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## INTRODUCTION

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The Institute of Animal Science (the Institute) is a scientific research institution that, since its foundation in 1951, has focussed its activities on animal husbandry and the biological and biotechnological fundamentals of animal production - genetics and animal breeding, reproduction, nutrition, the quality of animal products, ethology, farming technologies and management. In 2008, we commemorated the 55<sup>th</sup> jubilee of the Institute relocating to its present place of work-Uhrineves. In 2008, the Institute's staff comprised of 273 employees: 140 employees with university-level education (including 30 PhD. candidates), from which 72 were research workers with an academic degree (including 5 Professors and 7 college lecturers). Further, there were 95 technicians and people providing services and 38 blue-collar workers in animal and plant production. The Institute is permanently in contact with global knowledge in all areas of its theoretical and practical specializations and, where necessary, it develops the technical standards for a high-quality animal farming environment. Top level laboratories with a high-quality experimental background are available. This is reflected in the gradual changes in the methods of scientific work, where the biotechnological techniques necessary for contemporary research into the biological fundamentals of animal production are used.

Early in the year, the Institute's researchers successfully published in the prestigious journal *Science* a breakthrough result related to early embryonic development gained by the international team in which they participated. Other revolutionary discoveries include revitalising lyophilized cells for cloning, which was verified and published that year by the same research team. These were evaluated among greatest successes in Czech science in 2008. Throughout the year some of the five-year research plans came to an end. These plans contributed to a qualitative shift in knowledge and to developing the life sciences. This year was also the preliminary stage for the next research plan for 2009 – 2013, in which the case was subsequently successfully argued for.

In late 2008, the Institute achieved another important success. In cooperation with the Czech-Moravian Breeders' Association and in the presence of the Ministry of Agriculture, the President of the Agrarian Chamber and representatives of breeding associations, the Central Gene Bank of the National Programme for Conserving Farm Animal Genetic Resources was opened. Coordination of this programme is one of the main activities of the Institute. Charged by the Ministry of Agriculture, the workers of the Institute participated also in the preparations for and the provisions of agendas that were needed for the Czech EU presidency, which started at the beginning of 2009.

Besides these positive facts we have not lost sight of the complexity of developments in the global and national economies, which impose increased demands into the future and which will be a great challenge, especially in the effectiveness of research activities and the work of the whole Institute.

## INSTITUTE MANAGEMENT IN 2008

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Chairman of the Institute Board



**Ing. Věra Mátlová**  
Research Secretary

## RESEARCH PLANS AND PROJECTS IN 2008

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### RESEARCH PLANS

In 2008 three research plans were successfully finished. The Institute succeeded in the competition for new research plans from the Ministry of Agriculture. The new research plan **MZE0002701404** Sustainable Development of Livestock Farming in the European Model of Multifunctional Agriculture, which will be worked on from 2009 – 2013 and it continues with the research results already obtained.

#### **MZE0002701401 (2004 – 2008)**

**From growing oocyte to producing in vitro embryos and embryonic stem cells**

Guarantor: Ing. Josef Fulka, DrSc.

#### **MZE0002701402 (2004-2008)**

**Developing the sectors of welfare technologies, ethology, management and economy of livestock farming with respect to environmental aspects**

Guarantor: doc. Ing. Oldřich Doležal, DrSc.

#### **MZE0002701403 (2004-2008)**

**Advanced studies in the field of animal nutrition aimed at improving the quality and safety of animal products**

Guarantor: doc. Ing. Věra Skřivanová, CSc.

### RESEARCH PROJECTS

In 2008, the projects supported by the MoA, (National Agency for Agricultural Research's - NAZV), the Czech Science Foundation (GA CR), the Grant Agency of the Academy of Sciences of the CR (GA AV CR) were successfully concluded. Other projects were continued or started.

#### **Project NAZV**

##### **1B44035 (2004-2008)**

The interactions of heifer rearing, longevity, health and reproductive efficiency of dairy cows

##### **1B44037 (2004-2008)**

Management of the process for increasing the quality of milk and milk products by the addition of essential amino acids

##### **1G46085 (2004-2008)**

The use of biologically active substances of natural origin for increasing the efficiency of controlled reproduction in pigs

##### **1G46086 (2004-2008)**

The strategy of dairy cow farming in competitive conditions

##### **1G570051 (2005-2008)**

The use of genetic resources of national sheep and goat breeds for the production of genetically defined milk with various nutritive and functional qualities

##### **QG50052 (2005-2009)**

Reproductive biotechnology for pigs

##### **QG60142 (2006-2009)**

The use of selected lupine species for farm animals' nutrition

##### **QH71275 (2007-2011)**

Research into the factors influencing dairy cows' health and longevity

**QH71280** (2007-2011)

The formation of a Merinolandschaf (Merino landsheep) sheep breed's fertile line using molecular genetics methods

**QH71284** (2007-2011)

Determining the biological and management parameters for a high level of yield capacity for pigs

**QH72134** (2007-2011)

Research into the fundamental environmental aspects regarding livestock breeding from a view of greenhouse gases, odour, dust and noise, supporting animal welfare and BAT development

**QH72286** (2007-2011)

The influence of the farming environment and milking methods on the welfare, yield capacity and milk qualitative properties of dairy sheep

**QH81228** (2008-2012)

Genetic factors affecting fatty acid composition in beef

**QH81280** (2008-2012)

Study of main factors influencing stability of sustainable management of grasslands in the Czech Republic

**QH81309** (2008-2012)

Optimization of the nutrition and rearing dairy cows under conditions of agricultural policies of the EU

**QH81312** (2008-2012)

Genetic evaluation of cattle reproduction and growth

**Project GA ČR**

**GA523/06/0295** (2006-2008)

The activation of pig oocytes by nitric oxide donors

**GA523/08/0808** (2008-2011)

Hormonal base of the relationship between social activity and antler growth III.

**GA523/07/0673** (2007-2009)

Hydrolysis of phytic acid in laying hens' digestive system

**GD525/08/H060** (2008-2011)

Synbiotics and plant extracts in human and animal nutrition

**GP523/07/P340** (2007-2009)

The application of caprylic and lauric acid in broiler rabbits' and chickens' nutrition: effect on growth, mortality and enteropathogenic bacteria

**GP523/08/P301** (2008-2010)

Behavioural function of pre-orbital gland opening in red and fallow deer

**GP523/08/P313** (2008-2010)

Intraspecific and interspecific characteristics of sucking behaviour in captive equids

**Project GA AV ČR**

**IAA601410612** (2006-2008)

Modelling of behaviour synchronisation

**IAA603070801** (2008-2010)

The impact of piglet's behaviour and vocalization on the maternal behaviour of the sow with consequences on piglet mortality

**Ministry of education, youth and sports**

**MEB080802** (2008-2009)

Effective utilization of computer technology in breeding of ruminants

**MEB040707 (2007–2008)**

Effective use of informational technology for establishing sustainable breeding objectives in farm animal breeding

**European Science Foundation**

**GESTE/05/E004 (2005-2008)**

The oocyte as the environment of differentiated nucleus reprogramming

**FOOD-CT-2004-506508 (2005-2008)**

Welfare quality (Integration of farm animals' welfare into the production chain of quality food)

**Other projects**

**1M0021620803 (2005–2009)**

Center for Cell Therapy and Cell Repair, 2<sup>nd</sup> Faculty of Medicine, Charles University Prague

## RESEARCH PLANS

Three research plans financed from the Czech Republic Ministry of Agriculture resources were a basic programme of the research in 2004 – 2008. Interesting subjects and some of the results of this research are presented in the following review.

### **PROGRESS IN THE CATTLE GENOME RESEARCH ACHIEVED THROUGH THE MOLECULAR GENETICS METHODS**

Jitka Kyseľová

#### **Introduction**

An absolute majority of economically significant production traits of cattle has a polygene character; it is influenced by a number of genes and their mutual interactions. It means that their performance qualities are manifested in a wide range of possible extent, but not through the occurrence of a few discrete values of phenotype. Detailed studies of genes responsible for these quantitative traits are possible only in large sets of animals by means of the analysis of a number of genetic markers.

Currently there exist two approaches different on principle for genetic dissection of complex and quantitative traits. There are the procedures, in particular, which are based on the genome-wide screening and localisation of QTL (quantitative trait loci, marker-assisted selection) in the chromosomal regions, on the basis of their linkages with DNA markers (the most frequently microsatellites or SNP – single nucleotide polymorphism). The main reason for the QTL studies is the establishing genes/markers which can be “simply” implemented into the breeding programmes through the MAS (marker-assisted selection). An alternative approach which results from the genetic polymorphism of candidate genes is based on the idea that the function mutations of DNA causative genes are responsible for a great deal of genetic quantitative variance. For these genes is generally known their biological function, which controls, directly or indirectly, the examined trait development. The effect of particular causative gene varieties and their established combinations is estimated in the association studies with various production traits using data available from the production performance checks, possibly fertility, longevity and health checks. The results of these studies became a basis for the targeted breeding process. Currently there is fast developing trend based on the combination of both approaches – the analysis of presumptive QTL in immediate vicinity of the chromosomal localisation of candidate genes, whose products are a part of metabolic pathways significantly influencing the performance (for example, milk proteins and enzymes, or hormones, which influence their synthesis and expression) or constitute integrated functional system (main histocompatible system).

The Molecular Genetics Department in the co-operation with the Cattle Breeding Department of the VUZV, v.v.i. (the Institute of Animal Science) is already in a long-term basis engaged in the analyses of allelic polymorphism of milk proteins and other selected candidate genes and the assessment of their relation to the parameters of milk yield and technology qualities of milk in Ruminants. For the Czech Fleckvieh is currently under development demanding project of QTL mapping for health, performance and longevity which processes and evaluates data from the DNA fragmentation analyses (which establish length polymorphism of microsatellite markers).

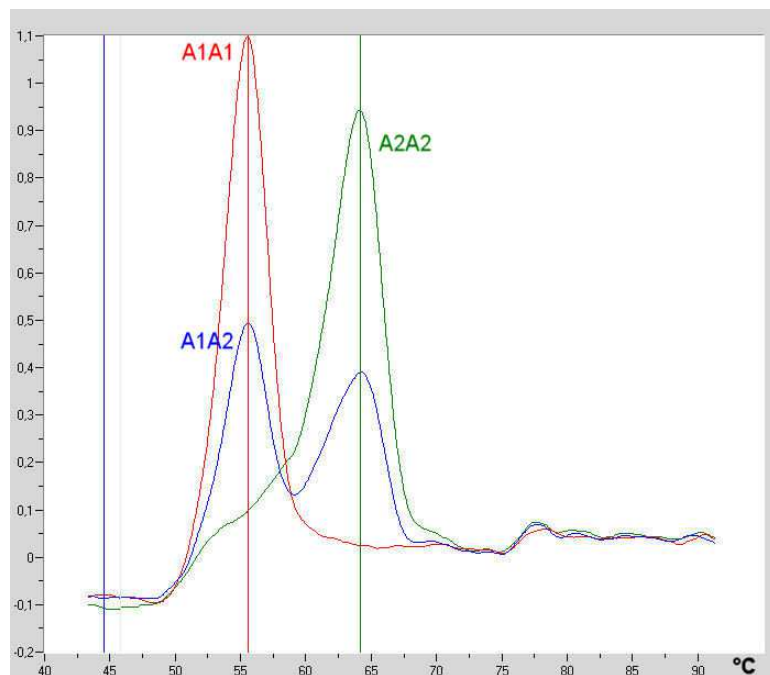
#### **Candidate genes in milk protein synthesis and lactation**

Genetic determinants of the protein content in milk of Ruminants are the subject of relatively intensive research already from the fifties, from the discovery of beta-lactoglobulin polymorphism in cattle in 1955. During the next 30 years the majority of genetic variants of milk proteins has been characterised, predominantly using starch and polyacrylamid electrophoresis methods at the beginning, later by means of much more sensitive isoelectric focusing. Then the sequence of protein chains and amino acid substitution positions, which are the most common forms of the mutation in lactoproteins, have been detected using biochemistry methods. The DNA technology implementation enabled the typification of lactoprotein genes independently on sex, age (if need be even for embryo)

and lactation stage of an animal and discoveries of new allelic variants and mutations as well in non-coding and regulatory regions.

Currently are recognised practically 50 genetic variants in four casein ( $\alpha$ -S1 casein,  $\alpha$ -S2 casein,  $\beta$ -casein and  $\kappa$ -casein) and two whey lactoproteins ( $\beta$ -lactoglobulin,  $\alpha$ -lactalbumin), cross a wide spectrum of cattle breeds (Farrell et al., 2004). A number of detailed, but often conflict studies, have been focused on the explanation of genetic variant effect on the milk performance, milk composition and its technological characteristics. The correlation with a higher milk, milk fat and protein yields has been evidenced in  $\alpha$ -S1 casein B and  $\beta$ -casein A of the alleles as well as a positive influence of  $\kappa$ -CN BB and  $\beta$ -LG AA genotypes on protein content in milk. Significant positive effects on fat ratio and casein content have been confirmed for  $\kappa$ -CN B and  $\beta$ -LG B alleles. From the point of view of the assessment of genetic polymorphism influence on cheese characteristics there is evident a positive effect of  $\kappa$ -CN BB genotype on the coagulation time and the cheese curd quality and yield, in particular.

The Molecular genetics Department carries out the genotypization of CSN1S1 ( $\alpha$ -S1 casein), CSN2 ( $\beta$ -casein), CSN3 ( $\kappa$ -casein) and LGB ( $\beta$ -lactoglobulin) loci and further gene for growth hormone (GH), which influences lacteal gland, lactogenic hormone - prolactin gene (PRL) and leptin gene development. By means of PCR-RFLP methodologies and association analysis of amplified DNA with marked hybridization sounds on LightCycler instrument are determined genotypes for heifers of the Czech Fleckvieh in several farm breedings and for heifers and bull-calves of Holstein cattle from the special purpose farm in Netluky. The results are continuously published in the *Czech Journal of Animal Science* (Matějčák et al., 2008). For example, in the comprehensive study on milk protein genotyping in 440 heads of C breed we determined allelic and genotype frequencies and established relationships between genotypes and parameters of the milk production expressed in the breeding values. The significant differences have been shown in CSN1S1 locus with an average breeding value for milk production, in CSN2 locus for all indicators of milk performance, with the exception of protein content, and in CSN3 locus for milk protein content and yield (Kučerová et al., 2006).



**Figure 1:** The result of CSN2 genotype determination on the principle of hybridization of amplified fragment of gene with specific fluorescence marked sounds which are linked to DNA in the region of mutation. Light Cycler v. 3.3 (Roche) instrument

In past decade a great deal of attention was paid to the research of polymorphism inside regulatory, possibly introne gene sequences as one of possible causes of quantitative differences in milk protein synthesis. For example, associations between polymorphism of these regions in LGB, CSN3 and LALBA ( $\alpha$ -lactalbumin) and milk productivity have been proven. For applications in the milk cattle breeding there results a significant conclusion that the polymorphism of the whole casein cluster must be considered as the complex and the detection of productive traits of casein genes influencing at the level of haplotypes becomes necessary.

The milk protein genes represent currently one of the best examined polymorph systems in cattle. The gene polymorphism is studied in more detail for genes which are associated with lactoprotein gene regulation or participate in milk protein synthesis. They are detected inside their sequences and



various types of the polymorph DNA regions (e.g. substitutions, SNPs, deletions, repetitions and insertions) and are archived in relevant databases. The polymorphism of related candidate genes is under a very intensive investigation both through classic methods (such as PCR-RFLP, AS-PCR, SSCP, DGGE...) and newer ones (resequencing, hybridization analysis, methods based on RT-PCR...). The enzymes influencing synthesis and secretion of fatty acids and lipid metabolism: DGAT1, butyrophilin, leptin and its receptor, acetyl-CoA-carboxylase, lipoprotein lipase, low density lipoprotein (LDL) are ranked among the most significant of them. Further, also the factors influencing the lacteal gland development, growth and apoptosis: growth hormone and prolactin receptors, transcription and signal factors (for example, STAT5A) and many others. For a number of them are known also the first results of association studies with milk performance and fertility traits.

With the development of the instrument equipment and automation of the analyses a number of another identified SNPs (single nucleotide polymorphism) influencing milk protein synthesis constantly increases. The simultaneous genotypization of the greatest number of informative SNPs will lead to the better understanding genetic basis of the milk protein content. The 339 SNP database identified inside 49 genes participating in milk protein biosynthesis (Kaminski et al., 2004) has been constructed relatively recently. An unquestionable advantage of the database is the possibility of the automatic downloading directly from the GenBank (database of genetic sequences, file of annotated public available DNA NCBI sequences; <http://www.ncbi.nlm.nih.gov/Genbank>) and simultaneous design of PCR primers and allele-specific DNA sounds for use in the microarray technology (for short, the technology which enables the miniaturisation of the genotyping on so call microchips – plates of the size of a laboratory glass or smaller). Last year the methodology of the typification of main milk protein mutations using the microarray technology simultaneously for 22 polymorph loci in coding as well non-coding CSN1S1, CSN2 and CSN3 sequences and LGB genes has been developed. (Chessa et al., 2007).

The DNA microarray technology is currently considered as the best method for the determination of SNPs, nevertheless it requires knowledge on type and localisation of given SNP and it is still from the point of view of instruments and finances relatively expensive. SNP - single nucleotide polymorphism is a single-point DNA polymorphism, characterised by the variations of single nucleotide in given position in homologous chromosomes, it means the most simple type of the polymorphism. One of the applications of The Project for bovine genome sequencing is commercial production of chips with ten thousand to fifty thousand of SNPs for individual genotypization. There is a possibility with up-to-date technologies to identify simultaneously 60 thousand of the single nucleotide polymorphism in the whole genome, financial costs amount approximately 300 dollars per animal (Adelson, 2008). The research of single nucleotide DNA polymorphism has its application not only for structural genes for the performance of farm animals, but it will be with the highest probability used also for the characterization of the EU member states genetic resources and QTL detection, there is an alternative to the up to now implemented methods on the basis of the determination of microsatellite DNA regions polymorphism

### **QTL mapping for economically significant traits in relation to the dairy cattle performance**

The gene mapping in cattle gradually identified a several hundred of QTL (Polineni et al., 2006) in last 20 years and it gave rise to several genetic linkage maps. The plan of detailed bovine genome sequencing has been finished in last year and it is available on-line ([http://www.ensembl.org/Bos\\_taurus/index.html](http://www.ensembl.org/Bos_taurus/index.html) and <http://bovinegenome.org/>) with links at the QTL integration, protein families, integrated linkage maps, identification of microsatellites and a number of further sequence characteristics. The bio-information instruments for Quantitative Trait Loci are available through the National Centre for biotechnology information of the USA (NCBI) (such as <http://www.animalgenome.org/QTLdb/cattle.html>).

