



Project applications

for the research programme

FØJO II (2000-2005)

**funded by the Ministry of Food, Agriculture and Fisheries
funding for research under sections 24.33.02 and 24.38.60.30**

1. Project title (maximum 10 words):

II.12 Product quality of organic beef and pork in relation to grazing system and feeding with bio-active crops (PROSQUAL)

2. Project manager (name, title, address, telephone, fax and e-mail. Project manager of the project. For projects in which several institutes participate, one project manager must be appointed to head the project):

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3. The project falls within the following area: (if the project falls within several areas, please list all the areas):

Food quality, safety and health

to be submitted in 2 copies to:

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7. **Project duration:** 3 years From 2002 To 2004

8. **Main objective** (maximum 10 lines):

The overall objective is to improve the meat and eating quality, including increase of the content of matters with a potential beneficial effect on human health in organic meat from cattle and pigs raised outdoors and(or) finished with bioactive crops. The following objectives are included in the project:

- to examine the eating quality and the content of vitamin E and selenium and fatty acid composition in pork from pigs fed with bio-active crops, i.e. chicory roots.
 - to determine the fatty acid composition and CLA content in meat from extensively raised steers finishing-fed by use of different combinations of clover-grass silage, concentrates, and chicory roots
 - to compare the fatty acid composition including CLA in meat from steers and young bulls raised in various production systems
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9. Project summary (summary of project background, objective, method and expected results – approximately 1 page):

Organic meat production in Denmark covers mainly beef and pork. The present market share of organic pork and beef is only 0.5% and 2.1%, respectively. The demand for organic high quality pork and beef is thus restricted despite a growing number of organic pig and dairy farms.

The objective of this project is to contribute to the development of economically profitable farming systems for the production of good quality organic beef and pork.

Compared with conventional pork production, organic pork has diverging quality parameters such as higher content of polyunsaturated fatty acids due to organic foodstuffs (protein sources and use of forage) and sometimes lower tenderness due to production systems resulting in lower daily gain. Although a higher content of polyunsaturated fatty acids is positive from a human health perspective however, the meat is prone to oxidation resulting in rancidity. This oxidation can be a problem with meat products used in catering products as they involve reheated meat. However, the oxidation of polyunsaturated fatty acids in meat can be inhibited by antioxidant substances such as vitamin E and enzyme systems with antioxidative activity.

Lacking economic profitability is seen as a major constraining factor in using dairy-type calves and young bulls in organic beef production. However, the interest in organic beef production is increasing and the need for reliable information on production parameters, feeding strategies, and ways to increase the domestic market share of organic beef from dairy-type steers is evident. Emphasis will be on improvement of animal health and welfare and product quality of steers, and on utilisation and conservation of the biodiversity of marginal areas by grazing. This may provide a scientific basis for decision support to organic beef producers and provide future guidelines for management of marginal areas.

The investigations include the effect of production system and the use of selected bio-active forages (primarily chicory) with a possible positive influence on health characteristics and meat quality and sensory eating quality of the meat from both steers and fattening/finishing pigs (e.g. CLA, selenium, drip loss and boar taint). This approach is aimed at improvement of meat and sensory eating quality in combination with human health promotion. It is thus the intention of the project to find ways of improving the quality of organic meat produce.

11. Collaboration with other institutes (national and international collaborative partners etc. – please include brief description of collaborative scheme).

The Dept. of Animal Product Quality (ANF), DIAS co-operates with the project leaders Chris Claudi-Magnussen and Patricia Barton-Gade at the Danish Meat Research Institute and consultant Hanne Maribo, The National Committee for Pig Production, Dept. of Nutrition and Reproduction in projects concerning the meat and eating quality of organic pork, among other things in the project '*The importance of organic pig production for meat and eating quality*'.

The Dept. of Animal Nutrition and Physiology, DIAS already has collaboration with DTU (Carl-Erik Høy) concerning CLA analyses in cow's milk. HEF also has a well-established collaboration with the Danish Meat Research Institute (DMRI) (Hanne Bang Bligaard) concerning all types of meat production experiments in cattle.

The Dept. of Animal Product Quality (ANF), DIAS co-operates with professor Jim Squires, Animal and Poultry Science, University of Guelph, Canada concerning androstenone measurement in blood plasma from male pigs.

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

1. Collaborative partners

National co-operation

The present project proposal relates to the project 'Organic production of steers and use of bio-active forages in livestock' (II.3) (PROSBIO) and complements this with further emphasis on the 2 aspects mentioned in work packages 1 and 2. Thus, there will be joint project meetings, overlap in project group members, and common status reports and publications (see Annual Status Report 2001).

ANF co-operates among others with head of the project Viggo Danielsen and project members Søren Krogh Jensen and José Fernandez, Dept. of Animal Nutrition and Physiology, DIAS, in the project '*Pig feeding under organic conditions with emphasis on nutrient utilisation, product quality and health (II.7)*' too.

Bio-active crops form part as an essential element of a project within the 5 EU framework programme: '*Worm control in organic production systems for small ruminants*' (WORMCOPS) (2001-2004) in a co-operation between KVL (Stig Milan Thamsborg), Swedish University of Agricultural Sciences (SLU), University of Utrecht, Moredun Research Institute, Scottish Agricultural College and others.

Magni Martens (KVL) has planned a co-operation with the leader of sensory/meat research Eric Dransfield INRA in Clermont-Theix, France.

