Associate Professor at Royal Veterinary and Agricultural University, Denmark

Role in project: Participating in WP6: Meat quality and food safety in organic production systems utilising fructan rich feedstuffs

Education:

1992 B.Sc. at University College Cork, Ireland

1995 M.Sc. at University College Cork, Ireland

2000 Ph.D. at Royal Veterinary and Agricultural University, Denmark

Employment:

1995-1996. Research assistant, Department of Food Science and Technology, University College Cork, Cork, Ireland.

1996-1997. Research assistant, Sensory Science, The Department of Dairy and Food Science, The Royal Veterinary and Agricultural University (KVL), Copenhagen, Denmark.

2001-2002. Assistant Professor (Adjunkt), Sensory Science, The Department of Dairy and Food Science, The Royal Veterinary and Agricultural University (KVL), Copenhagen, Denmark.

2003-. Associate Professor (Lektor), Sensory Science, The Department of Dairy and Food Science, The Royal Veterinary and Agricultural University (KVL), Copenhagen, Denmark. 1996 Post doc at University College Cork, Ireland

Relevant expertise:

Extensive expertise in meat related sensory science and consumer science methodologies, product quality, multivariate data analysis and experimental design. Previously a key participant in a number of organic pork and beef projects from a sensory and consumer perspective. Thus far, 33 publications in peer-reviewed journals.

Selected publications:

Bryhni, E.A., Byrne, D.V., Claudi-Magnussen, C., Agerhem, H., Johansson, M., Lea, P., Rødbotten, M., & Martens, M., 2002. Consumer perceptions of pork in Denmark, Norway and Sweden. *Food Quality and Preference* 13: 257-266.

Bryhni, E.A., Byrne, D.V., Claudi-Magnussen, C., Agerhem, H., Johansson, M., Lea, P., Rødbotten, M., & Martens, M., 2002. Consumer perceptions of pork in Denmark, Norway and Sweden. *Food Quality and Preference* 13: 257-266.

Byrne, D. V., O'Sullivan, M. G., Dijksterhuis, G. B., Bredie, W. L. P. and Martens, M. (2001). Sensory panel consistency during development of a vocabulary for warmed-over flavour. *Food Quality and Preference*, 12, 171-187.

Byrne, D. V., Bredie, W. L. P., Bak, L. S., Bertelsen, G., Martens, H. and Martens, M. (2001). Sensory and chemical analysis of cooked porcine meat patties in relation to warmed-over flavour and pre-slaughter stress. *Meat Science*, 59, 229-249.

Byrne, D.V. and Hansen, L.L. (2005). Sensory profiling and chemical investigations of the eating quality of male and female pork in relation to the influence of bioactive feeding: Part I. crude chicory. In preparation.

Dijksterhuis, G., and Byrne, D. V. (2005). Does the mind reflect the mouth? The future of sensory profiling. *Critical Reviews in Food Science & Nutrition*, (in press).

Martens, H., Dijksterhuis, G. B., and Byrne, D. V. 2000. Power of experimental designs, estimated by Monte Carlo simulation. *Journal of Chemometrics*, 14, 441-462.

CURRICULUM VITAE

Dr. Dorte Lau Baggesen

born: 17. May 1962

Role in project: Participating in WP5: Effect of fructan rich feedstuffs on intestinal pathogens in post-weaned pigs and WP6: Meat quality and food safety in organic production systems utilising fructan rich feedstuffs

Scientific degrees

DVM from the Royal Agricultural and Veterinary University, Copenhagen (1988)

Ph.D. in veterinary microbiology, Royal Agricultural and Veterinary University, Copenhagen (1992)

Employment record

From 1992 employed at the Danish Institute for Food and Veterinary Research (former National Veterinary laboratory of Denmark and Danish Veterinary Institute) as researcher, senior researcher and latest head of section.

Key qualifications for the project

Dorte Lau Baggesen has since 1994 been responsible for the bacteriological *Salmonella* diagnostic and surveillance including being head of the National Reference Laboratory on Salmonella. Today, Dorte Lau Baggesen is responsible for diagnostic, characterisation and surveillance of all food borne pathogens and related research areas at DFVF.

Dorte Lau Baggesen has taken part in the development of the Danish program on control of *Salmonella* in the pork production since its start in 1994 and is a member of the technical committee related to the project. In addition, Dorte Lau Baggesen is member of the technical- and starring committee related to the Danish program on control of *S. Dublin* in cattle and of the starring committee of the Danish Research Centre for Organic Farming (DARCOF).