The traditional methods for a targeted genetic progress in dairy cattle resulted from combining information on the performance and pedigree. The discovery of the genetic markers in relation to the QTL simplified the detection of genome regions significantly associated with differences of the phenotype values of milk production. The reason why the science community and professionals are interested in QTL, it is their potential use in MAS selection which combines use of sophisticated genotype, phenotype and pedigree data and enables to specify the selection. The advantage will be also the pre-selection of young bulls even before offspring testing, shortening of the generation interval and the enhancement of a genetic profit.

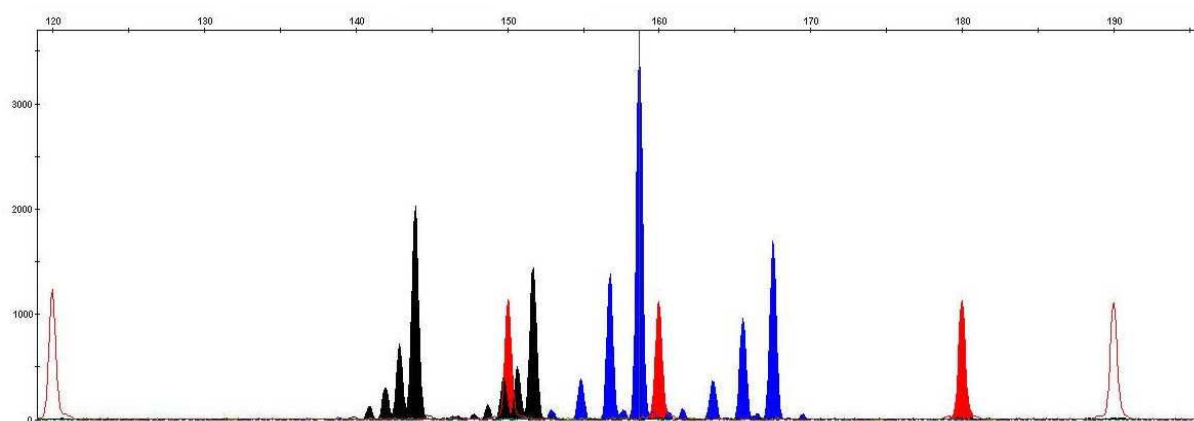
Currently, the most used markers in QTL studies are microsatellites (short DNA sequences, which include many times repeated motive of 2-4 nucleotides whose variability consists in a different number

of the repetitions). An indisputable advantage, there are their distribution in the whole genome, a high degree of the polymorphism and implemented methods of their determination by means of the capillary DNA sequencer. The result from the DNA fragmentation analysis is the genetic profile – generally the set of several tens of alleles with a different number of base pairs, which are characterised by the selected microsatellites in the linkage with possible QTL. A certain disadvantage of this approach are significant laboratory expenses within the genotyping a number of microsatellite markers and the necessity to implement demanding experimental procedures (granddaughter design, if need be, daughter design) which require three generation structure and a great number of the records from KU daughters.

The QTL influencing milk production have been determined in 20 from 29 bovine autosomes, in total. The studies mostly detected QTL on chromosome 6 where is located as well casein complex and further on chromosomes 1, 3, 9 and 20. The QTL for the percentage and protein content in milk have been found on chromosomes 1, 3, 6, 9, 14 and 20. QTL significant at the genome level has been established for the percentage and lipid content close to chromosome 14 centromere and on chromosome 3. In a number of studies have been also confirmed the QTL pleiotropic effects on the milk production traits on certain chromosomes, e.g. QTL on chromosome 14 increases milk and protein production, but it decreases the fat production (Khatkar, 2004).

The recent methods of QTL mapping combine the advantages of a high frequency and density of SNP markers in genome with their relatively cheap and fast automatic determination by means of the special microchips with precisely defined sounds. In this year Canadian scientists, for example, published the results of the mapping QTL economically significant traits for Holstein cattle by means of genome scanning with almost 10 thousand of SNPs on the chips (Daetwyler, 2008). The density of SNP map potentially increases the weight of association studies. A number of complex and quantitative polygene based traits (among others, such as milk character, formation of udder and dug properties, milking speed, proportion of somatic cells, body depth, constitution, length of productive age, daily gain and other indicators of meat production and meat quality, parasite resistance, etc.) in which the QTL have been identified, exceeded a hundred. A fewer scientific results have been collected in the research of other yield properties, such as reproduction, health (somatic cell content, mastitis), constitution and fitness, however they get into the centre of attention due to their economic significance and are considered as an integral part of the total animal performance and longevity.

The project which is worked out at the Molecular Genetics Department and the Cattle Breeding Department set an objective to analyse just the relationships between longevity and function and production properties of dairy cows by means of QTL mapping related to cow health, performance and longevity. This is the first study of the QTL mapping on breeds kept in the Czech Republic, which promises to bring original results, because current results originate only from foreign cattle populations. The research team has due to a long-term co-operation with farm breedings in the Czech Republic the access to the database of health control which is not widely available. In this year the model database of three generation structure of the Czech Fleckvieh families in classic „granddaughter design“ has been created. For the purpose of this study sperms samples have been collected and DNA isolated from each available breeding bull (grandfather and son generations; cca 160 animals) acting in the Czech Fleckvieh breeding and particular families as well as the databases of daughter performance have been completed. Through the compilation of science publication results and cattle QTL database records, there was designed for fragmentation analyses the determination of polymorphism in 38 microsatellites which have been identified as potential QTL markers for certain traits of the reproduction and health (somatic cells content, mastitis, calving ease, insemination interval, productive life length). The QTL were ranked into the selection, in which pleiotropic action is expected and whose which influence some traits of milk performance (milk, protein and fat production). Microsatellite markers were selected with the respect to a high measure of the heterozygous and the biggest possible number of alleles for given locus. The optimisation of the anelation temperatures for the PCR reactions on the gradient thermocycler enabled their integration into so-called multiplexes (it means the amplification of several selected DNA regions at once) and a decrease of the expenses for the genotyping on the automatic capillary DNA sequenator Applied Biosystems. GeneMapper – software instrument for evaluating the fragmentation analyses generates directly the lengths of microsatellite homologous alleles which are intrinsic enter value into the mathematic model for calculating. The relationships between the longevity and other parameters of functional and production properties of dairy cows and the identification of possible QTL related to the longevity will be analysed subsequently using the mathematic models. The results will be a basis for improving dairy cows' health status and longevity and accompanying decrease in the costs for milk production and further for optimising the conditions of dairy cow breeding in the Czech Republic.



**Figure 2:** The demonstration of microsatellite analysis on the DNA capillary sequencer, program GeneMapper. In the PCR multiplex were amplified 3 different DNA regions and particular alleles are differentiated by colour peaks, whereas their length is red on x-axis.

## Conclusion

To comprehend the whole benefit of the molecular genetics for cattle and other production animal breeding is difficult, because this field develops in a bustling rate in last decade and new knowledge rapidly gather. A great deal of other specialised research areas of farm animals, not even a breeding process, cannot get along without this branch. The possibilities, which are due to the instrument equipment and the development of biotechnologies in this field more and more complex, are not long time ago to be processed by an individual, and the future belongs to the large research teams and international projects which cross the borders of states and frequently the continents.

## Acknowledgment

Allow me to express appreciation to all my co-workers from the Molecular Biology and the Cattle Breeding Departments, namely Mr. Tomáš Kott, Ms. Eva Kottová, Ms. Blanka Kottová, Ms. Zuzana Sztankoová, Ms. Vladimíra Czerneková, Mr. Jiří Soldát, Ms. Jitka Matějčková, Ms. Miloslava Štípková, Ms. Jaroslava Šefrová, Ms. Eva Němcová and other current and former colleagues, who have had a merit in the development of our branch. The Molecular Genetics Department succeeded during the last period thanks to functional co-operation within the framework of the Institute of Animal Science, v. v. i. and the most up to date instrument equipment to achieve a number of original results which we patented or published in reviewed scientific journals. The scientific research cannot be managed without a large technical support in a form of the sample recording and the gene bank keeping, collecting data from breedings and further an everyday laborious work, so sincere thanks deserve our specialised technicians Ms. Soňa Melčová, Ms. Iva Hölzelová and Ms. Michaela Krejčová.

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## POSSIBILITIES FOR INFLUENCING PERCENTAGE OF FATTY ACIDS IN BEEF

Luděk Bartoň

### Introduction

For a modern consumer constantly increases significance of the information related to the food quality and connections between the nutrition and the occurrence of certain, particularly „civilisation“ diseases, such as atherosclerosis, obesity or cancer diseases. As a result are determined the limits of recommended daily intake of nutrients for individual population groups. With respect to the amount of lipids in human nutrition, there is the recommendation of the World Health Organization to take a share in total energy intake for total fat 15-30%, saturated fatty acids (SFA) < 10%, polyunsaturated fatty acids (PUFAs) 6-10%, n-3 v PUFAs 1-2%, n-6 PUFAs 5-8% and *trans* fatty acids < 1% (WHO, 2003). The purpose is to increase, particularly the percentage of total fat in human nutrition (if recommended values are exceeded) and the modification of particular nutritionally significant fatty acids (FA) distribution.

Beef is for human organism a reach resource of biologically valuable proteins, certain essential elements and vitamins. The fat is contained in meat particularly in the form of triacylglycerols (subcutaneous, intermuscular and intramuscular fat) and phospholipids (cell membrane component). It is an important resource of certain n-3 PUFAs and conjugated linoleic acid (CLA), for which a number of favourable effects on human health is supposed. But on the other hand its consumption uses to be often criticised, because of its high content of saturated fatty acids (SFAs) in adipose tissue (45-48% from a total amount of fatty acids), certain of which (myristic and palmitic acids, in particular) increase a blood cholesterol level and thereby also a risk of cardiovascular disease generation. Therefore, there are sought the methods by means of which the proportion of fatty acids in beef could be efficiently influenced, then reduced the percentage of SFAs, in particular, and increased the percentage of n-3 PUFAs and conjugated linoleic acid (CLA).

### The modification of fatty acid composition in beef through the cattle nutrition

While the composition of fatty acids in meat phospholipids is relatively constant, a variability of fatty acids in triacylglycerols is much higher and it is possible to influence them more easily by the nutrition. The feedingstuffs with a high content of PUFAs are used preferably, for instance, vegetable oils, oilseeds, fish meal or fish oil. A further significant resource of PUFAs (linoleic acid, in particular) is the pasture vegetation. Whereas, in monogasters, there is a possibility to influence a fatty acid profile in muscle and fat relatively easily (fatty acids from feed are absorbed in small intestine in unconverted condition), in ruminants the efficiency of this method is limited to a great extent by the biohydrogenation process in rumen. Large volumes of unsaturated fatty acids are there hydrogenated on relevant saturated fatty acids by the action of rumen microorganisms, which is a main reason of their high rate in ruminant fat. Nevertheless, a certain fraction of PUFAs avoids the process of biohydrogenation in rumen and they become finally phospholipid and triacylglycerol components in individual tissues. Even if achieved changes in fatty acid profile are not high in absolute values, the use of feedingstuffs, particularly with a high percentage of linoleic acid, in animal nutrition can be consider as a significant instrument by which it is possible to influence positively the nutritionally significant fatty acid proportion in human nutrition, so through the consumption of food of animal origin (De Henauw et al., 2007).

A favourable effect on fatty acid composition in beef has the feeding of pasture vegetation or grass and clover grass mixture. In comparison with the feeding rations with a high content of grain feed a significantly higher rate of n-3 PUFAs and CLAs and a lower rate of SFAs use to be achieved. This effect is further intensified by a number of days spent on the pasture (Scollan et al., 2006).

The feedingstuffs, which have a high potential for increasing a content of nutritionally favourable PUFAs with the long chain (EPAs, DHAs) in muscle, are cod-liver oil and fish meal.

Within the framework of our research we carried out an experiment, in which the influence of flax-seed included in the feeding ration on fatty acid composition in intramuscular and subcutaneous fat of heifers of two meat breeds has been monitored. The use of feeding ration with a higher content of linoleic acid expressed in a twice higher distribution of this acid and in the decrease of palmitic acid content in

analysed tissue samples. At the same time the content of n-3 PUFAs (especially EPAs and DPAs) and CLAs managed to be positively influenced. For AN experimental group with the flax-seed content in feeding ration there has been established a higher rate of PUFAs/SFAs and a markedly lower rate of n-6 PUFAs/n-3 PUFAs (Bartoň et al., 2007).

In further of our trials we examined the influence of untreated sunflower seed (a high rate of linoleic acid) in the feeding ration for bulls on fatty acid profile in triacylglycerols of intramuscular fat in muscles *m. longissimus thoracis* and *m. infraspinatus*. There has been shown a significant increasing c9t11 CLA and PUFAs/SFAs, but at the same time the proportion of n-6 PUFAs/n-3 PUFAs increased, which cannot be considered as favourable from the nutritional point of view (Bartoň et al., 2008).

As already has been mentioned, the most serious problem within the endeavour after the modification of fatty acid profile in ruminants there is a large biohydrogenation of PUFAs contained in feedingstuffs by the action of rumen microorganisms. Therefore, the ways how to protect these acids against the degradation in rumen are sought and there are used mainly various heat or chemical treatments of oilseeds and vegetable oils before their feeding.

### Intramuscular fat content

A fatty acid profile in beef muscle is to a certain extent also dependent on the total intramuscular fat (IMF) content. With the rising percentage of IMF there increases a relative distribution of SFAs and monounsaturated fatty acids (MUFAs), whereas the percentage of PUFAs decreases. The reason there is a different composition of phospholipide and triacylglycerol fatty acids. While in phospholipide fraction the percentage of PUFAs reaches approximately 30%, the PUFA concentration in triacylglycerols does not exceed 5%. And while the phospholipide content in lean beef muscle is relatively (up to 1%), the content of triacylglycerols can range from 0.2 and even more than 5%. Therefore, it is evident that in the animals with a high percentage of IMF will be the percentage of PUFAs in muscle substantially lower than in those animals with a low percentage of IMF. It results in the practice in interbreed differences, when in breeds with the double muscle (Belgian Blue cattle, Piemontese cattle) which are characterised by very low values of the IMF content, the proportion of PUFAs/SFAs can range in values even higher than 0.5, whereas for breeds with typically higher values of IMF this proportion can decrease as low as to 0.05 (De Smet et al., 2004). From the point of view of the nutrition the higher values of PUFAs/SFAs are desirable, though the n-6 PUFAs/n-3 PUFAs proportion, which would not exceed the value of 5, is currently considered as a more significant "health" indicator.

### Genetic factors

In the cases, when the animals of the same sex originating from the same production system are fed by the identical feeding ration and are slaughtered in the same age, the slaughter weight as well as a degree of fatness (IMF content) show sometimes the significant distinctions in a fatty acid profile in fat between various breeds or individuals of the same breed. These differences have a genetic background and it is evident, that they reflect the differences in genotype, gene expression or enzymatic activities, which participate in the fatty acid transport, synthesis of metabolism. The mentioned differences we described in our papers, in which has been studied the influence of a breed to which the animal belongs, and this for some meat cattle breeds kept in the Czech Republic on the fatty acid profile in beef muscle and subcutaneous fat (Bureš et al., 2006; Bartoň et al., 2007 and 2008).

Only a few information related to the genetic parameters of the fatty acid distribution in meat or milk is currently available. The estimations of the coefficients of heritability for particular fatty acids in beef markedly differ, but for the most significant SFAs and MUFAs they range from 0.20 to 0.49 (Tait et al., 2007). From available data there issues that the selection for „healthier“ meat is theoretically possible. But there is evident that rather than for individual fatty acids, it will be necessary to carry out the selection for certain indexes of fatty acids which reflect the activity of particular enzymatic systems participating in the total fatty acid profile in meat.

The way of fatty acid absorption from a feeding ration and their *de novo* synthesis in different ruminant tissues are gradually clarified together with the role of particular enzymes and regulatory mechanisms. The development of molecular genetics and genomics methods enables a study of individual genes which determine the meat quality traits and so the distribution of fatty acids in fat. The genomics can be divided in two basic parts. While the structural genomics works out the genome „sequencing“ of various species and enables a better understanding the genome structure, polymorphisms and possible markers utilisable for breeding, the functional genomics is focused on the functionality

characteristics of particular genes within the protein creation and the method of the regulation of this process (Hocquette et al., 2007).

In order to be the methods of molecular genetics used in future within the framework of breeding procedures or production systems, there is a necessity to prove the relevancy of the relationships of respective „candidate“ genes related to the distribution of fatty acids in meat and to examine more thoroughly the mechanisms of their function. Therefore, we are currently aimed at the determination of the relationship between the gene of enzyme stearoyl-CoA desaturase (SCD) which significantly participates in the biosynthesis of some nutritionally significant MUFAs, if need be other genetic factors, and phenotype variability of the fatty acid profile in beef.

## Conclusion

The issues of health and safety food are recently the subject of an increased attention. Due to the fact that the „harmfulness“ or vice versa „benefit“ of the consumption of certain fatty acids contained in lipids of cattle body tissues is well known, within the framework of our research activities we try to contribute to the description of the factors, which are influenced by the distribution of these fatty acids influence. The information obtained would lead in future to the targeted production of beef, which will better fulfil the requirements of nutritionally balanced food.

## Acknowledgment

The described research plan is supported by the MZE 0002701403 and QH 81228 projects. I would like express my thanks to my colleagues from the Cattle Breeding, Molecular Genetics, Physiology and Nutrition of Farm Animals and Quality of Animal Products Departments, with whom I co-operate on given research plans.

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*Bull fattening in the experimental stable of the Institute of Animal Production Uhřetín*



## DEVELOPMENTS IN CATTLE BREEDING

Josef Přibyl

### Introduction

The research in the area of dairy and meat cattle breeding is very closely linked to the practical breeding, for which the individual breeders associations are responsible. The unit with whom we co-operate is the population (breed). Through the breeding associations and the Central Register of Farm Animals are received the records for the research and from the co-operation result the subjects for the research plans. The research results are continuously revised methodological procedures for particular sectors of the breeding. Current state of the breeding is influenced by the following items:

- Development of computer technology, informatics, programming and mathematic statistics;
- Development of the reproductive biotechnology methods;
- A great extent of the bred populations' performance control and the state of kept databases;
- Records on the performance of animals overlapping a number of generations;
- Development of molecular and population genetics;
- State of national economy and international trade.