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13. Budget

The budget must allow for increases in the level of salaries and prices. The proposed budget must be specified for each year. The proposed budget must specify the number of man-months and related direct salary costs for scientific staff and non-scientific staff, other direct costs and costs to buy equipment. To this should be added a contribution to overheads on 20% of direct costs.

Salaries must not exceed union levels for comparable positions with the government (e.g. laboratory assistant, researcher or senior researcher).

Official journeys must be included at the government allowances.

Recipients of funding should generally procure or make all necessary equipment available for the project themselves. If that is not possible, acquiring the equipment applied for will be considered, and at the end of the project, a decision will be made as to the ownership of such equipment.

The Directorate for Developments research funding is provided exclusive of the recipient's input VAT (purchase VAT) and output VAT (sales VAT).

For government institutes, the Directorate for Food, Fisheries and Agri Business' funding is provided by way of funding from foundations and programme funding pursuant to the Ministry of Finance budget guidelines on activities receiving programme funding, and the funding is granted for one year at a time.

Budget for the entire project in DKK thousands:

Please show the proposed budget for the entire project in the table below. If several institutes participate, the sum of the institutes' budgets must be given. Any co-financing (item 14) should not be included in this table.

Year	2002	2003	2004	2005	2006	2007	total
Man-months							
Scientists:	1.5	9.0	1.5				12.0
Non-scientists:	1.5	1.1	0.9				3.5

Year:	2002	2003	2004	2005	2006	2007	Total
Salary costs							
Scientists:	57.00	368.50	58.00				483.50
Non-scientists:	35.80	27.00	23.70				86.50
Operating costs							
Equipment		36.02					36.02
Other (please specify)	21.30	23.20	4.20				48.70
Total direct costs	114.10	454.72	85.9				654.72
Overheads							
(20% of direct costs)	22.90	69.28	17.1				109.28
Total	137.00	524.00	103.00				764.00

Any comments to the budget:Total budget is 764 (budget in 1000 DKK)

Budget for each participating institute in DKK thousands

For projects with several participating institutes, a proposed budget must be given for each institute. The budgets must be prepared according to the same guidelines as those described under item 13.

Name of institute: Dept. of Animal Product Quality (ANF), Danish Institute of Agricultural Sciences, Research Centre Foulum

Year:	2002	2003	2004	2005	2006	2007	Total
Man-months							
Scientists:	0.5	2.5	0.5				3.5
Non-scientists:	0.5	0.6	0.4				1.5

Year:	2002	2003	2004	2005	2006	2007	Total
Salary costs							
Scientists:	19.0	97.5	20.0				136.5
Non-scientists:	11.8	15.0	11.7				38.5
Operating costs							
Equipment	0	12.5	0				12.5
Other (please specify)	0	0	0				0
Total direct costs	30.8	125.0	31.7				187.5
Overheads (20% of direct costs)	6.2	25.0	6.3				37.5
Total	37.0	150.0	38.0				225.0

Any comments to the budget:

Budget for each participating institute in DKK thousands

For projects with several participating institutes, a proposed budget must be given for each institute. The budgets must be prepared according to the same guidelines as those described under item 13.

Name of institute: Dept. of Animal Nutrition and Physiology (HEF) Danish Institute of Agricultural Sciences Research Centre Foulum

Year:	2002	2003	2004	2005	2006	2007	total
Man-months							
Scientists:	1.0	0.5	1.0				2.5
Non-scientists:	1.0	0.5	0.5				2.0

Year:	2002	2003	2004	2005	2006	2007	Total
Salary costs							
Scientists:	38.0	19.0	38.0				95.0
Non-scientists:	24.0	12.0	12.0				48.0
Operating costs							
Equipment	0	0	0				0
Other (please specify)	21.3	23.2	4.2				48.7
Total direct costs	83.3	54.2	54.2				191.7
Overheads							
(20% of direct costs)	16.7	10.8	10.8				38.3
Total	100.0	65.0	65.0				230.0

Any comments to the budget:

Budget for each participating department (if applicable) in DKK thousands:

Specified budget proposal according to guidelines described under item 13.

Name of institute and department: The Department of Dairy and Food Science, The Royal Veterinary and Agricultural University (KVL), Copenhagen, Denmark.

Year:	2002	2003	2004	2005	2006	2007	Total
Man-months							
Scientists:		6.00					6.00
Non-scientists:		0.00					0.00

Year:	2002	2003	2004	2005	2006	2007	total
Salary costs							
Scientists:		252.00					252.00
Non-scientists:		0.00					0.00
Operating costs							
Equipment		23.52					23.52
Other (please specify)							
Total direct costs		275.52					275.52
Overheads (20% of direct costs)		33.48					33.48
Total		309.00					309.00

Any comments to the budget:

14. Support from third parties/co-financing

Please use the table below to indicate whether any other funds or own funds are made available for the project (possibly by way of man-months).

not applied for _____ applied for _____ already approved X (*please tick*)

From: Danish Cattle (The Danish Cattle Research Centre, KFC)

Year:	2002	2003	2004	2005	2006	2007	total
Man-months							
Scientists:	1						1
Non-scientists:	1						1

Year:	2002	2003	2004	2005	2006	2007	Total
Salary costs							
Scientists:	38						38
Non-scientists:	24						24
Other operating expenses	63						63
Equipment	0						0
Other (please specify)	0						0
Total direct costs	125						125
Overheads (20 per cent of direct costs)	25						25
Total	150						150

Any comments to the budget:

Re 14: The 150,000 DKK already approved by Danish Cattle (The Danish Cattle Research Centre, KFC) is partly financing the sub-project aiming at "compare the fatty acid composition including CLA in meat from steers and young bulls raised in various production systems", which had a total budget of 240,000 DKK. Thus 90,000 DKK given with the present application will specifically be used for this sub-project.