Dorte Lau Baggesen has participated in 16 external financed research projects related to different aspect of zoonotic infections in animal herds and microbiological food safety and been project manager of 7 of these. In relation to organic farming, Dorte Lau Baggesen has been project manager of two projects: Basics for advise of the significance of animal feed in relation to salmonella infection in organic pig herds (2001-2003) and Bacterial infection risk associated with outdoor organic pig production (2002-2004). Dorte Lau Baggesen has been supervisor for 5 ph.d. students of which the latest was educated under the DARCOF/SOAR program.

Selected relevant publications:

Baggesen, D.L., Wegener, H.C., Bager, F., Stege, H., and Christensen, J. Herd prevalence of *Salmonella enterica* infections in Danish slaughter pigs determined by microbiological testing. *Prev. Vet. Med.* 26:201-213, 1996.

Baggesen, D.L., Sandvang, D. and Aarestrup, F.M. Characterisation of *Salmonella enterica* serovar Typhimurium DT104 isolated from Denmark and their comparison with isolates from Europe and the USA. *Journal of Clinical Microbiology* 38 (4), 1581-1586. 2000.

Nielsen, B., Alban, L., Stege, H., Sørensen, L.L., Møgelmoose, V., Bagger, J., Dahl, J., **Baggesen, D.L.** A new *Salmonella* surveillance and control programme in Danish pig herds and slaughterhouses. *Berliner and Münchener Tierärztliche Wochenschrift*, 114 (9/10), 323-326, 2001.

Stenhard NR, Jensen TK, **Baggesen DL**, Roepstorff A, Møller K. Excretion in feces and mucosal persistence of *Salmonella* ser. Typhimurium in pigs subclinically infected with *Oesophagostomum* spp. *Am J Vet Research*, 63 (1), 130-136. 2002.

Christensen J, **Baggesen DL**, Nielsen B, Stryhn H. Herd prevalence of *Salmonella* spp. in Danish pig herds after implementation of the Danish Salmonella Control Program with reference to a pre-implementation study. *Vet Microbiol* 2002 Aug 25; 88(2):175-88

Jensen, A. N., J. Lodal, **D.L. Baggesen**. High diversity of *Salmonella* serotypes found in an experiment with outdoor pigs, NJAS, Wageningen Journal of Life Sciences, 52(2), 109-117. 2004.

CURRICULUM VITAE

Name and Birth: Annette Nygaard Jensen born: 12. January 1971

Role in project: Participating in WP5: Effect of fructan rich feedstuffs on intestinal pathogens in post-weaned pigs and WP6: Meat quality and food safety in organic production systems utilising fructan rich feedstuffs

Education: M.Sc. in Biology from University of Aarhus (1998), Ph.D. student in veterinary microbiology (2002-2005).

Employment:

1999-2002 Research assistant at Danish Institute for Food and Veterinary Research, Dept. of Microbial Food Safety

2002-2005 Ph.D. stud. at Danish Institute for Food and Veterinary Research, Dept. of Microbial Food Safety.

Key qualifications for the project

ANJ has been working on the DARCOF II.10 project "Bacterial infection associated with organic outdoor pig production – with special reference to *Salmonella* and *Campylobacter* as a part of her ph.d. This has yielded a good background in salmonella infection dynamics in pigs based on bacteriology and serology and experience with experimental outdoor organic trials including salmonella inoculation experiments. ANJ is experienced in molecular methods such as DNA/RNA preparation, PCR/real-time PCR, sequencing and hybridization e.g. through ANJ's employment on the project "Development of automated sample treatment methods for PCR-based detection of *Salmonella* in swine". Furthermore, the enrolment in the Research School for Organic Agriculture and Food Systems (SOAR) has provided ANJ with a basic understanding of the organic principles and ideas associated with the DARCOF III programme.

Oral presentations

Salmonella infection risk associated with outdoor organic pig production. SAFO (Sustaining Animal Health and Food Safety in Organic Farming) 4th Workshop, "Systems development: Quality and safety of organic livestock products", 17th-19th March. 2005, Frick, Switzerland.

Bacterial infection risk associated with outdoor organic pig production - including a small survey of wildlife as a reservoir of *Salmonella* and *Campylobacter*. Seminar, Rodent Control Strategies in Organic Pig and Poultry Production Systems, 26-28 May, 2004, Wageningen, The Netherlands.

[1719: *Campylobacter* species distribution in outdoor pigs: Oral presentation O44](#). SAFEPORK 5th International Symposium on the Epidemiology and Control of Foodborne Pathogens in Pork, Crete, Greece, October 1-4, 2003; Proceedings paper p 134-136.