The cattle breeding undergoes a high development which is shown in changes of the particular property levels which influence breeder's economy. The breeding is conditioned by the farming systems, economic conditions, monitored qualities and last but not least by the different extent of the insemination. From the world-wide point of view there is possible to detail according to the production conditions three main areas, which in an essential way effect the production economy and thereby also the selection plan, which is for individual countries considerably different, this is, as follows:

- The Europe with the excess and production elimination as well as forced decreasing livestock and production;
- America and Australia with a great market possibilities and increasing livestock and production;
- Third world with a lack of essential food.

Simultaneously, with the development of the breeding, the trade with genetic material thanks to the development in reproductive biotechnology methods becomes easier. This is shown in a general globalisation of the breeding and the escalation of economically strong companies' influence. The trade enables in breeding the use of the superior animals from the world-wide resources. It does not concern just the breeding of particular closed breeds, but common breeding of the breed group of the same production type. Currently, it is valid for every economically significant breed, the populations are world-wide open and there is a great migration of the genetic material. A global integration of the breeding without taking into account the genotype interaction with a breeding environment conflicts with different breeding conditions and economic situation in distinct countries.

A further result in intensively bred breeds is an increase of world-wide mutual relationship between every animal which is shown in a higher level of the inbreeding coefficient, inbreeding depression, fast global propagation of genetic defects (for example, CVM) through a few of individuals and decreasing effective size of the population. For the Holstein cattle with a total number of heads in particular countries amounts to hundreds of thousands up to million, the effective size of the populations is after the corrections for mutual relationship estimated as approximately 30 to 80 heads.

The world-wide breeding speeds the genetic changes in particular countries. Even though the performances of the same breed due to the breeding methods and conditions frequently substantially differs among the countries, with increasing relationship there occurs among the countries a decrease in genetic differences, which are almost negligible and only exceptionally reach a half of the genetic standard deviation (which related to the genetic profit represents a three year delay in breeding at the most – see below). A total variability of the measured indicators is from 60 to 80% generally influenced by the breeding conditions and remaining 20 to 40% is the natural biological (phenotype) variability. With the heritability of yield properties approximately  $\frac{1}{4}$ , then the genetic variability represents 5 to 10% from the original variability of the measured values. A significant shift has been reached after all using genetic variability in the breeding. An annual genetic profit in the milk performance for a number of breeds exceeds 120 kg of milk (VanRaden, 2005), which is approximately  $\frac{1}{5}$  of the genetic standard deviation.

For domestic farmers and breeders results from this a possibility for using a world-wide genetic material, but as well the global competition in possibilities for the implementation of its own product on the market. The results is that a number of breeders and breeding enterprises become „only businessmen“ with foreign genetic material and from a huge number of breeding husbandries become production or reproductive keepings of a foreign material. This fact has adverse effects, because „breeders-businessmen“ under the pressure of profit from the sale offer many times other genotypes than whose which are suitable for economic conditions of the breeders.

The breeders, breeding associations and insemination companies are involved in the breeding. Organisation of the selection programme is under these conditions difficult, because there are present interfering antagonistic interests of individual participants. It is hard to enforce an optimal organisation of the selection programmes which results from the optimisation simulation studies and enables as high as possible genetic and economic benefit for the breeder (Příbyl et al., 2004). The breeding is closely related to the legislation of single countries. In the northern countries and the Netherlands the cattle breeding is centralised and scientifically managed. But in most of other countries this is left to a free development, while the breeding associations are allowed by the act only to determine limit frameworks within the boundaries, where the individual participant can move

### Genetic evaluation

In these relationships the significance of national and international evaluations of animals' credibility increases. A permanent development of animal evaluation methods has become an advertising instrument for the trade with economic impacts, therefore each country pays attention to keep pace in the evaluation methods in the international comparison with other countries. Nowadays, there are generally used the evaluation methods for breeding animals based on the „Animal model“.

The mutual comparison of genetic levels of the populations kept in particular countries is due to various conditions difficult. Therefore, the International Committee for Animal Recording (ICAR) has been established, which issues the rules and recommendations for the performance inspection in order to be the data globally comparable. Within the framework of the ICAR the non-profit organisation Interbull ([www.interbull.org](http://www.interbull.org)) has been established in 1983. The Interbull carries out directly the international genetic comparison of breeding bulls of dairy breeds and issues the recommendations for the national methods of genetic evaluation (the estimations of breeding values). One of the first meetings of the Interbull took place in Prague in 1984. The importance of the Interbull increases; currently there are involved 42 countries. For the world-wide determination of bull breeding values is currently used the MACE method, which converts the partial breeding values from particular countries for a multi-dimensional quantity, the method considers the same properties in different countries as other qualities mutually correlated, which enables to take into account the interaction of genotype with the environment. With respect to the good experience with the Interbull and its benefit for particular member states the Interbeef ([www.interbeef.org](http://www.interbeef.org)) has been established in 2007, this organisation should carry out similar services for meat cattle.

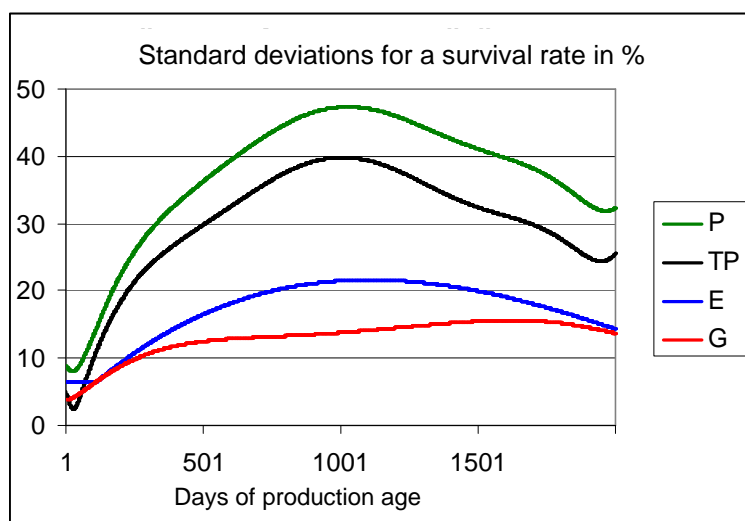
### The global development of the evaluation methods for breeding values is proceeding in several directions, as follows:

- **MT-AM** (Multi traits animal model). The breeding value estimation for as great as possible number of properties in the performance checks using mutual correlation between characteristics. The breeding value estimation of each property is specified through the data on further mutually correlated characteristics (Veselá et al., 2005).
- **RR-TDAM** (Random regression test day animal model). The method consists in the summary data scan into the causal components. It is related to the cases, when measured values can be considered as the same qualities determined by the repeated measurements (longitudinal data) and there is possible to smooth with them the curve depending on time. The curve is distributed into the components of fix average regression and random regressions for the genetic component and the permanent environment of the individual. An example of this are milk production established on the basis of check days during the lactation (Zavadilová et al., 2005), somatic cell content in milk and udder health status (Zavadilová et Němcová, 2008), growth curve of bulls (Příbyl et al., 2008), cattle longevity (Krejčová et al., 2008) and cattle fertility.

In the dependence on time changes the level of monitored feature but as well its variability and genetic conditionality. For example, the standard deviations for genetic component (G), component of permanent environment of an individual (TP), residual component (E) and their summary phenotypic expression (P)



for survival rates from 1<sup>st</sup> up to 2000<sup>th</sup> day of the production age are depicted in the Figure. Single components have different course. From mentioned issues the different heredity and probability as well other gene action on the survival rate in distinct age. Therefore, it is impossible to treat with this feature as just with a single simple quality, but there is necessary to modify the evaluation methods.



- M-Maternal** All qualities which related to the growth and fertility are simultaneously influenced by the direct and maternal effect, possibly even the paternal effect. The intrauterine development is already influenced partly by mother, partly genetic disposition of an embryo. This effect shows as a very strong in the pasture breeding of meat cattle with calves in mothers on the pasture. The maternal effect acting „takeoff“ of a young into the life dies away to a relatively high age, in cattle it is estimated up to the age of 18 to 20 months. The influencing by the mother has two components, namely the additive-genetic and the permanent maternal environment. In this case, the measured figure within the evaluation is distributed into three causal components: breeding value for direct effect, breeding value for maternal effect and non-genetic effect of the permanent maternal environment (Vostrý et al., 2007).
- Survival (Kit) Analysis**, (survival analysis). This method has been at first used in human medicine for the prognoses to what age will live newborns or how long will survive the patient with a certain disease. Currently, it is used in large sets for the determination the breeding value of cattle longevity (Páchová et al., 2005). In contrast with previous methods which are based on linear models, the survival analysis is based on the theory of hazard functions.

The presumption and enter data in the genetic evaluation are reliably determined by the population genetic parameters. Currently, they are generally determined by means of the REML and Gibbs Sampling methods and they require the expert analysis and the modification of enter sets to enable single components of the variance to be estimated (Vostrý et al., 2007, Zavadilová et al., 2005).

### Summary of the qualities

The breeding aim is to achieve the improved breeding economy which is reached by the improvement of the summary of each quality. The features, on which we are interested in, are generally distributed on the main yield properties, functional qualities – secondary, which are related to the total animal health and accompanying qualities, such as their exterior which mostly serves the supporting non-direct selection on other qualities.

The importance of properties in the breeding is given by their economic value which is determined on the basis of the bio-economic models of the closed herd turnover. It reflects a change in profit of the whole herd turnover counted per one average kept cow per year, as the monitored property has been changed by a unit. For the determination of economic values were worked out the programs for dairy and meat cattle (Wolf et al., 2008), which were used for modelling various economic and management conditions (Wolfová et al., 2007). The economic values of particular qualities are the basis for setting the selection aim under given management conditions.

Using the economic values, the breeding values of particular properties are combined into the selection indexes with the objective to reach as precise as possible the summary evaluation of the

individuals – candidates for the breeding (Šafus et al., 2005). In the co-operation with the breeders associations the indexes are continuously specified. Gradually, by the effect of changing economic conditions, the importance of properties in the breeding moves from the main production properties to the functional qualities and new indicators are added

### QTL and SNP

For the quantitative production qualities can certain genes play a greater role and therefore there is made an effort to their direct use within the framework of the breeding on the basis of the genotyping. It is related to the „candidate“ genes or QTL, which will explain a certain part of the genetic variability. The genes act in the mutual interactions. We anticipate that due to the influence of the multi-generation permanent selection the interactions for cultural breeds are steady in favourable conditions, suitable for a given production direction and breeding conditions. These combinations are due to the selection interventions and breeding bull import from other populations affected, and therefore they can within the some families for a certain period, until the stability of gene linkages will be set again, manifest differently, which is exploitable within the selection. The use of the molecular genetics markers in the breeding is included into the further selection point of view and related to further financial investments into the breeding. Their use consists in the selection indexes for the pre-selection of young animals. The benefits in comparison with „existing“ breeding:

- Enhancement of the selection difference by decreasing the correlation between the relatives;
- Enhancement in animal selection accuracy;
- Selection indicators utilisable for young individuals, which enable reducing a generation interval and saving the costs for following animal testing and production check.

The substance lies in the separation of the effect of simply heritable and ascertainable indicator from the influence of other genetic background. Using the analysis of the breeding values, the effect of selected loci for main qualities related to the milk production has been determined (Matějček et al., 2008). The evaluation is generally carried out on the basis of the yield expressed in DYD (daughter yield deviation), which is independent on the reliability of single breeding values and it makes possible to record the genetic variability also within the families. Its use in breeding is conditioned by an early laboratory analysis for the whole sub-population, which is to be a subject of the pre-selection (young bulls) and the use in breeding as fast as possible, until the disturbance of the found interactions occurs.

Due to the development of laboratory methods is currently possible and financially available to carry out the analyses for every individual from the respective sub-population in a great number (up to tens of thousands) of single nucleotides (SNP), closely covering the whole genome. Next it is possible on the basis of the correlations between every SNP and the rest of genome to establish the summary relationship to the respective performance property. Whereas using the pedigree values on the basis of polygenes the breeding value for young animals is predicted with the reliability of 30%, using the SNPs an increase in the reliability up to 50 to 70% is expected. Their use in breeding is related to a regular repeated evaluation of the SNP relation to the data in production check and the formation of always new selection indexes for young animals.

At the Interbull level the inclusion of SNPs into the international evaluation is under the consideration, there is the prerequisite of similar evaluations as well at the national levels of particular member states. Thereby, there are changed to a certain extent, the working methods, numerical and statistics procedures and algorithms of programming „Animal models“, because for each individual is necessary to determine, in the dependence on a number of SNPs, a great number of genetic regression coefficients (Tsuruta a Misztal, 2008).

### Conclusion

The importance of cattle breeding is closely related to the economic significance of the whole branch. The breeding as well the development of breeding methods, particularly method for the genetic evaluation of individuals (breeding value estimation) has an international character. Breeding fruitfulness, thereby also the fruitfulness related to the development is strongly dependent on the intrastate organisation and legal financial state aid. Practical breeding cannot get along without the permanent connection with the research and continuous specification of every working procedure. The research in breeding cannot still work without approaches to the whole population data which are at the level of world requirements and without the result examinations at the level of all developing populations.

The basis of the research in breeding is a permanent long-term activity at the level of a general development of the science in broad connections. The research, thereby workers' skill in the branch is based on the methods of the population and quantitative genetics using new knowledge related to the expertness in mathematics, statistics, informatics, programming, computer technology, other genetics areas, special and general zootechnics, economics and essential biological sciences. To this continuous development of the branch, accompanied by working skills of the researchers, the elaboration of partial tasks is connected. These tasks must be carried out from the point of view of the users very fast, and that in a time period of several weeks.

In the face of new knowledge in molecular genetics (SNP) a new field for the research in cattle breeding is opening.

### Acknowledgement

I would like to express my thank to my colleagues from the Genetics Department and Farm Animal Breeding Department as well as other departments, who participated on the development of methodical procedures and handover of the results to the users. The research was covered, particularly by the institutional aim MZE0002701401.

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## IMPORTANT RESEARCH RESULTS IN 2008

The year 2008 was a rich one for significant publications. Early in the year the prestigious journal **Science** published a breakthrough from the international team, with the Institute's scientists participating, about the role of nucleolus in embryo development. In September, the report about epochal technology – revitalising lyophilized cells for cloning, verified by the same team - attracted the attention of the world's media. This discovery was classified as the greatest success in Czech science.

### Reports

#### THE MATERNAL NUCLEOLUS IS ESSENTIAL FOR EARLY EMBRYONIC DEVELOPMENT IN MAMMALS

Sugako Ogushi, Chiara Palmieri, Helena Fulka, Mitinori Saitou, Takashi Miyano, Josef Fulka, Jr.

With fertilization, the paternal and maternal contributions to the zygote are not equal. The oocyte and spermatozoon are equipped with complementary arsenals of cellular structures and molecules necessary for the creation of a developmentally competent embryo. We show that the nucleolus is exclusively of maternal origin. The maternal nucleolus is not necessary for oocyte maturation; however, it is necessary for the formation of pronuclear nucleoli after fertilization or parthenogenetic activation and is essential for further embryonic development. In addition, the nucleolus in the embryo produced by somatic cell nuclear transfer originates from the oocyte, demonstrating that the maternal nucleolus supports successful embryonic development.



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### New Study Shows Cloning from Dried Cells Now Possible

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MT, LAUREL, N.J., Sept 08, 2008 /PRNewswire via COMTEX/ -- Core Dynamics Inc. today announced that cloning with freeze-dried

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### New Study Shows Cloning from Dried Cells Now Possible

Posted 08 September 2008 @ 05:20 pm EST

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MT, LAUREL, N.J., Sept. 8 /PRNewswire/ -- Core Dynamics Inc. today announced that cloning with freeze-dried cells is possible for the first time, according to new study findings in the August

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## IMPORTANT SCIENTIFIC PUBLICATIONS

**BARTOŇ, L., MAROUNEK, M., KUDRNA, V., BUREŠ, D. & ZAHRÁDKOVÁ, R.** Growth, carcass traits, chemical composition and fatty acid profile in beef from Charolais and Simmental bulls fed different types of dietary lipids. *Journal of the Science of Food and Agriculture*, 2008, roč. 88, s. 2622-2630.

*At present, owing to understanding of the role of dietary fat in human health, the nutritional quality of meat is of great attention. Thus, recent research has focused on feeding strategies increasing unsaturated fatty acids (FA) in the lipids of edible tissues. The objective of the study was to determine the effects of breed and whole sunflower seed on growth, carcass traits, chemical composition of meat and meat FA profile in Charolais (CH) and Simmental (S) bulls. The CH bulls had a lower feed intake, a higher killing out percentage and carcasses that are more valuable. The superiority of the CH over the S breed in a number of economically important traits was thus demonstrated. The sunflower seed supplement increased the proportions of linoleic acid and conjugated linoleic acid and the ratio of polyunsaturated FA to saturated FA and decreased the index of atherogenicity of FA in meat lipids. The breed effect on the nutritional quality of meat was ambiguous.*

**ROSOCHACKI, S.J., JUSZCZUK-KUBIAK, E., BARTOŇ, L., SAKOWSKI, T., POLOCZYNOWICZ, J., BARANOWSKI, A. & MATEJCZYK, M.** Preliminary observations upon relation between the G77A polymorphism in CATD gene and lysosomal proteinases activity and sensory traits of meat from bulls of three breed. *Animal Science Papers and Reports*, 2008, roč. 26, s. 25-35.

*In the present study for the first time, the associations were shown between RFLP/ApaI of the bovine CATD gene and the activity of cathepsins and several meat quality traits in a group of Polish Black-and-White, Charolaise and Simmental cattle. As the investigation was performed on 65 animals only, the findings presented might not be numerous enough to allow the proper definite conclusions concerning the influence of the mutation on activity of some lysosomal proteinases in different cattle genotypes and on meat quality traits.*

**HORKÝ, P., SLAVÍK O. & BARTOŠ, L.** A telemetry study on the diurnal distribution and activity of adult pikeperch, *Sander lucioperca* (L.) in a riverine environment. *Hydrobiologia*, 2008, roč. 614, s. 151-157.

*The diurnal movements and spatial distribution of adult pikeperch, Sander lucioperca, in the Elbe River, Czech Republic was observed using radio telemetry. The hypothesis that light intensity, within four different intervals (dawn, day, dusk, night), would determine the spatial distribution of pikeperch in a riverine environment were tested across a time span of 12 months. During the day, fish were located in deep water of the main channel, moving towards shallower waters during twilight and residing in the littoral zone, closest to the riverbanks, at night. Movement activity followed the behavioural pattern in a drainage canal with maximum at twilight and minimum at night. This suggests that nocturnal positions of adult pikeperch in the shallows were not associated with hunting but more likely with resting.*

**FRIČOVÁ, B., BARTOŠ, L., BARTOŠOVÁ, J., PANAMÁ, J., ŠUSTR, P. & CHALOUPKOVÁ, H.** Comparison of reproductive success in fallow deer males on lek and single temporary stands. *Folia Zoologica*, 2008, roč. 57, s. 269-273.