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- 15. Supplementary information** (please enclose for instance information on planned education of scientists, stays abroad, guest researchers, workshops and the like):

16. Signatures

Name	Institute	Date	Signature
Project manager: Laurits Lydehøj Hansen	Dept. of Animal Product Quality, Danish Institute of Agricultural Sciences		
Institute management: Henrik J. Andersen Research director	Dept. of Animal Product Quality, Danish Institute of Agricultural Sciences		
Institute management: Andreas Christensen Deputy Head of Dept.	Dept. of Animal Nutrition and Physiology, Danish Institute of Agricultural Sciences		
Institute management: Harald E. Mikkelsen Research director	Dept. of Agricultural Systems Danish Institute of Agricultural Sciences		
Institute management: Grete Bertelsen Head of Department	Dept. of Dairy and Food Science (MLC), The Royal Veterinary and Agricultural University		
Institute management:			

17. Description of the project:

Organic meat production in Denmark covers mainly beef and pork. The present market share of organic pork and beef is only 0.5% and 2.1%, respectively. The demand for organic high quality pork and beef is thus restricted despite a growing number of organic pig and dairy farms. The organic livestock production with pigs and ruminants is to a high degree based on either grazing of clover fields (in the summertime) and/or consumption of fresh clover grass or clover grass silage in the stable (primarily in the wintertime). Thus, relatively few species of plants form part of the rotation of crops while the grazing of nature areas offers a more balanced feed choice. An on-going FØJOII project (Organic PROduction of Steers and Use of BIOactive Forages in Livestock (II.3) (from now on named PROSBIO) (see PROSBIO objectives in appendix 1) aims to examine connections between the use of certain special crops and herbs in the grass field including chicory and the animals' health as well as the quality of the resulting products (meat). The present project proposal relates to the PROSBIO project and complements this, and puts further emphasis on the following 2 aspects:

- A. Eating quality of pork after feeding with bio-active crops, i.e. chicory roots.
- B. Fatty acid composition and CLA content of beef from steers produced on pasture and finishing-fed with ad libitum clover grass silage and either barley or chicory as concentrates on two feeding levels
- C. To compare the fatty acid composition including CLA in meat from steers and young bulls raised in various production systems

Sensory quality of pork after feeding with bio-active crops

It is well known that chicory (*Cichorium intybus*) as well as caraway, parsley and a few other herbs are used in practice to a certain extent in organic farming (Smidt, 1997). Chicory contains sesquiterpene lactones (bitter compounds; primarily in the roots) with a possible effect on the sensory eating quality of the milk and the meat (Barry, 1998; Choi et al., 1998; Moio et al., 1996), bitter coumarins, tannins (with astringent taste) that primarily are present in the leaves, and inulin, which seem to have an anthelmintic effect (Petkevicius et al., 1997). Certain cultivars of chicory have a particularly high content of inulin (18-20%) in the root, which might have a possible effect on the meat quality (colour and drip loss) in pigs for slaughter through a reduction of the glycogen content in the muscles (Rosenvold et al., 2001a&b). Furthermore, inulin has a decreasing (positive) effect on skatole concentration in blood and backfat (boar taint) due to decreased production of skatole in the colon (Jensen & Jensen, 1998). Pilot studies indicate that chicory, which is used in the present study, has a high content of selenium (J.H. Nielsen, 2001, personal communication). Seleno enzymes and vitamin E form part of an important interaction concerning the antioxidative capacity of the muscles and thus influence the shelf-life, rancidity and taste of the meat. Subclasses of glutathione peroxidase are known to take part in reduction of hydroperoxides.

Especially, the role of glutathione peroxidase subclasses would be of particular interest as these are known to reduce lipid hydroperoxides. Lipid hydroperoxides are key compounds in oxidative deterioration and understanding of to which extent these are broken down by glutathione peroxidase is of major interest. Several studies in animal products e.g. meat have shown that the concentration of glutathione peroxidase is dependent on the level of selenium in the feed. Few studies indicate that especially the level of organic bound selenium in the feed affects the activity of glutathione peroxidase in meat (Mahan & Rarrett, 1996). Moreover, it has been suggested that low tissue concentrations of the potent antioxidant, vitamin E, can be compensated for by increased synthesis of the antioxidative enzyme, glutathione peroxidase. Consequently, studies with focus on how the antioxidative capacity of meat are affected by dietary selenium, fatty acid composition and vitamin E are highly relevant.

In connection with the work packages WP6-8 in PROSBIO two experiments with fattening/finishing pigs fed with bio-active crops (primarily chicory) will be carried out, including measurements of slaughter, meat, and sensory eating quality. However, there is only funding for a sensory eating quality investigation in the first of two experiments planned. As the sensory eating quality is considered a very important parameter in the future marketing of organic meat, we hereby apply for funding to perform a sensory evaluation in the second experiment. Furthermore, we apply for the possibility to measure the glutathione peroxidase activity and vitamin E content in the blood and meat just before starting of the two experiments and at slaughter by blood and muscle biopsy samples (see PROSBIO objectives in appendix 1 and 2).