Publications:

peer-reviewed (selected)

Jensen, A. N., Andersen, M., Dalsgaard, A., D.L. Baggesen and Nielsen, E.M. 2005 Development of real-time PCR and hybridization methods for detection and identification of thermophilic *Campylobacter* spp. in pig faecal samples. J. Appl. Microbiol. 99(2), 292-300.

Jensen, A. N., J. Lodal, D.L. Baggesen 2004. High diversity of *Salmonella* serotypes found in an experiment with outdoor pigs, NJAS, Wageningen Journal of Life Sciences, 52(2), page 109-117.

Jensen, A.N., Sørensen, G., Baggesen, D.L., Bødker, R. and Hoorfar, J. 2003. Addition of Novobiocin in pre-enrichment step can improve *Salmonella* culture protocol of modified semisolid Rappaport-Vassiliadis. Journal of Microbiological Methods 55: 249-255.

Johansen, C.K., Jensen, A. N., Ahrens, P. and Andresen L. O. 2003. The porcine skin associated T-cell homing chemokine CCL27: molecular cloning and mRNA expression in piglets infected experimentally with *Staphylococcus hyicus*. Veterinary Immunology and Immunopathology 96(1-2):13-8.

Jensen, A.N. and Hoorfar, J. 2002. Optimal purification and sensitive quantification of DNA from faecal samples. Journal of Rapid Methods and Automation in Microbiology 10 (4): 231-244.

Jensen, A. N., Dalsgaard, A., Nielsen, E. M. and D.L. Baggesen. Transmission and survival of *Salmonella* Typhimurium in an outdoor experimental set-up with organic pigs (in preparation)

Name	Allan Roepstorff
Born	16 August 1950
Employment	1981-1983 Research Assistant at The National Committee for Pig Breeding, Health and Production 1983-1985 Ph.D.scholarship at Dept. Clinical Studies, KVL 1985-1989 Post-doctoral Fellow at Dept. Veterinary Microbiology, KVL 1990-1991 Post-doctoral Fellow at The Technical University of Denmark 1991-1994 Senior Research Fellow at Dept. Veterinary Microbiology, KVL 1994-2002 Senior Research Fellow at DCEP, Dept. Vet. Pathobiology, KVL 2003- Associate Professor at DCEP, Dept. Vet. Pathobiology, KVL
Role in project	Responsible for WP5: Effect of fructan rich feedstuffs on intestinal pathogens in post-weaned pigs
Research areas	The main research interests are population biology, ecology, epidemiology, host-parasite relationship, and sustainable control of helminth (<i>Ascaris</i> , <i>Oesophagostomum</i> , <i>Trichuris</i>) and coccidia infections of domestic animals (primarily swine). AR has been participating in the 2 Danish survey studies of parasite occurrence in organic swine and has since 1993 been working experimentally with helminth epidemiology in outdoor swine. These projects have been funded partly from FØJO-1 (3 projects) and FØJO-2 (2 projects). Daily head of the <i>Ascaris</i> / <i>Trichuris</i> research group.
Selected publications	Roepstorff,A. (2003). <i>Ascaris suum</i> in pigs: Population Biology and Epidemiology. Doctoral Thesis. Danish Centre for Experimental Parasitology, The Royal Veterinary and Agricultural University, Copenhagen, Denmark. 112 pp. Steenhard,N.R., Jensen,T.K., Baggesen,D.L., Roepstorff,A., Møller,K. (2002). Enhanced faecal excretion and mucosal persistence of <i>Salmonella</i> Typhimurium in pigs subclinically infected with <i>Oesophagostomum</i> spp.. American Journal of Veterinary Research 63, 130-136 Thamsborg,S.M., Roepstorff,A. (2003). Parasite problems in organic livestock production systems and options for control. Journal of Parasitology 89 (suppl.), S227-S284. Carstensen,L., Vaarst,M., Roepstorff,A. (2002). Helminth infections in Danish organic swine herds. Veterinary Parasitology 106, 253-264. Roepstorff,A., Murrell,K.D., Boes,J., Petkevičius,S. (2001). Ecological influences on transmission rates of <i>Ascaris suum</i> in pigs on pastures. Veterinary Parasitology 101, 143-153. Roepstorff,A., Murrell,K.D. (1997). Transmission dynamics of helminth parasites of pigs on continuous pasture: <i>Ascaris suum</i> and <i>Trichuris suis</i> . International Journal for Parasitology 27, 563-572. Petkevičius,S., Bach Knudsen,K.E., Nansen,P., Roepstorff,A., Skjøth,F., Jensen,K. (1997). The impact of diets varying in carbohydrates resistant to endogenous enzymes and lignin on populations of <i>Ascaris suum</i> and <i>Oesophagostomum dentatum</i> in pigs. Parasitology 114, 555-568.