*Lek is a territorial mating strategy, which is widely spread amongst males in the fallow deer, Dama dama high-density population. A group of fallow deer was studied where males exhibit a mixed mating system with territorial (single temporary stands, leks) and non-territorial strategies during the rut. Reproductive success was estimated indirectly by counting females/minute held per male on both the lek and single temporary stands. In contrast to other reports, males on leks were accompanied with significantly less females compared to those on single temporary stands. The results suggest that under specific conditions (over-abundance of adult males compared to females) attracting females on the lek need not be the most effective one..*

**BARTOŠ, L., BARTOŠOVÁ, J. & STAROSTOVÁ, L.** Position of the head is not associated with changes in horse vision. *Equine Veterinary Journal*, 2008, roč. 40, s. 599-601.

*It has become accepted that the horse cannot see directly in front when his nose is lowered and thus the horse must rely on the rider. The hypothesis was tested that this conclusion would be correct only if the horse did not adjust the eyeball horizontal axis to changes of the head position. The results of the present study suggest that it is unlikely that horses have limited vision in relation to their head*

position when driven by the rider, and that the horse maintains the optimal horizontal eyeball position regardless of head position relative to the ground.

LHOTA, S., JUNEK, T., **BARTOŠ, L.** & KUBĚNA, A.A. Specialized use of two fingers in free-ranging aye-ayes (*Daubentonia madagascariensis*). *American Journal of Primatology*, 2008, roč. 70, s. 786-795.

*The aye-aye (Daubentonia madagascariensis) possesses a hand with highly specialized the third and the fourth fingers. We observed the use of those fingers in various activities in four free-ranging aye-ayes. We found that the thin third finger was used exclusively or preferably for tapping, inserting into the mouth (probably for cleaning the teeth), probing for nectar, kernels and insects in bamboo, twigs, and live wood. In contrast, the robust fourth finger was used preferably when eating jackfruit (Artocarpus heterophyllus). When probing for invertebrates in soft plant tissues and in dead wood, both fingers were used. To extract the contents from coconuts, the two fingers were apparently used for different tasks. From this unique study, we conclude that the third finger appears to be specialized for use in tasks requiring high mobility, sensitivity and precision, whereas the fourth finger appears to be specialized for tasks requiring strength, scooping action and deep access.*

SVOBODOVÁ, I., VÁPENÍK, P., PINC, L. & **BARTOŠ, L.** Testing German shepherd puppies to assess their chances of certification. *Applied Animal Behaviour Science*, 2008, roč. 113, s. 139-149.

*Behavioural activity of 7-week-old German shepherd puppies was tested and the activities analyzed if they could be used for predicting police efficiency of the individual. The tests in our study seem to be a good base that might enable selection for suitable dogs as early as 7 weeks of age. The puppies having high probability to pass certification in adulthood were heavy individuals willing to chase, catch, and fetch a tennis ball, and following a rag drawn away from them, while weakly responding to a distracting noise in various situations and showing low activity while negotiating obstacles and interacting with the tester. To conclude, contrary to sceptical assumptions expressed by various authors, the specific puppy tests for police dogs provide a reliable tool for predicting future service ability of a puppy. Differences in methodology are likely to contribute to a lack of consensus among various studies.*

HOMOLKA, M., HEROLDOVÁ, M. & **BARTOŠ, L.** White-tailed deer winter feeding strategy in area shared with other deer species. *Folia Zoologica*, 2008, vol. 57, p. 283-293.

*Population numbers of introduced white-tailed deer (WTD) have remained stable despite almost no harvesting. One of the factors preventing expansion of the WTD could be lack of high-quality food in an area overpopulated by sympatric deer species. The winter diets were analyzed to recognize their feeding strategy focusing primarily on conifer needle - an indicator of starvation, and on bramble leaves - an indicator of high-quality items. The volume of bramble decreased in all four deer species from November to March. The content of conifer needles in the diet of WTD and roe deer made in spring up 90 % of their diet volume. Conifer needles in the diet of red and fallow deer occurred only in January with snow cover. A high content of conifers can negatively affect condition of WTD and roe deer. The dietary overlap of four sympatric deer species was extensive in winter. All species share a limited good quality food supply when food is scarce, thus, interspecific competition may occur.*

**BOUŠKA, J.**, ŠTÍPKOVÁ, M., PYTLOUN, P., PYTLOUN, J. & KUBEŠOVÁ, M. Relationships among body condition score, milk yield and sires' breeding value for beef production efficiency in Czech Fleckvieh cattle. *Czech Journal of Animal Science*, 2008, roč. 53, č. 11, s. 453-461.

*The objective of this study was to analyze the relationships among cows' BCS before calving, subsequent BCS changes, milk yield, lactation characteristics and their sires' relative breeding value for net daily gain. Regarding the results, it may be stated that BCS measurement can be an effective tool for general management improvement also in dual-purpose herds. The genetic merit of cows' sires for beef production efficiency did not have a statistically significant effect either on BCS development in the particular lactation periods or on the milk yield of their daughters. It can be recommended to include BCS evaluation in the exterior classification in Czech Fleckvieh cows similarly like it is used in other countries with the advanced breeding of Holstein cattle. These results show that it is also possible to select the Czech Fleckvieh population for good BCS and optimal milk yield.*

**BUREŠ, D.**, BARTOŇ, L., ZAHŘÁDKOVÁ, R., TESLÍK, V. & FIEDLEROVÁ, M. Calving difficulty as related to body weights and measurements of cows and calves in a herd of Gascon breed. *Czech Journal of Animal Science*, 2008, roč. 53, s. 187-194.

*This study was conducted to evaluate the body weights and measurements of Gascon calves and their dams. Internal pelvic measurements were significantly associated with the occurrence of assisted*

calvings and stillborn calves. Primiparous cows had a smaller pelvic area, lower live weight, and difficulty in calving was more frequent compared to older cows. A higher incidence of difficult calvings was observed in bull-calves due to their higher birth weight. High and significant correlation coefficients were determined between the birth weight and body measurements of the calves as well as between the calf birth weight and the course of parturition. Negative correlations were calculated between the internal pelvic measurements of the cows and the course of parturition score. It was concluded that the internal pelvic measurements of the dam and the size and shape of the calf were the factors influencing the course of parturition in this study to the largest extent.

**DLOUHÁ, G., ŠEVČÍKOVÁ, S., DOKOUPILOVÁ, A., ZITA, L., HEINDL, J. & SKŘIVAN, M.** Effect of dietary selenium sources on growth performance, breast muscle selenium, glutathione peroxidase activity and oxidative stability in broilers. *Czech Journal of Animal Science*, 2008, roč. 53, s. 265-269.

*This study examined the effects of supplementation of dietary sodium selenite (SS) and sodium enriched alga Chlorella (SCH) on growth performance, selenium concentration in breast meat and excreta, activity of glutathione peroxidase (GSH-Px) in meat, and oxidative stability of meat in broilers. Broiler cockerels were allotted to 3 dietary treatments. The basal diet was supplemented with 0 (control) or 0.3 mg/kg Se from SS or SCH. Dietary supplementation with SCH increased body weight. The breast muscle Se concentration was increased by SCH supplementation, but not by SS supplementation. The concentration of Se in excreta was highest in the SS group. The activity of GSH-Px in breast meat was significant in all treatments. The inclusion of SCH in the diet enhanced the oxidative stability of meat.*

**LOI, P., BEAUJEAN, N., KHOCHBIN, S., FULKA Jr., J. & PTAK, G.** Asymmetric nuclear reprogramming in somatic cell nuclear transfer? *Bioessays*, 2008, roč. 30, s. 66-74.

*The article discusses the eventuality of asymmetric nuclear reprogramming in somatic cell nucleus transfer clones. We suggest that changes in the epi/genotype observed in cloned embryos arise from unbalanced nuclear reprogramming between parental chromosomes. Thus, it is supposed that paternal reprogramming does not occur, as these chromosomes are rather resistant to oocyte reprogramming factors.*

**LOI, P., MATZUKAWA, K., PTAK, G., NATAN, Y., FULKA, Jr., J. & ARAV, A.** Nuclear transfer of freeze-dried somatic cells into enucleated sheep oocytes. *Reproduction in Domestic Animals*, 2008, roč. 43, s. 417-422.

*In our experiments we have tested the viability of freeze-dried somatic cell nuclei after their injection into enucleated sheep oocytes. Several modifications of lyophilisation were developed. We have demonstrated that approximately 16% of reconstructed embryos with lyophilised somatic cell nuclei developed at least up to blastocyst stage.*

**FULKA, Jr., J., FULKOVÁ, H., ST JOHN, J., GALLI, C., LAZZARI, G., LAGUTINA, I., FULKA, J. & LOI, P.** Cybrid human embryos-warranting opportunities to augment embryonic stem cell research. *Trends in Biotechnology*, 2008, roč. 26, s. 469-474.

*In our article, we discuss the possibility of hybrid human-animal embryos creation and the use of these embryos in embryonic stem cell research. We claim that these hybrid embryos can be acceptable from ethical point of view. On the other hand, we also discuss some biological aspects that need to be solved urgently.*

**FULKOVÁ, H.** Changes in global histone acetylation pattern in somatic cell nuclei after their transfer into oocytes at different stages of maturation. *Molecular Reproduction and Development*, 2008, roč. 75, s. 556-564.

*The article describes changes in global acetylation pattern in somatic cell nuclei after their transfer into oocytes at different stages of maturation. These changes are not prominent before germinal vesicle breakdown or after the oocytes activation. The extensive changes however occur when nuclei are transferred into oocytes with condensed chromosomes.*

**OGUSHI, S., PALMIERI, CH., FULKOVÁ, H., SAITOU, M., MIYANO, T & FULKA, Jr. J.** The maternal nucleolus is essential for early embryonic development in mammals. *Science*, 2008, roč. 319, s. 613-616.

*The article describes the essential role of maternal nucleoli for early embryonic development in mammals. These experiments are based on our original enucleolation technique that enables us to manipulate the oocyte nucleoli. We showed that these nucleoli are not essential for oocyte maturation.*



Once removed, they are re-assembled again. Moreover, the oocyte nucleolar material cannot be replaced with somatic or embryonic stem cell nucleolar material.

**FULKOVÁ, H., ST.JOHN, J., FULKA, J. & HOZÁK, P.** Chromatin in early mammalian embryos: achieving the pluripotent state. *Differentiation*, 2008, roč. 76, s. 3-14.

*Gametes of both sexes are highly specialized and terminally differentiated but within a very short time period after fertilization, both these genomes are converted into a totipotent embryo genome. Within further embryonic cleavages, this reprogramming continues but concomitantly certain differentiation processes occur. These changes are accompanied by DNA methylation and histone acetylation as well as with some others histone covalent modifications.*

**FULKOVÁ, H., BARNETOVÁ, I., MOŠKO, T. & FULKA, Jr. J.** Epigenetic analysis of human spermatozoa after their injection into ovulated mouse oocytes. *Human Reproduction*, 2008, roč. 23, s. 627-634.

*The epigenetic status of human spermatozoa is difficult to analyse. The method of interspecies fertilization is widely used for different purposes. In our experiments, we have adopted this approach for the analysis of epigenetic status of human spermatozoa after their injection into ovulated mouse oocytes. Our model system allows us to evaluate some epigenetic parameters of spermatozoa. This method can thus be used for different fertility assessment purposes.*

**HOMOLKA, P., KOUKOLOVÁ, V., NĚMEC, Z., MUDŘÍK, Z., HUČKO, B. & SALES, J.:** Amino acid contents and intestinal digestibility of lucerne in ruminants as influenced by growth stage. *Czech Journal of Animal Science*, 2008, roč. 53, s. 499-505.

*Lucerne is the main forage crop for ruminants. However, its protein value might be reduced by nitrogen losses that occur during extensive rumen degradation and, likewise, the protein value of forages are related to the stage of maturity (growth stage). A preliminary study was conducted to evaluate these influences in lucerne (var. Palava) grown in the CR. From this study, it can be concluded that, although limited in the sample size, the amino acid contents and intestinal digestibility are influenced by growth stage, even over a period as short as 30 days. However, these parameters cannot be treated as a constant, but have to be established for each growth stage in further studies.*

**HYÁNKOVÁ, L., NOVOTNÁ, B. & DARRAS, V.M.** Divergent selection for shape of growth curve in Japanese quail. 4. Carcase composition and thyroid hormones. *British Poultry Science*, 2008, roč. 49, s. 96-102.

*Changes in the relative weights of carcase, abdominal fat, breast and leg muscles, and plasma thyroid hormone concentrations occurring during the first 6 weeks of postnatal growth were analysed in Japanese quail males divergently selected for high and low relative body weight (BW) gain between 11 and 28 d of age, respectively, and constant adult BW. The results suggest that the selection for the shape of the growth curve, like the selection for body fat, modifies the carcase quality owing to shortening/prolongation of the acceleration growth phase. Individuals with a short acceleration phase of the growth curve are characterised by low carcase quality during the fattening period.*

**CHALOUPKOVÁ, H., ILLMANNOVÁ, G., PEDERSEN, L.J., MALMKVIST, J. & ŠIMEČKOVÁ, M.** Sow responsiveness to human contacts and piglet vocalization during 24 h after onset of parturition. *Applied Animal Behaviour Science*, 2008, roč. 112, s. 260-269.

*Sow responsiveness towards external disturbances and concurrent postural changes are proposed to be an important cause of early piglet crushing. The aim of this study was to assess whether loose-housed sows change their responsiveness over time within the first 24 h after birth of the first piglet upon exposure to human contact and towards piglets' scream. The responsiveness of sows toward direct human contact was lower during the first 12 h postpartum (pp). The careful handling of piglets in the home pen had a minimal effect on the probability of postural changes in sows. However, sows were highly reactive towards the screaming of own trapped piglet during the whole 24 h period pp. The relative lower responsiveness towards playbacks, decreasing from 12 to 24 h pp, cast doubt upon the piglet scream playback test as a useful approach to evaluate maternal responsiveness in sows.*

**ILLMANNOVÁ, G., NEUHÄUSEROVÁ, K., POKORNÁ, Z., CHALOUPKOVÁ, H. & ŠIMEČKOVÁ, M.** Maternal responsiveness of sows towards piglet's screams during the first 24 h postpartum. *Applied Animal Behaviour Science*, 2008, roč. 112, s. 248-259.

*Sow responsiveness towards piglet screams were studied. A sow's responsiveness to screams of her piglets was investigated along the first 24 h after birth, the period of highest mortality. Our results indicate that sows maintained their responsiveness towards piglet screams during trapping and during*



*fighting for teats within the first 24 h. Playbacks and real screams were similarly effective in evoking a response. The importance of the sound characteristics of piglet screams related to the sows' response were discussed in this paper.*

**POKORNÁ, Z., ILLMANNOVÁ, G., ŠIMEČKOVÁ, M., CHALOUPKOVÁ, H. & KRATINOVÁ, P.** Carefulness and flexibility of lying down behaviour in sows during 24 h post-partum in relation to piglet position. *Applied Animal Behaviour Science*, 2008, roč. 114, s. 346-358.

*Our study suggests that a sow's carefulness during standing-to-lying events follows a similar time course in the first 24 h postpartum as her general activity. Sows performed more pre-lying behaviour when piglets were nearby and when they were clustered at all times during 24 h after birth of the first piglet. A higher carefulness score and no piglets in danger zone factor decreased significantly the probability of piglet crushing. Further research should focus on the mechanisms, which decrease the probability that piglets are present in the danger zone and, specifically, on sow and piglet communication during the pre-lying behaviour.*

**JANČÍK, F., HOMOLKA, P., ČERMÁK, B. & LÁD, F.** Determination of indigestible neutral detergent fibre contents of grasses and its prediction from chemical composition. *Czech Journal of Animal Science*, 2008, roč. 53, s. 128-135.

*By the study on five grass species, commonly used in roughages for ruminants it was confirmed that the indigestible neutral detergent fibre (INDF) contents of grasses could be effectively predicted from acid detergent lignin contents. INDF contents markedly increased during the maturation of grasses, which has practical implications for the time of harvest.*

**KLEIN, P., KLEINOVÁ, T., VOLEK, Z. & ŠIMŮNEK, J.** Effect of *Cryptosporidium parvum* infection on the absorptive capacity and paracellular permeability of the small intestine in neonatal calves. *Veterinary Parasitology*, 2008, roč. 152, s. 53-59.

*Cryptosporidium parvum is one of the most important pathogens causing enteritis and severe diarrhoea in calves up to 1 month of age. The aim of the study was to determine the effect of cryptosporidiosis on the intestinal functions of neonatal experimentally infected Holstein calves. In infected animals, most of intestinal functions were significantly affected and changes were detected up to day 14 post infection. In contrast, results of all tests obtained on day 21 post infection suggest full recovery of the infected intestine. Significantly, growth of the calves that had recovered from cryptosporidiosis was still affected between days 14 and 21 post infection.*

**KLEIN, P.** Preventive and therapeutic efficacy of halofuginone-lactate against *Cryptosporidium parvum* in spontaneously infected calves: A centralised, randomised, double-blind, placebo-controlled study. *Veterinary Journal*, 2008, roč. 177, s. 429-431.

*The preventive and therapeutic efficacy of halofuginone-lactate (HFL) against was evaluated in a study using 260 spontaneously infected calves. HFL was administered orally for 7 days to 1-day-old and 8-day-old calves, respectively. In both treated groups the drug significantly, and in almost the same manner, decreased the intensity of diarrhoea and faecal oocyst count when compared to corresponding placebo groups. The only difference between treated groups was the time of onset of symptoms of the infection. The results confirm the anticryptosporidial activity of HFL in calves, but show that the outcome of infection following preventive treatment is comparable to that observed in calves treated after the onset of symptoms.*

**KLEIN, P., CIRIONI, O., GIACOMETTI, A. & SCALISE, G.** *In vitro* and *in vivo* activity of aurintricarboxylic acid preparations against *Cryptosporidium parvum*. *Journal of Antimicrobial Chemotherapy*, 2008, roč. 62, s. 1101-1104.

*The aim of this study was to assess the effect of commercial aurintricarboxylic acid (ATA) against *Cryptosporidium parvum*. The anticryptosporidial effect of ATA was evaluated in two *in vitro* models and *in vivo* in experimentally infected neonatal mice. In both *in vitro* models, ATA completely inhibited sporozoites. The treatment of neonatal mice with a daily ATA dose led to 97-99 % inhibition of infection without any observable negative effects on the animals. In comparison, the mean reduction of infection for paromomycin used as a positive control was 79-84 %. It can be concluded, ATA exerted high anticryptosporidial activity and should be considered for further study.*

DRÁBKOVÁ, J., BARTOŠOVÁ, J., BARTOŠ, L., **KOTRBA, R.**, PLUHÁČEK, J., ŠVECOVÁ, L., DUŠEK, A. & KOTT, T. Sucking and allosucking duration in farmed red deer (*Cervus elaphus*). *Applied Animal Behaviour Science*, 2008, roč. 113, s. 215-223.