Content of conjugated linoleic acid (CLA) in beef from steers produced on pasture
 Fat content and fatty acid composition of beef have a considerable influence on taste, shelf-life, nutritive value and health aspects of the meat products. The fatty acid composition of beef partly reflects the fatty acid composition of the feed and partly the microbial activity in the rumen, which leads to hydrogenation of some of the unsaturated fatty acids. Microbial synthesised fatty acids can be both *cis* and *trans* forms. One group of positional and geometric isomers of linoleic acid (C18:2, n6) have the double bonds in conjugation and are thus called conjugated linoleic acids (CLA). The conjugated double-bonds are either at the 9th and 11th or at the 10th and 12th position and can be *cis* and/or *trans*. The CLAs are produced by specific strains of bacteria in the rumen of cattle. Since the discovery that certain CLAs are possessing anticarcinogenic and antiatherogenic properties in laboratory animals (Kritchevsky, 2000), there has been great interest in elucidating the beneficial effects of these compounds for human health. These efforts include searching for methods to enrich milk and beef with the optimal content of CLA. There is evidence to suggest that organic farmed products due to different foodstuffs and production systems may have a higher content of CLA in comparison with the conventionally produced meat products. Thus, it has been shown that organically produced milk has a high content of CLA (Jahreis et al., 1997; Dhiman

et al., 1999), and the same is true for beef produced on pasture (Knight & Death, 1997; Pastushenko et al., 2000). The content of CLA in beef will probably become an important quality parameter in the near future. Furthermore, the outcome of the proposed activity in work package 2 (WP2) will complement and strengthen comparable ongoing activities with CLA in milk at The Danish Cattle Research Centre (KFC) and at the Danish Institute of Agricultural Sciences (DIAS).

The sub-projects WP3 and WP4 in the PROSBIO-project include an experiment with steers grazing on marginal areas (i.e., semi-natural meadows). One objective is to utilise natural pastures of marginal land for grazing purposes in order to conserve or even increase the biodiversity of these areas, which is a goal for organic farming. The experiment covers various grazing systems (e.g., a rotational versus a continuous grazing system) and various finishing feeding strategies (e.g., clover-grass silage *ad libitum* and different combinations of barley and chicory). Chicory contains different substances, which may positively affect meat sensory eating quality in pigs and steers and for that reason chicory has been selected for use in the experiments within this project. A sensory eating quality evaluation of the steer meat will be performed in WP8 from PROSBIO (see PROSBIO objectives in appendix 1 and 2). Due to the combined grazing and finishing feeding systems used, measurements of the CLA content in meat and fat of these steers seem obvious. These analyses will cost 140,000 DKK.

In another ongoing experiment at The Danish Cattle Research Centre (KFC), the fatty acid composition as well as the content of CLA is compared between four production systems for steers. These production systems are all based on grazing clover-grass fields, which is highly relevant for the organic farming situation. The fatty acid composition of these four groups of steers are also compared to that of a group of intensively raised (i.e., concentrate-fed) young bulls. These activities are estimated to cost 240,000 DKK in total of which the 150,000 DKK is already funded by KFC (The project proposal [in Danish] for the KFC experiment is attached as appendix 2). The extra 90,000 DKK, which we apply for herein, will give us the possibility to analyse CLA in meat of all these animals. Furthermore, the analyses of CLA in both steer-experiments will complement each other nicely, and both will further strengthen and complement the PROSBIO-project and increase our knowledge about how various production systems for steers affect these characteristics of the meat.

Overview of the two workpackages

WP1: Sensory eating quality of pork in relation to the influence of bio-active forage feeding	
Workpackage number:	1
Start date or starting event:	Sensory eating quality January/February 2003. Selenium and vitamin E November 2001
Responsible person:	LLH
Contributing persons:	DVB, MM, JHN and Mogens T. Jensen (DIAS)
Person-months:	Scientific 9.5 + technical 4.0
Objectives:	<ul style="list-style-type: none"> • To perform expert objective sensory profiling on cooked meat from second pig experiment • Measuring selenium and vitamin E (GSHPx-activity) in blood and pork <i>M. longissimus dorsi</i> in both pig experiments (blood and muscle biopsy samples from the first experiment started the 5th of November 2001 will be collected for analyses too). • To correlate the sensory profiling results to chemical and instrumental measurements e.g. GC-MS • To produce scientific reports on investigations carried out
Description of work:	<p>Sensory quality of pork and the health and shelf-life of the meat after feeding with bio-active crops (primarily chicory)</p> <p>The second PROSBIO experiment with fattening/finishing pigs in the period autumn 2002 to January/February 2003 is planned to consist of 4 experimental treatments with a total of 32 pigs like the first experiment (task 26 PROSBIO).</p> <p>1.1. Initially in 2003 descriptive vocabulary development followed by sensory profiling will be carried out on 4 feeding treatments each of 8 pigs = 32 samples (Byrne et al. 1999). The exact feeding treatments levels (primarily chicory) and one other bio-active forage are to be decided based on results of first pig experiment (task 26 PROSBIO). The pigs will be 16 male and 16 female so as to determine any gender differences which may be present in relation to sensory eating quality. From the total of 32 pigs a representative sample subset will be analysed taking into account a priori knowledge of the samples in terms of animal variability and possible sensory non-linearity effects of the feeding treatments. Multivariate methods will be utilised in the determination of this sub set of samples and in the analysis of the sensory profiling results as per Martens et al (2001) and Byrne et al. (2001), respectively.</p> <p>1.2. Sensory profiling results will then be correlated via multivariate statistical analysis to chemical (Selenium (glutathione peroxidase), vitamin E and fatty acid composition) and Instrumental analysis of the cooked meat aroma-profiled by Gas Chromatography-Mass Spectroscopy (GC-MS) (see also Byrne et al., 2001). These chemical and instrumental analyses will be performed in 2003 by Dept. of Animal Product Quality, DIAS.</p> <p>1.3. These results of 1.1. and 2.2. will be drafted as a scientific report with the ultimate goal of publication in a peer reviewed international scientific Journal (task 26 PROSBIO).</p>
Deliverables:	<p>D17 (see PROSBIO): Report</p> <p>D34 and D36 (see PROSBIO): International papers. These papers will be extended to include data on Selenium, vitamin E of both experiments and sensory profiling on cooked meat from second pig experiment too.</p>
Milestones:	<p>M24 (see PROSBIO): Assessment of the influence of chicory (and a related bio-active species) on meat and sensory eating quality in pigs (4/2002+4/2004).</p>