Name	Tim K. Jensen
Born	6 July 1962
Education	DVM (1991), Ph.D.
Employment	1991-1995 Ph.d. student, Laboratory of Veterinary Pathology, Department of Pharmacology and Pathobiology, The Royal Veterinary and Agricultural University, Copenhagen, Denmark. 1995-2000 Veterinary pathologist, scientist, Department of Pathology and Epidemiology, Danish Veterinary Laboratory, Copenhagen. 2001- Veterinary pathologist, senior scientist, Danish Institute for Food and Veterinary Research, Dept. of Veterinary Diagnostics and Research, Copenhagen (former Department of Pathology and Epidemiology, Danish Veterinary Laboratory).
Role in project	Participating scientist in WP5: Effect of fructan rich feedstuffs on intestinal pathogens in post-weaned pigs
Research area	Research is focused on diseases in pigs with special reference to clinical significance, pathogenesis, pathology and diagnosis of intestinal infections including <i>Lawsonia intracellularis</i> , <i>Salmonella</i> and spirochaetes of the genus <i>Brachyspira</i> . Project leader of national projects involving several different institutions. Author of about 40 original papers in international refereed journals, 13 as first author.
Selected publications	Stege, H., Jensen, T. K., Møller K., Vestergaard, K., Bækbo, P. and Jorsal S. E., 2004. Infection dynamics of <i>Lawsonia intracellularis</i> in pig herds Vet. Microbiol. 104:197-206, 2004. Boesen, H.T., T. K. Jensen, A.S. Schmidt, B.B. Jensen, S.M. Jensen & K.Møller, 2004. The influence of diet on <i>Lawsonia intracellularis</i> colonization in pigs upon experimental challenge. Vet. Microbiol. 103:35-45. Lindecrona, R.H., T. K. Jensen, K. Møller. 2004. Feeding study with pigs experimentally infected with <i>Brachyspira pilosicoli</i> . Vet. Rec. 154:264-267. Frydendahl, K., T. K. Jensen, J. S. Andersen, M. S. Fredholm, G. Evans. Association between the porcine <i>Escherichia coli</i> F18 receptor genotype and phenotype and susceptibility to colonisation and postweaning diarrhoea caused by <i>E. coli</i> O138:F18. Vet. Microbiol. 93:39-51, 2003. Lindecrona, R.H., T. K. Jensen, B. B. Jensen, T. D. Leser, W. Jiufeng, K. Møller, 2003. The influence of diet on the development of swine dysentery upon experimental infection. Animal Science, 76:81-87. Steenhard NR, TK Jensen, DL Baggesen, A Roepstorff, K Møller, 2003. Excretion in feces and mucosal persistence of <i>Salmonella</i> ser Typhimurium in pigs subclinically infected with <i>Oesophagostomum</i> spp. Am. J. Vet. Res., 63:130-136. Leser, T. D., J. Amenuvor, T. K. Jensen, R. H. Lindecrona, K. Møller, 2002. Culture-independent analysis of gut bacteria: the pig gastrointestinal tract microbiota revisited. Appl. Environ. Microbiol. 68:673-90. Aabo S, Christensen JP, Chadfield MS, Carstensen B, Jensen TK, Bisgaard M, Olsen JE, 2000. Development of an In Vivo Model for Study of Intestinal Invasion by <i>Salmonella enterica</i> in Chickens. Infect. Immun. 68:7122-7125.