*The objective of this study was to discriminate between sucking and allosucking behaviour in hinds and their calves of red deer according to the sucking duration. The duration of filial sucking was significantly longer than non-filial sucking. A large individual variance in the incidence of non-filial sucking was found. Sucking duration of occasionally allosucking non-filial calves was only marginally different from that of filial calves. Multiple sucking bouts were shorter than those with one calf were. Male calves sucked longer than female calves. Frequently allosucking non-filial males sucked the longest and differently from occasionally allosucking non-filial males. Frequently allosucking non-filial females sucked the shortest and differently from filial calves of both sexes. Allosucking calves differ in their sucking behaviour and two types of allosuckers (frequent and occasional) should be taken into account when analyzing allosuckling behaviour.*

MRÁZEK, J., ŠTROSOVÁ, L., FLIEGEROVÁ, T., **KOTT, T.** & KOPEČNÝ, J. Diversity of insect intestinal microflora. *Folia Microbiologica*, 2008, roč. 53, s. 229-233.

*The influence of geographic location, season, age, and part of the digestive tract on bacterial diversity was evaluated in intestinal microflora of honeybees, wasps, and cockroaches. The microflora of the bees exhibited little variations among the hives from distant locations. Their bifidobacterial population formed 2.8-8.4 % of total bacteria and was very homogeneous. The total gut microflora of wasps was also homogeneous, only two samples being affected by the season or the location; on the other hand, wasp bifidobacterial population was very heterogeneous. Cockroaches showed the highest variations in microflora composition, the age and diet being the ultimate factors. Bifidobacteria counts also varied among tested individuals (0.1-34.1 % of total bacteria). Our results suggest that nutrition habits are the strongest factor affecting the insect microflora, giving higher variations to omnivorous species.*

**KREJČOVÁ, H.**, PŘIBYL, J., PŘIBYLOVÁ, J., ŠTÍPKOVÁ, M. & MIELENZ, N. Genetic evaluation of daily gains of dual-purpose bulls using a random regression model. *Czech Journal of Animal Science*, 2008, roč. 53, s. 227-237.

*Daily gains of dual-purpose bulls from 100 to 400 days of age were analyzed by random regression models. The peak daily gain was attained between 230 and 280 days of age, which corresponded to the period of the lowest variance in daily gains. Heritability estimates of daily gain were in the range of 0.014 to 0.043. The reliability of composite trait – cumulative gains over the entire period was 0.87. Genetic correlations between gains at different ages were high for adjacent ages and decreased with increasing difference in ages. Correlations of permanent environmental effects were high for adjacent ages, but became negative for ages that were far apart, indicating the possibility of compensatory growth. The phenotypic correlations were close to zero. The correlations for cumulative daily gains were higher than those for individual daily gains were.*

JÍLEK, F., PYTLOUN, P., **KUBEŠOVÁ, M.**, ŠTÍPKOVÁ, M., BOUŠKA, J., VOLEK, J., FRELICH, J. & RAJMON, R. Relationships among body condition score, milk yield and reproduction in Czech Fleckvieh cows. *Czech Journal of Animal Science*, 2008, roč. 53, s. 357-367.

*The focus of this study was to confirm the relationship among body condition score (BCS) at the time around parturition, milk yield in subsequent lactation, reproductive efficiency and BCS development in Czech Fleckvieh dairy cows. Cows with lower BCS in the 1st month after calving showed an increase in both milk yield and FCPM yield. The BCS in the last month before parturition influenced its subsequent decrease in the 1st phase of lactation. Cows with the highest BCS before calving retained it in the next 5 months of lactation. Adequately, the cows with the lowest BCS in the 1st month of lactation had the lowest BCS in the next 4 months. BCS before calving was not related to reproduction indicators, but the significant effect of BCS in the 1st month after calving on the length of calving to the first service interval was confirmed. The group of cows with BCS>3.5 in the 1st month after calving had the most favourable reproduction indicators.*

**KUDRNA, V.** & MAROUNEK, M. Influence of feeding whole sunflower seed and extruded linseed on production of dairy cows, rumen and plasma constituents, and fatty acid composition of milk. *Archives of Animal Nutrition*, 2008, roč. 62, s. 60-69.

*Holstein cows were fed total mixed rations (TMR) supplemented with protected palm fat (PPF), whole sunflower seed (WSS) or extruded linseed (ELS). With WSS and ELS, percentage of milk fat and yield of FCM were increased. Concentration of PUFA was higher and PUFA n-6/n-3 ratios lower in the milk*

fat from ELS compared to WSS. Supplementation with oilseeds compared to PPF increased CLA in milk fat and decreased its atherogenicity. Both oilseeds improved the spreadability index of manufactured butter. Thus, feeding of oilseeds to dairy cows improved nutritional quality of milk fat.

**MAROUNEK, M., DUŠKOVÁ, D., SAVKA, O.G. & VÝBORNÁ, A.** A note on distribution of lipolytic activity in the digestive tract of veal calves. *Journal of Animal and Feed Sciences*, 2008, roč. 17, s. 166-170.

*Fat covers a major part of the calf energy requirement, thus digestion of lipids deserves attention. Six Holstein calves were fed a milk replacer and a starter concentrate. Calves were slaughtered in the 19th week of age, contents of segments of the digestive tract weighed, and lipolytic activity assayed using a tributyrine method. The highest and the lowest specific activity were found in the duodenum and abomasums, respectively. The rumen, thank to its great volume contained almost one half of the total lipolytic activity of the digestive tract. In pooled samples of digesta from the rumen, abomasums, duodenum and jejunum/ileum the highest activity was at pH of 5.5, 2.5, 8.5 and 9.0, respectively. There was no clear pH optimum of lipolytic activity in the caecal/colonic contents.*

**MAROUNEK, M., SKŘIVAN, M., DLOUHÁ, G. & BŘEŇOVÁ, N.** Availability of phytate phosphorus and endogenous phytase activity in the digestive tract of laying hens 20 and 47 weeks old. *Animal Feed Science and Technology*, 2008, roč. 146, s. 353-359.

*The availability of phytate phosphorus (P) was determined in hens fed a maize-soybean meal diet. The availability of phytate P was higher in 47-wk-old hens (53%) than in 20-wk-old hens (24%). The excreta of older hens contained significantly less phytate P (3.1 mg/g DM) than that of younger hens (4.5 mg/g DM). Specific activity (per g) in the stomach, intestinal mucosa and caeca was higher in 47-wk-old hens than in 20-wk-old hens. A relatively high total phytase activity was found in the caeca of both young (347  $\mu\text{mol/h}$ ) and old (632  $\mu\text{mol/h}$ ) hens compared to that in other digestive segments, with little activity in the stomach (47 and 102  $\mu\text{mol/h}$ , respectively), and intermediate in the small intestine (226 and 264  $\mu\text{mol/h}$ , respectively).*

**MAROUNEK, M., SKŘIVANOVÁ, V., VÝBORNÁ, A. & DUŠKOVÁ, D.** Performance and tissue fatty acid profiles in veal calves fed diets supplemented with conjugated linoleic acids. *Archives of Animal Nutrition*, 2008, roč. 62, s. 366-376.

*From clinical studies, the conjugated linoleic acid (CLA) seems to be beneficial for human health. Milk and meat of ruminants are the major sources of CLA in foods. The aim of the present study was to investigate the deposition of CLA in tissues, and alterations in performance, meat quality and tissue fatty acids (FA) profile in veal calves fed diets supplemented with CLA. In the experiment, any significant effect of CLA supplement on growth, intake of starter, feed conversion, chemical composition of meat and its oxidative stability were not detected. On the contrary, a higher dietary supplementation of CLA significantly increased CLA content in m. longissimus dorsi (MLD), in liver and in perirenal fat, but decreased the ratio of some CLA isomers in tissues, concentration of monounsaturated FA in MLD and fat and the concentration of C10 and C20 FA. In veal calves, unprotected CLA escaped ruminal hydrogenation, but it was preferentially incorporated into depot fat.*

**MAROUNEK, M., SKŘIVAN, M., DLOUHÁ, G. & BŘEZINA, P.** Digestibility of phosphorus in laying hens fed a wheat-soyabean diet and the excreta phosphorus fractions. *Journal of Animal and Feed Sciences*, 2008, roč. 17, s. 579-587.

*Availability of phytate phosphorus (P) was determined in hens 21 and 47 weeks old, fed a wheat-maize-soyabean diet, without a phytase supplement. The diet contained total and phytate P at 4.99 and 1.58 g/kg, respectively. Availability of phytate P and proportion of dietary Ca retained was non-significantly higher in older hens than in younger ones (47.3 and 56.9% vs. 38.7 and 44.4%, respectively). Amount of P retained was similar in both groups. Amount of Ca retained was significantly higher in older than in younger hens. Dry matter of excreta of 47-week-old hens contained significantly more total and phosphate P than excreta of 21-week-old hens. Phytate P represented 30.9% of excreta P in younger and 23.0% in older hens. Thus, the age and different egg production significantly affect retention of Ca and excreta composition in laying hens.*

MATĚJÍČEK, A., **MATĚJÍČKOVÁ, J.**, ŠTÍPKOVÁ, M., HANUŠ, O., GENČUROVÁ, V., KYSELOVÁ, J., NĚMCOVÁ, E., KOTT, T., ŠEFROVÁ, J., KREJČOVÁ, M., MELČOVÁ, S., HÖLZELOVÁ, I., BOUŠKA, J. & FRELICH, J. Joint effects of CSN3 and LGB genes on milk quality and coagulation properties in Czech Fleckvieh. *Czech Journal of Animal Science*, 2008, roč. 53, s. 246-252.

*The aim of this study was to determine the joint effects of CSN3 and LGB genotypes on parameters of production, quality and coagulation of milk in Czech Fleckvieh cows. Fifteen genotype combinations were detected, with ABAB (21.0 %) and AAAB (18.3 %) occurring as the most frequent. The observed genes significantly affected the contents of milk protein as well as solid non-fat in milk, casein number and curd quality. BBAA was found to be the genotype with the highest positive impact on most of the milk characteristics evaluated. Whereas ABAB, BBBB, BBAB and ABAB had a positive influence on milk quality and milk coagulation properties, genotypes containing CSN3 allele E had a negative effect. Results presented in this study are applicable in the selection of Czech Fleckvieh cattle.*

VLKOVÁ, E., RADA, V., TROJANOVÁ, I., KILLER, J., ŠMEHILOVÁ, M. & **MOLATOVÁ, Z.** Occurrence of bifidobacteria in faeces of calves fed milk or a combined diet. *Archives of Animal Nutrition*, 2008, roč. 62, s. 359-365.

*The development of faecal bacteria composition in calves fed milk or a combined diet was investigated. On day 7, bifidobacteria in faeces of milk-fed calves already increased and did not change until the end of the study, whereas in calves fed the combined diet bifidobacteria only moderately increased and then decreased slowly until day 21. The counts of bifidobacteria in calves on a combined diet were significantly lower compared to those in milk-fed calves. The results showed that the occurrence of bifidobacteria in calf faeces is highly dependent on the diet composition. Faecal bacteria flora of calves fed exclusively by milk is rich in bifidobacteria, but in calves on a combined diet coliforms dominated.*

JEŠETA, M., **PETR, J.**, KREJČOVÁ, T., CHMELÍKOVÁ, E. & JÍLEK, F. *In vitro* ageing of pig oocytes: effects of the histone deacetylase inhibitor trichostatin A. *Zygote*, 2008, roč. 16, s. 145-152.

*After in vitro maturation, the unfertilized pig oocytes underwent the process called ageing. This process involves typical events such as fragmentation, spontaneous parthenogenetic activation or lysis. Inhibition of histone deacetylase, using its specific inhibitor trichostatin A (TSA), significantly delayed the maturation of pig oocytes cultured in vitro. The ageing of oocytes matured under the effect of TSA is the same as the ageing in oocytes matured without TSA. The inhibition of histone deacetylase during oocyte ageing significantly reduced the percentage of fragmented oocytes. The parthenogenetic development in oocytes aged under TSA treatment is similar to the development of fresh oocytes (29% of blastocyst) artificially activated immediately after in vitro maturation.*

VODKOVÁ, Z., RAJMON, R., **PETR, J.**, KLABANOVÁ, P. & JÍLEK, F. Effects of genistein and genistin on *in vitro* maturation of pig oocytes. *Czech Journal of Animal Science*, 2008, roč. 53, s. 1-8.

*The effects of GEN (genistein – an inhibitor of tyrosine protein kinase – TPK) and GIN (genistin, an analogue of GEN without effects on TPK) on pig oocyte maturation and cumular cell expansion under in vitro conditions and connection with their estrogenic activity were tested. Further, the reversibility of GEN effects was verified. GEN blocked pig oocyte maturation at the stage of the germinal vesicle (GV), depending on the dose. After rinsing out the GEN the oocyte maturation recovered, but with abnormalities. As for GIN, with an increase in its concentration, the number of oocytes blocked at the GV stage significantly decreased, but the abnormal maturation increased. GEN inhibited the cumular cell expansion in proportion to its dose. GIN had a less pronounced effect. As GEN and GIN effects demonstrate similar patterns, it is probable that estrogenic activity is involved.*

KONEČNÁ, M., LHOTA, S., WEISS, A., URBÁNEK, T., ADAMOVÁ, T. & **PLUHÁČEK, J.** Personality in free-ranging Hanuman langur (*Semnopithecus entellus*) males: Subjective ratings and recorded behavior. *Journal of Comparative Psychology*, vol. 122, p. 379-389.

*Commonly defined, personality refers to characteristics of individuals that describe and account for consistent patterns of feeling, thinking and behaving. In animals, two approaches to research of personality are used: either behavioral coding methods describing observed behavior in an ethogram or personality ratings using rating scales (adjectives) by knowledgeable raters. The goal of this study was to assess personality in Hanuman langurs (*Semnopithecus entellus*) individuals using the above two methods. By comparing the results to those derived in other nonhuman primates better understanding of the evolutionary bases of personality dimensions were expected. The findings highlighted the*

*comparability of behavioral coding and personality ratings and suggested that some aspects of personality structure would likely have been present in the common ancestor of Old World Monkeys.*

**PŘIBYL, J., KREJČOVÁ, H., PŘIBYLOVÁ, J., MISZTAL, J., TSURUTA, S. & MIELENZ, N.** Models for evaluation of growth of performance tested bulls. *Czech Journal of Animal Science*, 2008, roč. 53, s. 45-54.

*The growth curves of young bulls tested at performance-test stations were spread out into genetic, animal's permanent environment, and residual components. Heritability of body weight was on a moderate level and quite steady. The tested statistical models showed only small differences in describing the variability and population genetic parameters. The number of parameters in the random regression function is more important than the type of function. For traits such as live weight, in which the different stages are highly correlated, it is suitable to use Linear Spline function for random effects. For describing the growths of bulls, random regression functions with more than three parameters could be recommended. Editing the database plays a role in estimating genetic parameters.*

**PŘIBYL, J., PŘIBYLOVÁ, J., KREJČOVÁ, H. & MIELENZ, N.** Comparison of different traits to evaluate the growth of bulls. *Czech Journal of Animal Science*, 2008, roč. 53, s. 273-283.

*The live weights at 400 days of age and gains from 100-400 days of age of performance-tested bulls were analysed at various monthly intervals. Estimates of variance components differed depending on the trait definition and model of analysis. Determinations of breeding values ranged from 0.64 to 0.94. Growth of animals according to daily gains in short consecutive intervals evaluation was preferred because more animals and more observations per animal were included in the evaluations, and the growth curve was separated into genetic and non-genetic parts. Simple evaluation of growth according to the final weight or daily gain in a long interval is not entirely correct, since environmental compensatory growth can occur.*

**FIEDLEROVÁ, M., ŘEHÁK, D., VACEK, M., VOLEK, J., FIEDLER, J., ŠIMEČEK, P., MAŠATA, O. & JÍLEK, F.** Analysis of non-genetic factors affecting calving difficulty in the Czech Holstein population. *Czech Journal of Animal Science*, 2008, roč. 53, s. 284-291.

*The objective of this study was to analyze the effects of non-genetic factors affecting calving difficulty in the Holstein population of the Czech Republic for subsequent compilation of the model for genetic evaluation as well as for herd management practice. Calving difficulty was assessed in three categories. A data set was analysed by a linear model with fixed effects of season, parity of dam, sex of calf and Holstein gene proportion. All these effects were significant. The results of analyses of gestation length, age at first calving and preceding calving interval revealed that a higher risk of difficult calving was associated with short or long gestation and with a prolonged preceding calving interval in multiparous cows. A decreased risk of difficult calving could be achieved by an altering of calving interval and age at first calving as a management tool.*

**SKŘIVAN, M., DLOUHÁ, G., MAŠATA, O. & ŠEVČÍKOVÁ, S.** Effect of dietary selenium on lipid oxidation, selenium and vitamin E content in the meat of broiler chickens. *Czech Journal of Animal Science*, 2008, roč. 53, s. 306-311.

*Selenium (Se) plays an important role in the regulation of various metabolic processes in the body, being an integral part of selenoproteins. Organic Se in the form of selenomethionine is a predominant form of this element in feed ingredients. Therefore, the digestive system of animals has been adapted to this form of Se. However, selenite is a common form of Se used in diets. There is little information available on the effects of Se supplementation on lipid oxidation in broiler chicks. Thus, the objectives of the experiment were to compare the effect of dietary sodium selenite and selenomethionine on selenium and alpha-tocopherol (vitamin E) concentration in breast meat and oxidative stability of meat in broilers. From this study, it can be concluded that dietary selenomethionine supplementation was more effective than inorganic Se. Further, selenomethionine is capable of simultaneously increasing the Se and vitamin E contents of broiler meat and can prevent the oxidation of products during storage.*

**SKŘIVAN, M., MAROUNEK, M., DLOUHÁ, G. & ŠEVČÍKOVÁ, S.** Dietary selenium increases vitamin E contents of egg yolk and chicken meat. *British Poultry Science*, 2008, roč. 49, s. 482-486.