WP2: Content of conjugated linoleic acid (CLA) in beef from steers produced on pasture

Workpackage number: 2
 Start date or starting event: January 2002
 Responsible person: MV
 Contributing persons: TK, Søren Krogh Jensen (DIAS) and Carl-Erik Høy (DTU)
 Person-months: Scientific: 2.5 + technical: 2.0

Objectives:

- to determine the fatty acid composition and CLA content in meat from extensively raised steers finishing-fed by use of different combinations of clover-grass silage, concentrates, and chicory roots.
- to test the effects of different finishing strategies with bio-active forages (chicory) on meat and eating quality of steers coming from pasture
- to compare the fatty acid composition including CLA in meat from steers and young bulls raised in various production systems.

Description of work:

In the PROSBIO-project, 40 steers will be slaughtered in January 2003 and coming from various grazing (rotational versus a continuous grazing system) and finishing systems (Ad libitum clover-grass silage and two feeding levels of barley and chicory) (task 27 PROSBIO).

In the KFC-project, 44 Holstein and 44 Jersey steers, coming from 4 different production systems are slaughtered from August to December 2001. Furthermore, 20-30 young bulls coming from another cattle project are slaughtered in late 2001 (Task 28).

In both projects mentioned above, 2 times 25 g of muscle and 2 times 25 g of tallow from the longissimus muscle are taken at the 10th rib in connection with the slaughter process. Samples are taken by the Danish Meat Research Institute (DMRI) in collaboration with DIAS. The samples will be analyzed at DIAS (Søren Krogh Jensen, HEF) and at Danish Technical University (DTU, Carl-Erik Høy) for CLA content and fatty acid composition.

Deliverables:

D29, D30 and D34 (see PROSBIO).

These papers will be extended to include data on CLA and fatty acid composition of the meat.

Milestones:

M9 (see PROSBIO): Establishment of the relationship between finishing strategy and fatty acids in meat (5/2003).

M9 will be extended to include CLA content in meat and to include data also from the steers in the KFC-project.

M25 (see PROSBIO): Evaluation of the effect of different finishing strategies on fatty acids composition and sensory quality in steers fed bio-active forage (6/2003).

18. Milestones and timetable

Milestones:

WP 1:

M24 (see PROSBIO): Assessment of the influence of chicory (and a related bio-active species) on meat and sensory eating quality in pigs (4/2002+4/2004).

WP 2:

M9 (see PROSBIO): Establishment of the relationship between finishing strategy and fatty acids in meat (5/2003).

M9 will be extended to include CLA content in meat and to include data also from the steers in the KFC-project.

M25 (see PROSBIO): Evaluation of the effect of different finishing strategies on fatty acids composition and sensory quality in steers fed bio-active forage (6/2003).

Ministry of Food, Agriculture and Fisheries

Directorate for Food, Fisheries and Agri Business
Research Office



Timetable (according to PROSBIO)

TITLE		2001*				2002*				2003*				2004*				2005*			
Tasks	Co-ordination	Quarter				1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
		WP1: Sensory eating quality of pork in relation to the influence of bio-active forage feeding																			
26	<i>Investigation of meat and eating quality in pigs fed chicory</i>				x	x			x	x											
M24	<i>Assessment of the influence of chicory on meat and sensory quality in pigs</i>							x								x					
		WP2: Content of conjugated linoleic acid (CLA) in beef from steers produced on pasture																			
27	<i>Study of the effect of finishing strategy and bio-active forage on meat and sensory quality in steers</i>								x	x											
28	<i>In the KFC-project, the samples will be analyzed for CLA content and fatty acid composition</i>								x	x											
M25	<i>Evaluation of finishing strategy and bio-active forage in relation to meat and sensory quality in steers</i>												x								

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19. C.v.'s for the participating researchers

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Research Areas

Sensory science, Meat Quality, Multivariate data analysis, Experimental design

Teaching Areas

Sensory science, Meat Quality, Multivariate data analysis, Experimental design

Research Collaboration and Networks

Danish Institute of Agricultural Sciences, Foulum, Denmark

EU Health Sense Project

Nordic Industrial Fund (NIF) 'Pork Flavour' project

'Føjo project' Denmark, on ecological animal rearing and feeding in relation to sensory effects

Education

1992. B.Sc. Degree, University College Cork, Cork, Ireland.

1995. M.Sc. Degree, University College Cork, Cork, Ireland.

2000. Ph.D. Degree, The Royal Veterinary and Agricultural University (KVL), Copenhagen Denmark.

Positions

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.