Name	Lars Mølbak
Born	5 July 1971
Education	Ph.D,m M.Sc. (biology)
Employment	1997 Research Assistant (Molecular microbiology) at University of Stockholm 1999 Research Assistant (Molecular microbiology) at DTU 2000-2003 Ph.D.scholarship (Gene-transfer) at Technical University of Denmark DTU and National Environmental Research Institute, NERI 2003- Post-doctoral Fellow (Gastrointestinal microbiology) at Danish Institute for Food and Veterinary Research, DVFV
Role in project	Participating scientist in WP5: Effect of fructan rich feedstuffs on intestinal pathogens in post-weaned pigs
Research area	The Danish Institute for Food and Veterinary Research (DFVF), Department of Veterinary Diagnostic and Research has focused on gastrointestinal diseases for the last 8 years. During the past years the Group of Microbial Activity has build up an expertise in microarray methods, in situ hybridisation, Terminal-restriction fragment length polymorphism (T-RFLP), laser microdissection, real-time PCR and gastrointestinal pathology (<i>E. coli</i> , <i>L. intracellularis</i> , <i>Clostridium perfringens</i>) and the necessary equipment for these activities is available at the institute.
Selected publications	Molbak L, Johnsen K, Boye M. Bakterier i svins mave-tarmsystem. Veterinær, Den Danske Dyrlægeforening, 2004, Nr. 13, 1 juli., Molbak L, Tett A, Ussery DW, Wall K, Turner S, Bailey M, Field D. 2003. The plasmid genome database. Microbiology 149(Pt 11):3043-5. Molbak L, Licht TR, Kvist T, Kroer N, Andersen SR. 2003. Plasmid transfer from <i>Pseudomonas putida</i> to the indigenous bacteria on alfalfa sprouts: characterization, direct quantification, and in situ location of transconjugant cells. Appl. Environ. Microbiol. 69(9):5536-42. Ramos C, Molina L, Molbak L, Ramos JL, Molin S. 2000. A bioluminescent derivative of <i>Pseudomonas putida</i> KT2440 for deliberate release into the environment. FEMS Microbiol Ecol. 1;34(2):91-102. Ramos C, Molbak L, Molin S. 2000. Bacterial activity in the rhizosphere analyzed at the single-cell level by monitoring ribosome contents and synthesis rates. Appl Environ Microbiol. 66(2):801-9. Unge A, Tombolini R, Molbak L, Jansson JK. 1999. Simultaneous monitoring of cell number and metabolic activity of specific bacterial populations with a dual gfp-luxAB marker system. Appl Environ Microbiol. 65(2):813-21.

Name	Stig Milan Thamsborg
Born	31 October 1956
Qualifications	DVM, Ph.D.
Employment	1981-1984 General practitioner in large animal practice. 1984-1987 Ph.D. scholarship, Dept. of Clinical Studies, Large Animal Medicine, KVL. 1987-1991 Lecturer and 1991- 1997 associate professor, same place as above. 1994-1995 (Leave of duty) Coordinator of DANIDA funded Livestock Helminth Research Project in East-Africa, at DCEP, KVL. 1997-2000 Research professor in Organic Animal Husbandry Systems, Dept. of Animal Science and Animal Health, KVL. Project co-ordinator for national collaborative projects and EU-project. 2002- Professor in Veterinary Parasitology, KVL. 2003- Director of Danish Centre for Experimental Parasitology, KVL; Head of WHO/FAO Collaborating Center for Parasitic Diseases and head of FAO Collaborating Center for Helminth Epidemiology 2004- Head of Section for Parasitology.
Role in project	Participating scientist in WP5: Effect of fructan rich feedstuffs on intestinal pathogens in post-weaned pigs
Membership of scientific societies , boards, etc	Danish Veterinary Association Danish Cattle Society (member of the board 1995-1998) Sheep Veterinary Society (UK) Danish Society of Parasitology (member of the board 1994-1997) Scandinavian and Baltic Society of Parasitology Steering board of Centre of Ecology and Environment at KVL (vice chairman)(1997-2001) Steering committee of EU-project: Network of Animal Health and Welfare in Organic Agriculture 1999-2002 World Association for Advancement of Veterinary Parasitology (WAAVP) (board 2001-) Diplomate, European Veterinary Parasitology College (DipEVPC) (2003-) Executive board of Danish Research Centre for Organic Farming (DARCOF/FØJO) (2003-) The SOAR scientific advisory panel (2004-)
Selected publications	Damm, B.I., Pedersen, L.J., Jessen, L.B, Thamsborg, S.M., Mejer, H. & Ersbøll, A.K.. The gradual weaning process in outdoor sows and piglets in relation to nematode infections. <i>Applied Animal Behaviour Science</i> , 2003, 82:101-120. Enemark, H.L., Ahrens, P., Bille-Hansen, V., Heegaard, P.M.H., Vigre, H. Thamsborg, S.M. & Lind, P. <i>Cryptosporidium parvum</i> : infectivity and pathogenicity of the 'porcine' genotype. <i>Parasitology</i> , 2003, 126:407-416. Hovi, M., Sundrum, A. & Thamsborg, S.M. Animal health and welfare in organic livestock production in Europe: current state and future challenges. <i>Livestock Production Science</i> , 2003, 80(1-2):41-53. Thamsborg, S.M. & Roepstorff, A. Parasite problems in organic livestock production systems and options for control. <i>Journal of Parasitology</i> , 2003, 89(Suppl.):S277-S284. Pedersen, M.A., Thamsborg, S.M., Fisker, C., Ranvig, H. & Christensen, J.P. New production systems: Evaluation of organic broiler production in Denmark. <i>Journal of Applied Poultry Research</i> , 2003, 12:493-508.