*The influence of different forms of dietary selenium (Se) on vitamin E (alpha-tocopherol) and Se contents of egg yolk and chicken meat was investigated. Dietary Se supplementation increased the alpha-tocopherol content of egg yolks from 297 mg/kg dry matter in treatment without supplementation*

to 311 mg/kg when selenium was supplemented as selenite and to 370-375 mg/kg when organic supplements were used. The Se and vitamin E contents of breast and thigh meat in broilers were significantly increased by organic dietary Se supplementation. The inclusion of organic dietary Se sources in the diets of laying hens and broilers would enhance the nutritional value (vitamin E and Se contents) of products (eggs and meat) for human consumption.

**SKŘIVANOVÁ, E., MOLATOVÁ, Z. & MAROUNEK, M.** Effects of caprylic acid and triacylglycerols of both caprylic and capric acid in rabbits experimentally infected with enteropathogenic *Escherichia coli* O103. *Veterinary Microbiology*, 2008, roč. 126, s. 372-376.

*Caprylic acid and TAG of caprylic and capric acid significantly reduced numbers of coliform bacteria in the caecum and faeces of rabbits experimentally infected with the enteropathogenic strain of Escherichia coli O103. Although mortality of infected rabbits was decreased in treated groups, differences were nonsignificant. This could probably be attributed to a low number of rabbits in control and experimental group.*

**STĚHULOVÁ, I., LIDFORS, L. & ŠPINKA, M.** Response of dairy cows and calves to early separation: Effect of calf age and visual and auditory contact after separation. *Applied Animal Behaviour Science*, 2008, roč. 110, s. 144-165.

*In this study, it was evaluated how the response of dairy calves to separation from their mothers is affected by age of the calf at separation and the presence of visual and auditory contact between the mother and calf after separation. It was found that the behavioural response of calves increased with their age. Further, the response to separation was more intense and lasted longer in both of the animals when they had visual and auditory contact after separation. The age of calves at separation and contact with the mother was long lasting influence on the behaviour of the calves during social challenges. From the welfare point of view, there seems to be a trade-off between the more stressful option of separating calves from their mothers soon after birth and the potential longer lasting benefits of prolonged contact between a cow and a calf. Further research should focus on the importance and benefits of additional cow-calf contact.*

**SZTANKÓOVÁ, Z., KYSELOVÁ, J., KOTT, T. & KOTTOVÁ, E.** Technical note: Detection of the C allele of beta-casein (CSN2) in Czech dairy goat breeds using LightCycler analysis. *Journal of Dairy Science*, 2008, roč. 91, s. 4053-4057.

*The advantage of LightCycler analysis (LCA) is based on speed, efficiency, and safety (absence of hazardous chemicals). At present, work is in progress to analyze further polymorphisms within CSN2 locus to allow the simultaneous detection of all the known genetic variants of the gene and exploit all the potential of the LCA technique. In this study, a protocol was developed for rapid genotyping of A and C variants at the CSN2 locus in two goat breeds reared in the Czech Republic validated (White Shorthaired and Brown Shorthaired goat). Monitoring of CSN2 variability in the goat breeds indicated the predominance of the C allele. In both breeds, CSN2A and CSN2C showed almost similar frequencies.*

**ŠEVČÍKOVÁ, S., SKŘIVAN, M. & DLOUHÁ, G.** The effect of lycopene supplementation on lipid profile and meat quality of broiler chickens. *Czech Journal of Animal Science*, 2008, roč. 53, s. 431-440.

*Lycopene is a carotenoid mostly presented in vegetables and in some fruit species as a red pigment and is a most potent known antioxidant of plant origin. A large number of studies dealing with the importance of lycopene for human health and disease have been published, but few papers deal with the effect of lycopene in poultry diet on its meat quality. Therefore, an experiment was conducted to determine the potential effect of lycopene on lipid profile and quality of meat of broiler chickens. It was found that the dietary supplement of lycopene significantly increased the final live weight and positively affected the lipid profile of blood plasma of broilers. However, any significant effect of diet lycopene on meat quality of broiler chickens was not proved.*

**PETRŮ, M., ŠPINKA, M., LHOTA, S. & ŠÍPEK, P.** Head rotation in the play of hanuman langurs (*Semnopithecus entellus*): Description and analysis of function. *Journal of Comparative Psychology*, 2008, roč. 122, s. 9-18.

*Although head rotations are frequent patterns in play behaviour in many mammalian species and differ from head movements used in other contexts, they have not been quantitatively described and their function remains unclear. The head rotations of free-ranging Hanuman langurs (*Semnopithecus entellus*) were described. Two hypotheses about their function were tested. Either the head rotations*

serve to create unexpected situations and should therefore occur in both solitary and social play and be very variable or they serve as play signals, should therefore occur only in social play, and are ritualized. If head rotations have both functions, they should be less variable in social play. The results do not support the function of head rotations as play signals but, rather, suggest that head rotations may serve to create unexpected situations in play.

**TOMÁNEK, M., CHRONOWSKA, E., KOTT, T. & CZERNEKOVÁ, V.** Telomerase activity in pig granulosa cells proliferating and differentiating *in vitro*. *Animal Reproduction Science*, 2008, roč. 104, s. 284-298.

*The present study provides the evidence that pig granulosa cells originating from small (SF) and large (LF) ovarian follicles differ in proliferative and differentiative capacities in vitro. SF showed significantly higher proliferation potential in vitro, LF showed significantly advanced steroidogenic functions. Any substantial difference in average telomerase activity between freshly isolated SF and LF was not detected. When cultured, both SF and LF were responsive to EGF and FSH treatment and expressed absolutely higher levels of telomerase activity in comparison to freshly isolated cells. Except of basic and EGF conditions at a 24 h interval, no significantly different levels of telomerase activity between the SF and LF at an interval of 24 and 48 h of in vitro culture were observed. The activity of telomerase in pig ovarian follicle development may not be linked only to granulosa cell proliferation but some regulatory mechanisms of differentiation might be involved, too.*

**TYROLOVÁ, Y. & VÝBORNÁ, A.** Effect of the stage of maturity on the leaf percentage of lucerne and the effect of additives on silage characteristics. *Czech Journal of Animal Science*, 2008, roč. 53, s. 330-335.

*As the results of this study indicated, the leaf percentage of lucerne at the growth stage of small buds was significantly higher than in the growth stage of bloom. The harvested mass was of higher quality. It can be recommended to ensile lucerne at the maturity stage of large buds. At this stage, the crude protein content was only about 7.5 % lower than at the small buds stage and at this stage the WSC content was highest and the crude protein content was still optimal. The yields of dry matter were highest at the maturity stage after bloom. At the stage of maturity after bloom, the dry matter yield was increased but the nutritive value was reduced. All the additives improved the quality of lucerne silage. All treated silages contained higher amounts of lactic acid. The addition of the inoculant with *Lactobacillus buchneri* improved acetic acid in the silage. The additives decreased the intensity of proteolysis process.*

**OKADA, K., PALMIERI, CH., DELLA SALDA, L. & VACKOVÁ, I.** Viability, acrosome morphology and fertilizing capacity of boar spermatozoa treated with strontium chloride. *Zygote*, 2008, roč. 16, s. 49-56.

*The positive effect of strontium ions (Sr<sup>2+</sup>) on sperm motility, capacitation and acrosome reaction has been demonstrated in the mouse, human, guinea pig and hamster. In the present study, the effect of Sr<sup>2+</sup> on the viability and acrosome morphology of boar spermatozoa, and on the fertilization and development after the microinjection of Sr<sup>2+</sup>-treated spermatozoa into porcine oocytes were evaluated. The results demonstrated that Sr<sup>2+</sup> could positively affect the fertilizing capacity of spermatozoa in the pig.*

**VÍTEK, M., PULKRÁBEK, J., VALIŠ, L., DAVID, L. & WOLF, J.** Improvement of accuracy in the estimation of lean meat content in pig carcasses. *Czech Journal of Animal Science*, 2008, roč. 53, s. 204-211.

*Fat thickness including skin and muscle depth was measured in pig hybrid carcasses. The lean meat content was then determined based on simplified dissections of the carcasses. The basic regression formulae for the ultrasound and probe apparatuses were constructed and the relationships between the lean meat content and other indicators of carcass value were assessed. The highest correlation coefficient was determined in the ratio of the fat cover area above the longissimus muscle depth (MLLT) to the MLLT area. The lean meat content demonstrated the lowest correlation with the cold carcass weight. Major carcass cuts (ham, loin, shoulder, belly with bones) from the carcasses classified in different SEUROP classes were evaluated. Significant differences between the classes were found in the proportions of cuts without fat cover, fat thickness measured at point P2, and fat thickness measured on the midline plane separating the left and right sides of the carcass.*

**VOSTRÝ, L., PŘIBYL, J., JAKUBEC, V., VESELÁ, Z. & MAJZLÍK, I.** Selection of a suitable definition of environment for the estimation of genotype x environment interaction in the weaning weight of beef cattle. *Czech Journal of Animal Science*, 2008, roč. 53, s. 407-417.

*Knowledge of the genotype x environment (GxE) interaction is important for the optimum use of particular genotypes of animals in different production and breeding systems, especially for beef cattle, which are kept in both intensive and extensive environments. In the experiment, GxE for weaning weight in four breeds of beef cattle (Hereford, Aberdeen Angus, Beef Simmental, and Charolais) were tested using these definitions of environments: altitude, production areas, economic value of the land, less favourable areas (LFA), and performance levels of a breed within herds. It was found, that the most suitable definitions of environment were according to LFA and herd levels of performance. The results of this paper showed that the assignment of different breeds to specific environments and the routine evaluation of animals across all breeds are questionable under conditions in the CR. The evaluation within breeds could yield results that are more reasonable.*

**MÉSZÁROS, G., WOLF, J. & KADLEČÍK, O.** Factors affecting functional length of productive life of Slovak Pinzgau cows. *Czech Journal of Animal Science*, 2008, roč. 53, s. 91-97.

*A proportional hazard model was used to analyze the impact of the most important factors on the length of productive life of 44796 Slovak Pinzgau cows. The calculations were carried out with Survival Kit 3.12. The most important factor was the milk production level within herd. Cows with extremely low milk production (less than 1.5 standard deviations below average) had a 4.8 times higher culling risk than average cows. The culling risk for highest yielding cows was about one half of the risk of average cows. In the first lactation, the culling risk was highest at the beginning and decreased in the course of the lactation whereas in the subsequent lactations the culling risk was highest at the end of the lactation. The risk decreased with parity. Cows from expanding herds were at lower risk to be culled compared to cows in herds of stable and decreasing size.*

**WOLF, J., ŽÁKOVÁ, E. & GROENEVELD, E.** Within-litter variation of birth weight in hyperprolific Czech Large White sows and its relation to litter size traits, stillborn piglets and losses until weaning. *Livestock Science*, 2008, roč. 115, s. 195-205.

*Data from about 2900 litters (approximately 40,000 piglets) originating from 1063 Czech Large White hyperprolific sows were analyzed. The phenotypic and genetic relations between litter size traits, piglet mortality during farrowing and from birth to weaning and several statistics referring to the distribution of the birth weight within litter were analyzed. An increase in litter size was shown to be genetically connected with a decrease in the mean piglet birth weight and an increase in the within-litter variability of birth weight. Selection on litter size should be accompanied by selection on mortality traits and/or birth weight traits. Losses from birth to weaning and the minimal birth weight in the litter were proposed as potential traits for a selection against piglet mortality.*

**WOLF, J., WOLFOVÁ, M., KRUPA, E. & PEŠKOVIČOVÁ, D.** ECOWEIGHT 2.0 - C programs for modelling the economic efficiency of production systems in beef and dairy cattle. *Archiv für Tierzucht*, 2008, roč. 1, s. 397-401.

*Two C programs were written on the basis of a bio-economic model for a wide range of cattle production systems. The model simulates the life-cycle production of a beef or dairy cow herd and the growth performance of offspring in rearing and fattening. The Markov chain approach was used to simulate herd dynamics. The program calculates the structure of the integrated production system in its stationary state, the economic efficiency of the system expressed as a function of biological traits of animals and of management and economic parameters, the number of discounted expressions for direct and maternal traits transmitted by breeding animals and the economic weights for 16 economically important traits for beef and 21 traits for dairy cattle. The program is freely available on request.*

**HEJCMAN, M., ŽÁKOVÁ, I., BÍLEK, M., BENDO VÁ, P., HEJCMANOVÁ, P., PAVLŮ, V. & STRÁNSKÁ, M.** Sward structure and diet selection after sheep introduction on abandoned grassland in the Giant Mts., Czech Republic. (Struktura porostu a výběr diety po zavedení pastvy ovcí na opuštěných horských loukách Krkonoš na území České republiky). *Biologie*, 2008, roč. 63, s. 506 – 514.

*In the study, the effect of rotational grazing on the sward structure of long-term abandoned grassland and the sheep diet selection were investigated in the Giant Mts. The aims of the research were to ascertain if sheep grazing affect the sward structure, how sheep diet selection develops in grazing seasons and what plants do sheep prefer to graze. Seasonal as well as inter-annual changes in sheep diet selection were detected. In the first spring, sheep grazed over a wide variety of plant species*



*in low quantities. In subsequent springs, they preferred species favored during previous autumns and changed the diet only after elimination of favored plants. Furthermore, sheep preferred grazing at the highest part of the pasture probably as a consequence of anti-predator behavior. Changes in the sward structure were mostly of a quantitative character. The diet selection changed probably due to the sheep experience, as they were able to recognize favored plant species after 6 months.*

## PATENTS

### **Method of parthenogenetic activation of oocytes using a stimulation of Ca-independent protein kinases**

CZECH UNIVERSITY OF LIFE SCIENCES, INSTITUTE OF ANIMAL SCIENCE. Inventor: JÍLEK, F., PETR, J., JEŠETA, M., et al. CZ. Patent file No. 298 869. (2008)

*This relates to the method of advanced parthenogenetic activation of oocytes in vitro, using in addition to classical activation stimuli, a specific stimulation of Ca-independent protein kinases C. This activation is of a great use in reproductive biotechnologies for farm animals and for assisted reproduction in human medicine.*

### **Method of prolonging the *in vitro* vitality of mammalian oocytes**

CZECH UNIVERSITY OF LIFE SCIENCES, INSTITUTE OF ANIMAL SCIENCE. Inventor: PETR, J., JÍLEK, F., JEŠETA, M., et al. CZ. Patent file No. 299 219. (2008)

*This relates to the prolonged storage of mammalian oocytes in vitro with the simultaneous activation of protein kinases C. This cultivation method can support a higher vitality of oocytes and is of great use in the reproductive biotechnologies for farm animals.*

### **Using a histone deacetylase inhibitor in preparing a culture medium enabling the *in vitro* vitality of mammalian oocytes to be prolonged**

INSTITUTE OF ANIMAL SCIENCE. Inventor: JÍLEK, F., PETR, J., JEŠETA, M., et al. CZ. Patent file No. 299 271. (2008).

*This relates to using a histone deacetylase inhibitor in preparing a culture medium enabling the *in vitro* vitality of mammalian oocytes to be prolonged. Here mammalian oocytes are removed, cultivated in vitro in a culture medium with the addition of a specific inhibitor histone deacetylase. The storage of removed mammalian oocytes in vitro with simultaneous histone deacetylase inhibition can support a higher vitality of oocytes and is of great use in reproductive biotechnologies for farm animals and for assisted reproduction in human medicine.*

### **Method for detecting pig telomerase expression**

INSTITUTE OF ANIMAL SCIENCE. Inventor: KOTT, T., TOMÁNEK, M., KOTTOVÁ, E. et CHRONOWSKA, E. CZ. Patent file No. 299 220. (2008)

*This relates to detecting pig telomerase expression.*

### **Method for detecting genetic polymorphism in sheep kappa caseine**

INSTITUTE OF ANIMAL SCIENCE. Inventor: KOTT, T., TOMÁNEK, M., KOTTOVÁ, E. et CHRONOWSKA, E. CZ. Patent file No. 299 220. (2008)

*This relates to a method for detecting genetic polymorphism of point mutation in sheep kappa caseine by means of the polymerase chain reaction (PCR) and using the LightCycler apparatus.*

### **Method for detecting DNA and/or mRNA for red fluorescent protein in genetically modified organisms**

INSTITUTE OF ANIMAL SCIENCE. Inventor: KOTT, T., KOTTOVÁ, E. et SZTANKÓOVÁ, Z. CZ. Patent file No. 299 221. (2008)

*This relates to a method for detecting DNA and/or mRNA for red fluorescent protein in genetically modified organisms.*

## APPLIED RESEARCH OUTPUTS

The research results application is implemented by several methods. In the area of professional support of the consultancy system in the field of animal production, two methodologies for the consultants, Agrarian Chamber and breeders associations have been elaborated within the framework of two projects achieved from the supporting programme of the MoA. The Methodology "Agricultural consultant in the stable II – Calves and Fattening young boars under the organic farming conditions was presented at the professional seminar.

In addition to the workers from the Transfer and Publicity Department together with research workers ensured the expert content for 15 seminars in the Czech Republic regions with the subject matter Good breeding practice, welfare in cattle breeding, principles cross compliance and production of safety feedingstuffs related to the legislation. The seminars were organised by the Agricultural Association of the Czech Republic, Agrarian Chamber, the Institute of Agricultural Economics and Information, Breeders Associations and vocational schools.

Scientific knowledge and the results from the research projects have been published in the form of eighteen certified methodologies from the field of animal fattening and nutrition, alternative feedingstuffs, breeding value estimation, carcase assessment and breeding technology as well three software programs (programs for the count of economic balances for sheep, meat and dairy cattle and change modelling in the entire structure of pork production chain). From the results of research projects as well seven workable samples and three verified function prototypes resulted.

### CERTIFIED METHODOLOGIES

#### **Agricultural consultant in a stable: II. Calves**

DOLEŽAL, O., STANĚK, S. & BEČKOVÁ, I. Institute of Animal Science, 2008. 63 p. ISBN 978-80-7403-014-7.

*The methodology summarizes the available research on and practical findings of calf rearing. The requirements and techniques in calf rearing are formulated.*

#### **Fattening young boars under organic agriculture conditions**

DOSTÁLOVÁ, A. & KOUCKÝ, M.. Institute of Animal Science, 2008. 34 p. ISBN 978-80-7403-023-9.

*The purpose of the methodology is to apply the positive aspects of fattening young boars in practice. This fattening technique could be realized in both conventional management and organic agriculture.*

#### **Methodology of conserving and utilizing the genetic resource of the Přestice Black-Pied pig breed**

FIEDLER, J. & SMITAL, J. Institute of Animal Science, 2008. 38 p. ISBN 978-80-7403-012-3.