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

Miscellaneous Information

Member of the Institute of Food Technologists (IFT)
 Member of the Sensometrics Society
 Journal reviewer for The Journal of Food Quality and Preference

Publications

- Byrne, D. V., Bak, L. S., Bredie, W. L. P., Bertelsen, G. and Martens, M. (1999a). Development of a sensory vocabulary for warmed-over flavour: Part I. in porcine meat. *Journal of Sensory Studies*, 14, 47-65.
- Byrne, D. V., Bredie, W. L. P., and Martens, M. (1999b). Development of a sensory vocabulary for warmed-over flavour: Part II. in chicken meat. *Journal of Sensory Studies*, 14, 67-78.
- Brøndum, J., Byrne, D.V., Bak, L.S., Bertelsen, and G., Engelsen, S.B. (2000). Warmed-over flavour in porcine meat – a combined spectroscopic, sensory and chemometric study. *Meat Science*, 54 (1), 83-95.
- 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.
- 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., Bredie, W. L. P., Mottram, D. S. and Martens, M. (2001). Sensory and chemical investigations on the effect of oven cooking on warmed-over flavour development in chicken meat. *Meat Science*, (in press).
- Byrne, D. V., Bredie, W. L. P., O’Sullivan, M. and Martens, M. (2001). Descriptive sensory profiling and physical/chemical analyses of warmed-over flavour in meat patties from carriers and non-carriers of the RN⁻ allele. *Meat Science*, (in press).
- O’Sullivan, M.G., Byrne D. V., Stagsted, J., Andersen, H. J., and Martens, M. (2001) Sensory colour assessment of fresh meat from pigs supplemented with iron and vitamin E. *Meat Science* (in press).
- Dijksterhuis, G., Frøst, M. B., and Byrne, D. V. (2001). Selection of a subset of variables: minimisation of Procrustes loss between a subset and the full set. *Food Quality and Preference*. (in press).
- O’Sullivan, M.G., Byrne D. V., and Martens, M. (2001). Sensory and data analytical methodologies in the development of a vocabulary for evaluation of meat quality *Food Quality and Preference*. (submitted for publication).

CURRICULUM VITAE

I. Personal data.

Name: Laurits Kristian Lydehøj Hansen.
Born: 14th. February 1947 in Allerslev sogn.
Address: Vingevej 33, Ørum, DK-8830 Tjele.
General Certificate of Education: Undergraduate (Student mat. fys.) from Herlufsholm.
Agricultural education: Agricultural school (Næsgaard Agerbrugsskole) and practice on farms in the period 1967-69.
Position: Senior scientist,
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II. 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*.
Scientific Education: Mathematics and statistics (Ph.D. education), The Royal Veterinary and Agricultural University of Copenhagen.
 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.
Price: Sct. Antonius Price in 1994.

III. Positions:

Danish Institute of Animal Science: Research Scientist at The Danish Institute of Animal Science Dept. for Research in Pigs and Horses, from 1st of July 1974 to 31st of July 1995, and then at The Dept of Product Quality until 31st Marts 1997.
Danish Institute of Agricultural Sciences Senior Scientist 1st of April 1997 at The Danish Institute of Agricultural Sciences, Dept. of Animal Product Quality, Research Centre Foulum,
 P.O. Box 50, DK-8830 Tjele
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IV. Research Activities

Scientific work: Chairman of Research Area IV: "Environment, production technique and economy" in the period 1983-85.
Research activities: My research work has been concentrated on the effects of environmental factors in the pig house on behaviour, health, production results and meat quality in swine (in the period from 1974 to 1992). In the period from 1992-1997 my work was concentrated on the influence of environment and genetics on boar taint. This resulted in 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, several international publications and chapter 8 "Influence of environmental factors and antibiotics on skatole in pigs" in the book "Skatole and boar taint" published by Danish Meat Research Institute, 1998.
 From the 1st of April 1997 my research work contributes to a basal description and understanding of aroma development in fresh and cooked meat. Central research areas are: The importance of production conditions for flavour- and aroma development in fresh and cooked meat.

V. 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. *Anim. Prod.* **59**, 1, 99-110.
- Hansen, L.L., Mikkelsen, L.L., Agerhem, H., Laue, A., Jensen, M.T. & Jensen, B.B. 2000. Effect of fermented liquid food and zinc bacitracin on microbial metabolism in the gut and sensoric profile of *m. longissimus dorsi* from entire male and female pigs. *Anim. Sci.* **71**, 65-80.
- Danielsen, V., Hansen, L.L., Møller, F., Bejrholm, C. & Nielsen, S. 2000. Production results and sensory meat quality of pigs fed different amounts of concentrate and ad lib. clover grass or clover grass silage. In: Hermansen, J.E., Lund, V. and Thuen, E. (editors) *Ecological Animal Husbandry in the Nordic Countries. Proceedings from NJF-seminar No. 303*, Horsens, Denmark 16–17 September 1999. Danish Research Centre for Organic Farming 2000, 79-86.
- Hansen, L.L., Agerhem, H., Rosenvold, K. & Jensen, M.T., 2001. Effect of Brussels sprouts and inulin/rape seed cake on the sensory profile of pork *M. longissimus dorsi*. *Meat Science* (accepted for publication November 2001).
- Hansen, L.L., Claudi-Magnussen, C. & Andersen, H.J., 2001. (Meat and eating quality from organic produced pigs). In: Jakobsen, K. & Hermansen, J.E. (ed.), *Intern rapport no. 145, 2001 from Danish Institute of Agricultural Sciences. Theme Meeting. Aug. Tuesday the 21st 2001. (Organic and outdoor pig production – What is the present state?)*, 39-47.