*The methodology was written due to the present requirements of breeders and the National Reference Centre for Conservation and Use of Farm Animals Gene Resources. The Přestice Black-Pied pig breed will be bred in a closed population. A selection program will be created based on stabilizing selection for the qualities included in quality checks. Cryopreservation of boar semen will be used. Based on the breed, the influence of both the environment and breeding measures on selection efficiency will be studied.*

#### **Lupine utilization in cattle nutrition**

HOMOLKA, P., KOUKOLOVÁ, V., KUDRNA, V., JANČÍK, F., SKŘIVANOVÁ, V. Institute of Animal Science, 2008. 25 p. ISBN 978-80-7403-006-2.

*Lupine seed is an important source of protein and has a high energy value. In contrast to soyabean, the lupine seeds contain less of the proteins, lysine, methionine, cysteine and threonine, more fibre, starch and fat. The composition of nutrients is similar as in soya extruded meal. The seeds must be mechanically processed but not heat treated. Lupine seed is an alternative to soya in the feed of farm animals. In cattle diet, whole plants can be further utilized in the form of green fodder or silage.*

### **Optimal harvest time for grasses with regard to cell-wall digestion**

JANČÍK, F., HOMOLKA, P. & KOUKOLOVÁ, V. Institute of Animal Science, 2008. 33 p. ISBN 978-80-7403-011-6.

*The nutritional value of grasses is determined by cell-wall digestibility (NDF). Accordingly, the optimal time of grass harvest is the beginning of heading. After this growth phase, the parameters of rumen degradability and cell-wall digestibility quickly deteriorate. In the methodology recommended harvesting times for early- and late- maturing grass species are stated. These terms are adapted to the grass variety, the application of fertilizers, altitude, soil and climatic conditions. A combination of grass species with regard to their digestibility of NDF, which determines grass quality, is recommended as well. In grass and grass-legume mixtures the harvesting should start when the first predominant grass species begins heading.*

### **Evaluating the digestibility of neutral-detergent fibre in cattle nutrition**

KOUKOLOVÁ, V. & HOMOLKA, P. Institute of Animal Science, 2008. 29 p. ISBN 978-80-7403-016-1.

*Rumen digestibility is a dynamic time-dependent process resulting in a relationship between the enzymatic activity of microorganisms and the rumen outflow rate. Neutral-detergent fibre (NDF) digestibility is important for evaluating the feed quality of cattle nutrition. The ratio of feed ingredients significantly influences the feed's utility and thus the performance of farm animals.*

### **Methods of affecting yield and quality of milk fat in dairy cows through nutrition**

KUDRNA, V., HOMOLKA, P. & BURDYCH, J. Institute of Animal Science, 2008. 18 p. ISBN 978-80-7403-007-9.

*In the methodology the current findings of the probable influence of diet on milk fat concentration and its fatty acids profile are compiled. The practical applications for influencing milk fat levels are presented.*

### **Economic aspects of bull fattening**

KVAPILÍK, J. Institute of Animal Science, 2008. 81 s. ISBN 978-80-7403-020-8.

*In the methodology, the basic requirements for the good economics of bull fattening are described. These include meeting the rate of average daily weight gains in bulls of meat and dairy breeds (1200 and 1000 g, respectively), high carcass weights (700 and 650 kg live weight), the prices for bull calves for fattening, which provide economically effective fattening, the good health state of bulls, minimum mortality and emergency slaughters, the high quality of slaughter animals and a guaranteed discount market price. The optimal nutrition, skilled staff and cost-effectiveness are prerequisites. The SEUROP classification system is a stimulus for quality improvement. A preliminary analysis on the introduction of the bull fattening branch and an annual evaluation of production results are necessary.*

### **Methods for eliminating hypothermia in lambs**

MALÁ, G. Institute of Animal Science, 2008. ISBN 978-80-86454-83-2.

*The methodology is designed for breeders, breeding consultants, practitioners from breeding organizations and students. This methodology enables the level of lambs' health to be evaluated, to detect symptoms of hypothermia and to choose a suitable method for eliminating hypothermia and to propose measures for reducing lamb losses.*

### **Methodical handbook for breeders on producing conserved feeds (silages) from perennial fodder crops and permanent grasslands**

POZDÍŠEK, J., MIKYSKA, F., LOUČKA, R. & BJELKA, M. Institute of Animal Science, 2008. ISBN 978-80-87144-06-0.

*The publication presents recommendations that are important for exercising technologies in a cattle breeding system in a LFA by maximising permanent grassland usage in the form of pasture and conserved forage. The aim of the publication is to give farmers recommendations for the choosing suitable perennial fodder crops and for managing permanent grasslands by using them in cattle nutrition and other recommendations for harvesting, conserving, storing, treating and feeding. It concerns ways for obtaining high-quality conserved feeds using quality biomass from perennial fodder crops and permanent grasslands with as little waste as possible and furthermore their effective*

*exploitation in the feeding rations of cattle. Based on the authors' knowledge and practices, methods for the qualitative evaluation of silages made from perennial fodder crops and permanent grasslands are mentioned.*

### **Pig carcass classification by means of IS-D-05 apparatus**

PULKRÁBEK, J., VALIŠ, L., VÍTEK, M., DAVID, L. & WOLF, J.. Institute of Animal Science, 2008. 23 p. ISBN 978-80-7403-017-8.

*The purpose of this methodology is classifying pig carcasses by means of the IS-D-05 apparatus. A special regression equation was constructed for predicting lean meat content in pig carcasses. The classification technique was tested in practice.*

### **Pig carcass classification by means of IS-D-15 apparatus**

PULKRÁBEK, J., VALIŠ, L., VÍTEK, M., DAVID, L. & WOLF, J.. Institute of Animal Science, 2008. 23 p. ISBN 978-80-7403-018-5.

*The purpose of this methodology is classifying pig carcasses by means of apparatus with the IS-D-15 needle probe. A special regression equation was constructed for predicting lean meat content in pig carcasses. The classification technique is already used in practice.*

### **Application of fatty acids with antimicrobial effects to substitute dietary antibiotics in farm animals**

SKŘIVANOVÁ, E., MAROUNEK, M. & SKŘIVANOVÁ, V.. Institute of Animal Science, 2008. 13 p. ISBN 978-80-7403-008-6.

*The methodology is related to applying fatty acids with antimicrobial effects to substitute dietary antibiotics in farm animals.*

### **Technique of fattening pigs separated according to sex**

ŠEVČÍKOVÁ, S. & KOUCKÝ, M.. Institute of Animal Science, 2008. 38 p. ISBN 978-80-7403-009-3.

*The methodology takes into account the differences in production according to sex. In this manner natural biological reserves for indicators of performance and carcass value are available. By the SEUROP classification, the quality of final product is higher. It is recommended using the methodology everywhere that favourable conditions exist.*

### **Methods of intensive cattle fattening - technology and housing technique**

STANĚK, S. & DOLEŽAL, O.. Institute of Animal Science, 2008. 12 p. ISBN 978-80-7403-024-6.

*The methodology specifies practical findings about the category of fattening bulls. The authors create principles and standards in intensive cattle fattening, determine the innovated dimensional parameters of surfaces, trough body, housing capacities etc., which meet the conditions of welfare, breeding practice including environmental protection, i.e. implementation of Cross-compliance.*

### **Predicting rumen degradability of crude protein - enzymatically with bromelain**

TOMÁNKOVÁ, O. & HOMOLKA, P.. Institute of Animal Science, 2008. 19 p. ISBN 978-80-7403-012-3.

*The methodology is focused on the enzymatic determination of crude protein degradation range in rumens by means of bromelain protease in vitro. The advantage of bromelain is its stable specific activity, in contrast to the commonly used Pronasa E protease. Prediction equations for specific groups of feeds are constructed enabling the actual value of degradability to be stated.*

### **Evaluation of maize hybrids tested on a long-term basis in a sugar beet growing area**

TYROLOVÁ, Y. & VÝBORNÁ, A.. Institute of Animal Science, 2008. 36 p. ISBN 978-80-7403-022-2.

*Based on long-term experiments, the methodology presents information about various maize hybrids. The hybrids suitable for cultivation in a sugar beet growing area are determined.*

## **Breeding value estimation for semen traits of boars of dam breeds**

WOLF, J. & SMITAL, J. Institute of Animal Science, 2008. 21 p. ISBN 978-80-7403-015-4.

*A procedure for the genetic evaluation of the semen traits of boars of dam breeds is presented. The traits are: semen volume, sperm concentration, motility, percentage of abnormal sperm, total number of sperm and number of functional sperm from one collection. The method is applied nationally.*

## **SOFTWARE**

### **Bioeconomic model of pig breeding. User's manual for the CERDO program package**

FIEDLER, J., SMITAL, J. & FIEDLEROVÁ, M. 2008. Software, Praha Uhřetěves: Institute of Animal Science.

*In pig breeding, it is advantageous to use computer technology for modelling changes in all the structures of the pork production chain. Evaluating the effect of breeding measures by means of operational experiments is problematic and uneconomic. Three models for both commercial herds and pedigree breeding of pigs were constructed.*

### **User's manual for the ECOWEIGHT program package (C programs for calculating economic weights in livestock), Version 4.0.1. Part 1: Programs for cattle**

WOLF, J., WOLFOVÁ, M. & KRUPA, E. 2008. Software, Praha Uhřetěves: Institute of Animal Science.

*This part of the ECOWEIGHT program package contains two programs for calculating the economic weights for beef and dairy cattle. In comparison with the 2<sup>nd</sup> version published in 2005, in the 4<sup>th</sup> version considerable changes and improvements have been made, as documented in Appendix C in the Manual, especially in the program for dairy cattle. The programs simulate a large range of production systems so that they can be applied to almost every cattle breeding programme. The programs are written in C, the source code and versions for Windows and LINUX are made available as freeware.*

### **User's manual for the program package ECOWEIGHT (C programs for calculating economic weights in livestock), Version 4.1.1. Part 2: Program for sheep**

WOLF, J., WOLFOVÁ, M., KRUPOVÁ, Z. & KRUPA, E. 2008. Software, Praha Uhřetěves: Institute of Animal Science.

*This part of the ECOWEIGHT program package contains a program for calculating the economic weights for dairy and meat sheep. The program simulates a range of production systems for sheep with one lambing per year. Economic weights are applicable to selection programs for different sheep breeds. The program is written in C, the source code and versions for Windows and LINUX are made available as freeware.*

## **UTILITY MODELS**

### **An autonomous system for measuring and recording gas concentrations**

DOLEJŠ, J., TOUFAR, O., MAŠATA, O. & KNÍŽEK, J. 2008. Utility model, CZ19069U1, Institute of Animal Science.

*The solution concerns the system of measuring and recording gas concentrations in animal stables in both the animals' living quarters and stable exhausts. The control of gas concentrations serves to calculate emissions.*

### **Medium for transversal sections of keratinous tissues preparation**

KNÍŽKOVÁ, I., KUNC, P., SAMEK, M. & ŠÁNOVÁ, P. 2008. Utility model, CZ18794U1, Institute of Animal Science.

*The solution concerns a mounting medium for preparing histological transversal sections of keratinous tissues (hairs) ensuring hardness as well as plasticity of sections for examination under a microscope.*

### **Central control unit of cooling equipment for animals**

KUNC, P., KNÍŽKOVÁ, I., BENEDIKT, P. & KOTAČKA, B. 2008. Utility model, CZ18338U1, Institute of Animal Science.

*The solution concerns a central control unit of cooling equipment for animals, especially for cattle.*

### **Individual box for animals kept in loose housing systems**

KUNC, P., KNÍŽKOVÁ, I. & MILLER, J. 2008. Utility model, CZ18888U1, Institute of Animal Science

*The solution concerns individual box for animals kept in loose housing systems, particularly for rearing the young of large mammals, especially for calves.*

### **Cereal and legume seeds with increased nutritive value and foods containing them**

KOUCKÝ, M., ŠEVČÍKOVÁ, S. & KUDRNA, V. 2008. *Utility model*, CZ18196U1, Institute of Animal Science

*The demand for cereals and legumes with increased nutritive value is not satisfied by their present supply. Therefore new possibilities of increasing their nutritive values have been sought. One of the ways to solve this problem is related to cereal and legume seeds with increased nutritive value and foods containing them. The nutritive value of these seeds is increased by their germination. Higher total amino acid content is then characteristic.*

### **Demountable individual box for animals kept in loose housing systems**

KUNC, P., KNÍŽKOVÁ, I. & MILLER, J. 2008. *Utility model*, CZ18683U1, Institute of Animal Science

*The solution concerns a demountable individual box for animals kept in loose housing systems, particularly for rearing the young of large mammals, especially for calves.*

### **Milk drink from heat-treated goat milk fermented with a probiotic culture**

DRBOHLAV, J., MARKOVÁ, M., SNÁŠELOVÁ, J., PECHÁČOVÁ, M. & MÁTLOVÁ, V. 2008. *Utility model*, CZ19077U1, MILCOM, a.s., Institute of Animal Science

*The solution concerns a milk drink from heat-treated goat milk fermented with a probiotic culture. The use of goat milk is increased. Further, persons allergic to cow milk proteins are given a suitable source of proteins and probiotic microorganisms. The drink is a balanced source of calcium, phosphorus and proteins; it does not contain any preserving or stabilizing agents.*

## **PROTOTYPES**

To verify the technical properties of some of the above utility models the following prototypes were made:

### **Prototype of an autonomous system for measuring and recording gas concentrations**

DOLEJŠ, J., TOUFAR, O., MAŠATA, O. & KNÍŽEK, J. 2008. *Prototype/VÚŽV/03/2008/19069*, Institute of Animal Science

### **Prototype of a central control unit for cooling equipment for animals**

KUNC, P., KNÍŽKOVÁ, I., BENEDIKT, P. & KOTAČKA, B. 2008. *Prototype/VÚŽV/01/2008/18338*, Institute of Animal Science

### **Prototype of an individual box for animals kept in loose housing systems**

KUNC, P., KNÍŽKOVÁ, I. & MILLER, J. 2008. *Prototype/VÚŽV/02/2008/18888*, Institute of Animal Science

## SPECIFIC ACTIVITIES EXECUTED ON THE AUTHORITY OF THE MINISTRY OF AGRICULTURE

### USE AND CONSERVATION OF ANIMAL GENETIC RESOURCES, REPRESENTATION THE CZECH REPUBLIC WITHIN THE ACTIVITIES OF THE FAO - UNITED NATIONS

Institute of Animal Science is the National Reference Centre for conservation and use of the farm animal genetic resources (NRC) and co-ordinates through the national co-ordinator a relevant part of the National Programme for the conservation and use of the genetic resources in agriculture – Animal National Programme (ANP). The national co-ordinator, Ms. Věra Mátllová, is a member of the European Regional Focal Point for Animal Genetic Resources (ERFP) and currently she carries out the function of the representative for the Central and East Europe countries in its Steering Committee.

For the Czech Republic presidency in the European Union Council (PRES - 2009) the national co-ordinator ensures as well agenda related to the genetic resources and biodiversity in the co-operation with the Ministry of the Environment. She represented the Czech Republic during the negotiations of the Working group for establishing the international system for ensuring the access to the genetic resources within the framework of the Convention on biological diversity (Geneva, January 2008) and as the selected representative from the region she participated in the negotiations of the expert group for sectorial approach and the concept of the international system (Namibia, December 2008).

Fundamental activities of the National Reference Centre in 2008 have been related to the **methodical guidance for the projects of genetic resources conservation**. Analyses of their development have been assessed; on the basis of the analysis there have been designed and agreed by the Council for Genetic Resources the innovations for methodical procedures for their conservation. For securing the implementation of specific activities within the National Programme the agreements with breeders associations and clubs, universities and research institutes have been signed.

**Continuous establishing and evaluating data on the genetic resources**, their recording and providing data into the global information system is long-term standard activity of the NRC. On the basis of the FAO requirements the questionnaires for breeders' associations have been worked out and sets of new established data gradually completed into the FAO-DADIS database. In the testing operation is also newly created the National Database for recording and monitoring the genetic material conserved *in vitro* in cryobanks.

**Ensuring cryoconservation of the genetic material:** The adaptation of premise for the facility of the licensed insemination station in Kostelec n. Orlicí has been implemented. After the completion of the certification procedure this facility will further ensure the cryoprogramme for boars, rams and goats. In the co-operation with the Czech and Moravian Breeders Association has been according to the requirements of State veterinary administration successfully completed the project of the Central genebank in the Sperm bank of the Czech and Moravian Breeders Association at Hradištko. The Bank serves as a main deposit of the genetic material, and it will be gradually completed with safety duplicates from other cryobanks within the framework of the National Programme as well.

#### **International co-operation and presentation of the National Programme results**

At the international conference "Monitoring for Future Effective Management of Animal Genetic Resources in Caucasus Region" (Tbilisi, July 2008), the national co-ordinator on the request of the Organisation Committee presented the principles and the function of the genetic resources conservation system. The results of the National Programme were presented as well during the occasion of the international workshop within the framework of the ELBARN - the project of the European non-government organisations (Kutná Hora, February 2008), the objective of which is to create the European Networks of the Conservation Programmes for endangered autochthonous breeds.

The National Reference Centre further participated in the implementation of special exhibition of national genetic resources during the international exhibition of small animals in Prague-Letňany, for which it ensured simultaneously the information stand and sets of information and promotion materials on the genetic resources.

## THE SCIENTIFIC COMMITTEE FOR ANIMAL NUTRITION

### The strategy for ensuring the food safety in the Czech republic

The Scientific Committee for Animal Nutrition has been established in 2002 within the Institute of Animal Science in accordance with the Government Resolution No. 1320/2001 on the Strategy of Ensuring Food Safety in the Czech Republic. The Committee evaluates on the scientific basis health risks of feedingstuffs and particular components of feedingstuffs and this activity has been ranked among the main activities of the Institute. In the Committee of fourteen members work five research workers from the Institute of Animal Science including the chairman Mr. prof. Ing. Milan Marounek, DrSc.

The Scientific Committee for Animal Nutrition as well answers to the questions put by the Coordination group for the food safety (CG). The coordination group is a permanent consultancy and initiation authority of the CR Ministry of Agriculture in the area of food safety and the Scientific Committee for Animal Nutrition belongs to its consultancy body. The chairman of the Scientific Committee for Animal Nutrition regularly participates in the negotiations of the Coordination group. The Committee provides also the backgrounds for the Czech Republic standpoints to the materials of the European Food Safety Authority (EFSA).

The work of the Scientific Committee for Animal Nutrition is executed according to the plan approved by the Ministry of Agriculture and in 2008 it met at four meetings to elaborate six expert studies which responded to the current issue in feed production and animal nutrition. All studies have passed scientific judgement and subsequently were transferred to the Food Safety Department of the Ministry of Agriculture. The Scientific Committee for Animal Nutrition further elaborated three expert standpoints for the Coordination group.