CURRICULUM VITAE

Name: **Mogens Vestergaard**
 Born: September 15, 1959
 Address: Tingstedet 6, Voldbæk, 8220 Brabrand, Denmark

Education

M.Sc. from the Royal Veterinary & Agricultural University (RVAU), Copenhagen (1985).
 Animal Physiology (minor) for PhD from University of Copenhagen (1986).
 5 inter-nordic post-graduate courses (statistics, endocrinology, metabolism, reproductive physiology, growth factors).
 Ph.D. (Animal Science) from RVAU (1991).

Present employment

Senior Research Scientist at the Danish Institute of Agricultural University (DIAS), Research Centre Foulum, Dept of Animal Nutrition and Physiology, PO Box 50, DK-8830 Tjele, Denmark.
 Tel.: +45 89 99 15 07, fax: +45 89 99 15 25, e-mail: Mogens.Vestergaard@agrsci.dk

Employment

1998 Senior Research Scientist at DIAS, Dept of Animal Nutrition and Physiology.
 1995-1997 Senior Research Scientist at DIAS, Dept of Product Quality.
 1993-1995 Senior Research Scientist at the National Institute of Animal Science (NIAS), Dept for Research in Cattle and Sheep.
 1988-1993 Research Scientist at NIAS, Dept for Research in Cattle and Sheep.
 1985-1988 PhD-student at RVAU, Copenhagen (scholarship) and at NIAS, Foulum

Research activities

Growth physiology, mainly in cattle (prepubertal heifers, young bulls, steers and cows), but also in swine (fetuses and gilts). Hormones and growth factors in blood and tissues, muscle physiology; adipose tissue metabolism; tissue growth; slaughter, carcass and meat quality of cattle. Endocrine aspects of lactation physiology.

Publications and other scientific activities

Twenty three per-reviewed journal papers, 46 other scientific papers in proceedings, abstracts, and other international contributions including 2 invited papers, 33 scientific contributions published in Denmark as reports from DJF etc., and 29 popular-scientific contributions. Several contributions to international meetings in different scientific societies and Danish seminars. Member of 3 international scientific societies, censor for MSc and PhD projects at RVAU, Copenhagen. Co-supervisor for MSc and PhD students at RVAU. Editorial board member (Domestic Animal Endocrinology) and referee for several scientific journals. Project leader for various research projects involving cows and young bulls.

References (selected within growth physiology and meat science)

- Vestergaard, M., Sejrsen, K. & Klastrup, S. 1994. Growth, composition and eating quality of longissimus dorsi from young bulls fed the beta-agonist cimaterol at different developmental stages. *Meat Science* 38, 55-66.
- Vestergaard, M., Henckel, P., Oksbjerg, N. & Sejrsen, K. 1994. The effect of cimaterol on muscle fiber characteristics, capillary supply and metabolic potentials of longissimus and semitendinosus muscles from Friesian young bulls. *Journal of Animal Science* 72, 2298-2306.
- Vestergaard, M., Purup, S., Henckel, P., Tonner, E., Flint, D. J., Jensen, L. R. & Sejrsen, K. 1995. Effects of growth hormone and ovariectomy on performance, serum hormones, insulin-like growth factor binding proteins, and muscle fiber properties of prepubertal Friesian heifers. *Journal of Animal Science* 73, 3574-3584.
- Vestergaard, M., Jensen, L.R. & Andersen, H.R. 1998. Influence of housing, floor space allowance and grazing in young bulls. II. Effects on meat and eating quality. In: L.O. Fiems & S.De Campeneere (Eds.). Effects of extensification on animal performance, carcass composition and product quality. EU-workshop, Melle-Gontrode, Belgium, May 14-16, 1997. pp. 268-277.

- Therkildsen, M., Vestergaard, M., Jensen, L.R., Andersen, H.R. & Sejrsen, K. 1998. Influence of feeding intensity, grazing and finishing on growth and carcass quality of young Friesian bulls. *Acta Agriculturae Scandinavica, Section A, Animal Science* 48, 193-201.
- Vestergaard, M., Oksbjerg, N. & Henckel, P. 2000. Influence of feeding intensity, grazing and finishing feeding on muscle fibre characteristics and meat colour of semitendinosus, longissimus dorsi and supraspinatus muscles of young bulls. *Meat Science* 54, 177-185.
- Vestergaard, M., Therkildsen, M., Henckel, P., Jensen, L.R., Andersen, H.R. & Sejrsen, K. 2000. Influence of feeding intensity, grazing and finishing feeding on meat and eating quality of young bulls and the relationship between muscle fibre characteristics, fibre fragmentation and meat tenderness. *Meat Science* 54, 187-195.

CURRICULUM VITAE

Magni Martens

Professor, Dr. agric, Civil engineer, Cand.mag.

PERSONAL DATA

Born November 10, 1948 in Norway. Married, two children.

ACADEMIC TRAINING

- MSc. 1971. Civil engineer/ biochemical engineering, Norwegian University of Science and Technology, Norway
- Exams 1973-75. Agricultural University of Norway: Anatomy and physiology. University of Lund, Sweden: * Food Science and Technology; * Human nutrition
- Dr. Agric. 1986 Agricultural University of Norway (Dr. agric. thesis "Determining sensory quality of vegetables: A multivariate study")
- Cand. mag. 1994. University of Oslo, Norway (philosophy, psychology)

EXPERIENCE/ EMPLOYMENTS:

- 1995/96 - Professor at The Royal Veterinary and Agricultural University, Denmark
- 1994- 1995 Director of Techne AS, Science Park, Oslo, Norway
- 1988 - 1993 Administrative leader/ project leader at Centre for Technology and Culture, Center for Medical Ethics, University of Oslo, Norway
- 1988 - 1989 Visiting statistician at Dept. of Food Science and Technology, University of California, Davis, USA (academic sabbatical year, commuting Norway-USA)
- 1986 - 1988 Program leader/Senior research scientist at the Norwegian Computing Center, Oslo, Norway
- 1975 - 1986 Group leader/ Senior research scientist at the Norwegian Food Research Institute, Norway
- 1975 Research scientist at the Swedish Food Institute, Sweden.
- 1972 - 1973 Research scientist at Kyoto University, Kyoto, Japan. Mobusho scholarship.
- 1972 Scientist United Nation (IBP-program), Makerere Univ. Kampala, Uganda

KEY QUALIFICATIONS

Research:

Sensory scientific experience: Psychophysics, physiology and psychology related to sensory science. Sensory analysis and quality analysis relevant for industries and research institutes. Building up a sensory scientific section at two research institutions.

Information technological experience: In general, applied several traditional univariate and multivariate statistical methods. Especially participated in developing multivariate soft modelling techniques for relating "hard" technical data (e.g.chemical/instrumental data) to "soft" data (e.g.human response).

Chemical/biochemical/agricultural experience: In general, training in chemical analytical and instrumental work related to food research and technology.

Technology and ethics experience: Studies and experiences in applying ethical theories on technological problems; author of book in technology-ethics. Technology-philosophy teaching.

Teaching:

Given numerous academic courses and lectures in sensory science, data analysis and quality analysis in Scandinavia, Japan, USA and European countries for undergraduate students and Ph.D. students. Supervisor for several bachelor, M.Sc. and Ph.D. students (1999: 8 Ph.D. students)

Administration:

Project and group leader for several large research projects. Building up sensory research groups in two countries. Member of board of the Norwegian Research Council (1983-86). Administrative leader of Center for Technology and Culture. Member of several scientific committees for evaluation of research work and doctoral thesis. Member of several scientific committees within food science and technology. Director of Techne AS (qualimetrics comp.)

SCIENTIFIC COMMITTEES AND ORGANIZATIONS :

- The Norwegian Academy of Technical Sciences (elected member)
- The New York Academy of Sciences (elected member)
- American Association for the Advancement of Science (member).
- Society for Philosophy and Technology (member).
- Member of Scientific committee 4th Sensometrics Meeting, Denmark, 1998
- Member of Scientific committee 3rd Pangborn Symposium, Norway, 1998
- Member of Scientific committee 5th Sensometrics Meeting, France, 2000
- Member of Danish Standard committee of ISO/TC 34/SC 12 sensory analysis
- Member of NMKL, Danish committee
- Member of editorial board of Journal of Food Quality (USA)
- Associate editor Food Ethics Review (UK)

AWARDS:

- Japanese Governmental scholarship, Research scientist, Japan, 1972-73
- Norwegian Research Council scholarship, UCD, USA, 1988-89
- Barnett & Foster 125 Annual Award 1987, English Research prize.
- The Norwegian Marshall Fund, Grant 1989.
- Environmental prize, Norwegian Society of Chartered Engineers, 1990.
- Marquis Who's Who in the World, 12.ed., 1995

PUBLICATIONS (overview):

- Books: 1 (ed. English), Flavour Science and Technology, J.Wiley & Sons, UK, 1987
- 1 (Norwegian), Ethics in Engineering; University Press, Oslo, 1992
- 1 (English), Introduction to multivariate data analysis for understanding quality, John Wiley & Sons, UK (contract, in prep)
- Invited contribution to books (w/referee): 10 (English), 2 (Norwegian)
- International journals (w/referee): 42 (English)
- International proceedings: 36 (English)

SELECTED REFERENCES

- Byrne D.V., Bak, L.S., Bredie, W.L.P., Bertelsen, G. and Martens, M. 1999. Development of a sensory vocabulary for warmed-over flavor. Part I In porcine meat. Journal of Sensory Studies, 14, 47-65.
- Byrne D.V., Bredie, W.L.P. and Martens, M. 1999. Development of a sensory vocabulary for warmed-over flavor: Part II In chicken meat. Journal of Sensory Studies, 14, 67-78.
- Folkenberg, D.M., Bredie, W.L.P. and Martens, M. 1999. What is mouthfeel? sensory-rheological relationships in instant hot cocoa drinks. Journal of Sensory Studies, 14, 181-195.
- Martens, M. 1999. A philosophy for sensory science. Food Quality and Preference. 10, 233-244.
- Martens, M., Bredie, W.L.P. and Martens, H. 2000. Sensory profiling data studied by partial least squares regression. Food Quality and Preference, 11 (1-2), 147-149 .
- Thybo, A.K. and Martens, M. 1999. Instrumental and sensory characterization of cooked potato texture. Journal of Texture Studies, 30 (3) 259-278.