### Studies

#### Introduction into the issue of the relation between the health state and animal nutrition

In the study there is described the standard for the nutrient requirements for particular animal categories, immunity system of an organism, effect of the nutrition influencing the immunity system of an animal, effect of the excess feed intake and excessive element and vitamin intake.

#### Natural substances and their biological activity

##### 1. Substances potentially influencing pig reproduction

A first part of the study works out factors influencing fertility (specification of the sexotype, ontogenetic and physiological factors of the both sexual types, genetic background of animal organism which are used for breeding as well common production, production of sex hormones in boars and sows and these factors resulting from the level of libido). A second part describes using plant content substances, particularly for boar libido increasing and semen profile improving. The application of natural substances is very favourable, because these substances are not of a hormonal origin; do not influence organoleptic properties of final products, and therefore are entirely acceptable from the point of view of feed and food chain safety.

#### Natural substances and their biological activity

##### 2. Anti-nutritional and toxic substances in feeds (Picture atlas)

In agriculture practice there is not knowledge level related to the toxic plants high. On this account undesirable substances are present in feedingstuffs. In the study methods of quantitative analysis are declared, these methods are used for the determination of content on different degrees. Simultaneously are introduced the most significant compounds responsible for toxicity or undesirable physiological effect and pictures of plant sources of their origin. This photographic documentation is important for primary risk assessment. In this study is included for each described compound a character of its acting, occurrence in plant, significance of farming practice and the method of its determination.

#### The significance of beef in the food chain – the influence of cattle feeding ration on the fatty acid profile in beef

The study is distributed into several chapters which work out, for example, meat quality, recommended fatty acid intake in human nutrition, feed and meat processing and storing influence on the fatty acid profile in beef and its oxidation stability. From the nutritional point of view beef is an excellent source



of biologically valuable protein, vitamin B12, niacin, vitamin B6, choline, ferrum, zinc and phosphorus as well as the source of omega-3 polyunsaturated fatty acids with a long chain.

### **Mycotoxins sterigmatocystin, moniliformin, diacetoxyscipenol and phomopsin influence on animal health (summary of literature knowledge)**

The subject of this study has been designed in the EFSA material „Preliminary Management Plan of the European Food Safety Authority for 2008“. The objective of this study was to elaborate literature knowledge on the occurrence of respective mycotoxins from the point of view of their effect on farm animal health, food safety and human health. One chapter is devoted to each given mycotoxin.

### **Vegetable oil quality and their significance from the point of view of animal health and possible influence on nutritional values of food of animal origin**

The study consists of two parts – theoretical and practical. The oils have the significance both nutritional and energy. In the Europe are the prevailing crops oil plants: olive, winter rape, common sunflower, opium poppy, common flax and soybean. The oil plant areas are permanently increased.

The authors focused on the comparison of quality for the most significant vegetable oils used in human and animal nutrition. They analysed rapeseed, sunflower, poppy and flax oils as well as oil in certain legumes. Several varieties of each species have been analysed.

### **Standpoints**

#### **Risk assessment for undesirable substances in feedingstuffs – use of the feeding products with the content of false flax (*Camelina sativa* L.) for poultry feeding, in particular**

The standpoint answered to the Coordination group question, if it is possible to include false flax seeds into the animal nutrition. False flax seeds content very positively acting n-3 polyunsaturated fatty acids. But further they content undesirable erucic acid, which has a cardiotoxic action. Its content should be on the lowest possible level, because it can in animals (particularly chickens) cause the retardation of the circulatory system development. Further are in seeds present glucosinolates which have significant anti-nutritional properties. Another unfavourable compound in false flax seeds is sinapin which in the amount of 5 mg/g of seed (0.5 %) becomes unfavourable compound within the feeding. Aliphatic carbohydrates (eicosane and heptacosane) can also participate in a decrease of feeding ration conversion as well as irritate digestive tract.

#### **Risk assessment of undesirable substance in feed**

The issue in the risk assessment is the fact, that the data which should serve for establishing and managing the risk in feed are monitored by a number of institutions and laboratories. Therefore it would be good, if the food chain (as well as feed) safety management would be coordinated from one point and so the result would be presented uniformly. In the standpoint have been described the designs on possible solution for submitted issue.

#### **The issue of a risk occurring within the use of products which are offered to farmers in order to eliminate mycotoxins contamination effects**

The issue of so-called mycotoxin sink is not legally laid down and this is in the interest of fair producers (both these sinks and quality feedingstuffs) as well as customers to describe and define legislatively this issue.

With respect to the fact, that current tests are not prepared to that extent to determine the efficiency in a particular product under defined environment conditions, there is necessary to define (describe) tests through which the efficiency of these substances will ascertained.

## **SEUROP AND THE STEERING COMMITTEES OF THE EUROPEAN COMMISSION FOR MEAT (ECM)**

On the basis of the agreement with the CR Ministry of Agriculture on fulfilment of public procurements „SEUROP classification system of carcasses of slaughter animals and its application in the Czech Republic and European Union conditions“ the Institute specialists have been engaged in methodical procedures for processing and transfer of the data obtained from the pigs and cattle classification. This activity includes the data evaluation from a numerous sets by means of special computer equipment (within the pig carcasses classification according to the SEUROP-system about 10 million carcasses was classified, for example, from 2005).

Subsequently, there was elaborated the first Yearbook which evaluates the data from the classification of pig and cattle carcasses (JUT) according to the SEUROP-system. The data are worked out in details for 2007 and compared with the data from 2005 and 2006. The mentioned Yearbook was negotiated at the meeting of the SEUROP Council which is advisory body of the Ministry of Agriculture for the JUT classification of carcasses. The members of the Council are representatives from non-government organisations, professional union and associations, representatives of marketing cooperatives, farm animal breeders, meat processors, scientific-research base as well state administration. The main objective of the SEUROP Council is to objectify the JUT classification of carcasses at maximum level and to promote with expert knowledge the use of results from the JUT classification of carcasses into the practice during their commercialisation.

A significant activity at the division – the SEUROP-system is the expert training for the classifiers of pig and cattle carcasses, where the Institute of Animal Science has been authorised according to the MoA Decree No. 194/2004 Coll. *on the method of carrying out the classification of carcasses of slaughter animals*.

In 2008 were realized the basic and refresher courses for the pig and adult cattle JUT classifiers by the SEUROP-system. The basic courses intended for classifiers-aspirants comprise one-day theoretical part performed in the Institute of Animal Science and subsequent two-day practical training in selected slaughterhouse operations. These courses were completed by the final examination. The examinations for the pig JUT classification passed for 41 participants, exams for the adult cattle JUT classification successfully completed 21 aspirants. Simultaneously, within the framework of the periodical professional training were realized three one-day refresher courses for pig and cattle JUT classifiers, in which were trained 65 classifiers, in total.

At the activities of the Steering Committees of the European Commission for meat (ECM) participated three representatives from the Institute of Animal Science Mr. Jan Pulkrábek, Mr. Luděk Bartoň and Ms. Věra Mátlová, as specialists in pork, beef and mutton production. It is related particularly to the processing backgrounds for the preparation of the Czech Republic position at the negotiations at the European Commission for meat, expert opinions and documentation for following implementation of respective directives into the national legislation. 22 protocols to the method designs for the pig carcass classification have been assessed. These were submitted for the approval by particular EU member states. Further, there were elaborated materials for the Working group „Cattle carcass classification “ and „Pig carcass classification “.

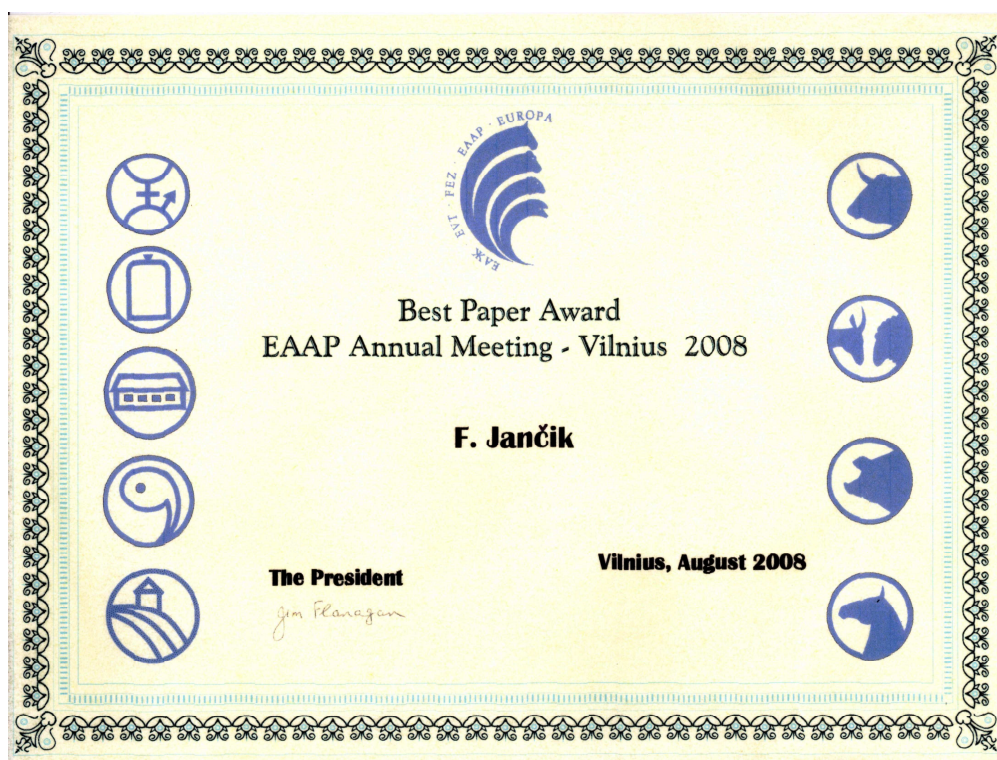
At the enlarged meeting of the SEUROP Council with the participation of foreign experts Mr. Luděk Bartoň reported his knowledge on current issues related to the cattle and veal JUT classification. Mr. Jan Pulkrábek informed on the Steering Committees activities for pork. In the course of 2008 were also commented particular versions of new in-process Commission Regulation related to the implementation of the cattle, pig and sheep JUT classification system, which enter in force of the day of 1 January 2009..

## INTERNATIONAL ACTIVITIES

The Institute's international activities are particularly related to the **European Association for Animal Production** (EAAP), where the Institute of Animal Science is a long-term official representative of the Czech Republic. The Institute of Animal Science is in permanent direct contact with the EAAP management and secretariat in Roma, it ensures all administrative agenda, sponsored trainee-ship of young research workers at annual EAAP meetings, participation of the Czech Republic on international projects organised by the EAAP, etc. The Institute as a corporate member uses its possibility to express its opinion on the EAAP activity and proposals of programme activities.

The development of the EAAP scientific-research work is ensured through its Study commissions which propose priority directions of the research resulting from changing requirements of the European animal production (Commission for Genetics, Animal Physiology and Animal Nutrition, Management and Animal Health, Cattle, Pig and Goat Breeding, Horses Breeding and Raising Production Systems). The Institute is represented in these Commissions by Ms. Věra Mátllová, who is from 2006 a vice-chairman of the Study Commission for Livestock Farming Systems, and Mr. Michal Milerski, a member of the Commission for Sheep and Goat Breeding.

In the course of scientific conference annually held along with the EAAP plenary meeting the latest results from the European scientific workplaces are presented in particular sections. The participation and presentation of our research workers' papers at the EAAP annual meetings has a long-term tradition. In 2008 eight workers from the Institute of Animal Science participated in the EAAP annual meeting in Vilnius (Lithuania), mostly students of the Doctoral Study Programme and young scientists.



*The lecture „Prediction of indigestible neutral detergent fibre of grasses“ presented in Vilnius by Mr. Ing. F. Jančík, Institute's worker, has been selected by the EAAP Committee and its president Mr. Jim Flanagan as the best lecture of the conference*

### Mobility of research workers

The Institute creates conditions for the implementation of the international co-operation on the research project solving, exchange study stays and stages, results presentation and information exchange with the aim to support professional growth and arrange valuable work contacts. The co-operation develops on the basis of concluded contracts with foreign institutes and universities (for

example, with the University of Natural Resources and Applied Life Sciences Vienna, Austria; Ondokuz Mayıs University, Samsun, Turkey; Instytut Zootechniki, Krakow - Balice, Poland; Agrobiointitute Sofia, Bulgaria; *Universidad de Castilla-La Mancha*, Spain).

Traditionally very intensive is the co-operation with the Slovakia (Slovenská poľnohospodárska univerzita, Nitra – the Slovak University of Agriculture in Nitra, Univerzita veterinárského lekárstva, Košice – the University of Veterinary Medicine in Kosice, Slovenské centrum poľnohospodárskeho výskumu, Nitra – the Slovak Agricultural Research Centre). Within the framework of the KONTAKT Programme for supporting the mobility funded from the Ministry of Education, Youth and Sports has been completed the solution of common project „Effective use of informational technology for establishing sustainable breeding objectives in farm animal breeding“.

Within the framework of the ERASMUS scholarship programme financed from the European Union three young experts from the Ondokuz Mayıs University, Samsun (Turkey) participated in three-month stage in the Technology and Breeding Technique of Farm Animals Department.

The study stays and stages are focused on the acquirement of new methods and procedures required for detailed knowledge of worked out research subjects, in particular. For shorter stays in order to cooperate within the creation of the methodologies for counting breeding values of farm animals and economic values of traits in cattle and sheep arrived professionals from Hungary and Slovakia, in particular. The ECOWEIGHT Programme developed in the Institute of Animal Science has been used for practical counts of economic weights of dairy sheep in Slovakia and collective publication was created. Under the attendance of Slovakian experts was carried out also testing the sonographic measurement of fattened bulls' muscle.

Further stays related to the preparation of new trials (preparation of common experiment with Spain partner on the subject Cervidae Etology) and testing (co-operation with Finland on the assessment and testing methods for the determination of feed digestibility). Another scientific erudite foreign visitors lectured on the subject from the etology field, in particular (scientists from Spain spoke on breast feeding in Cervidae and experimental farm for Cervidae and Mr. Xavier Boivin from France on human relationship to the farm animals, etc.).

In 2008 three foreign research workers from France, Poland and Slovakia worked in the Institute during their long-term working stays, they participated in elaborating the research plans.

### **Our trainees abroad**

In the long-term study stays in partnership universities were in 2008 Ms. Anna Chronowska (Leibniz Institute, Gatersleben, Germany) and Ms. Eva Václavková (Akademia Rolnicza my Wrocławiu, Poland).

Further specialised stages get through in the Tsukuba University, Japan (Ms. Helena Fulková, for completion of the experiments with embryonic somatic cells derivation), Ms. Eva Urbanová-Skřivanová (Smith College Northampton, USA; participation in the course of molecular biology and Fla-typing samples analysis and lecture at the Gent University, Belgium), Ms. Irena Vacková (University of Milan, problem of pig stem cells) and Mr. Zdeněk Volek (Kaposvár University, Hungary).

### **International conferences**

The Institute' workers participated in 2008, in addition to the EAAP in significant international conferences and symposia:

- The 21st International Symposium of the International Committee on Food Microbiology and Hygiene Aberdeen, Great Britain
- 4<sup>th</sup> joint INRA-Rowett Research Institute Symposium: Gut Microbiology, Clermont-Ferrand, France
- 7<sup>th</sup> BOKU-Symposium TIERERNAHRUNG im Spannungsfeld zwischen Lebensmittel produktion, Energieerzeugung und Umweltschutz, Vienna, Austria
- 22nd European Grassland Federation General Meeting - Biodiversity and Animal Feed, Uppsala, Sweden
- 9<sup>th</sup> Conference on the Nutrition of Pigs and Poultry, Halle, Germany
- 3<sup>rd</sup> International Symposium. Safe Food. Plant and Animal Production, Management, Market, Bydgoszcz, Poland

- 42<sup>nd</sup> International ISAE Meeting, Dublin, Ireland
- 12<sup>th</sup> International Behavioral Ecology Congress, Ithaca, USA
- IESM (International Equine Science Meeting) 2008 , Regensburg, Germany
- European Science Foundation, Amsterdam, Netherlands
- 6<sup>th</sup> ISSCR( International Society for Stem Cell Research) Annual Meeting, Philadelphia, USA
- Annual Conference in Reproduction and Fertility, Society for Reproduction and Fertility (SRF), Edinburgh, Great Britain
- Incontro scientifico internazionale, Università degli Studi di Teramo: Luce verde per la clonazione: la scienza al di là della legislazione, Teramo, Italy
- Benelux qPCR Symposium Gent, Belgium
- 54<sup>th</sup>. Biometrisches Kolloquium - Lifestat Conference, Munich, Germany
- 9<sup>th</sup> th Congress of the Spanish Association for Animal Reproduction, Gijón, Spain
- 9<sup>th</sup> th World Rabbit Congress, Verona, Italy
- XXXV. World Charolais Congress, Lajosmizse, Hungary
- 2<sup>nd</sup> International Scientific Poultry Days, Slovak University of Agriculture (SUA), Nitra, Slovakia
- Rural Buildings 2008, Slovak University of Agriculture (SUA) in Nitra, Nitra, Slovakia
- Konzervovanie krmív 13. (Forage Conservation 13.) Slovenská poľnohospodárska univerzita (SPU) v Nitre, Slovakia
- Dni výživy a veterinárnej dietetiky VIII., Univerzita veterinárskeho lekárstva v Košiciach
- XXIII. Dni živočíšnej fyziológie, Ústav fyziológie hospodárskych zvierat SAV, Smolenice, Slovakia



## THE EXPERIMENTAL BASIS – SPECIAL PURPOSE FARM



The experimental basis which serves especially the research activity of the Institute's scientific departments consists of 24 accredited facilities in the four centers (Uhrineves, Netluky, Kralovice and Kostelec). In addition, this special-purpose farm enables designed technologies and measures to be tested in practice and their demonstration for educational purposes and for further education in breeding and consultancy practice. On cooperation with the University of Life Science in Prague and the College and the Agricultural school in Benesov, the students participated in theoretical and practical trainings. Further, excursions for primary schools and gymnasiums and the training courses for animal transport specialists were realized here. The facilities and workplaces are continually modernized and re-equipped to satisfy the requirements of planned experiments. From the major capital equipment, the new shelter for calves and the new stable for rabbits were built in 2008.

- At the main experimental workplace in Netluky, there are facilities for cattle (cattle fattening station, experimental stable for dairy cows, 3 cow houses, a milking parlour, a rearing house for young cattle, a calf house), sheep, pigs (2 farrowing houses and a pig testing station) and horses. Furthermore, there are the biotechnological laboratory and the air-conditioned stable with a controlled microclimate. In Podlesko, the base for experiment concerning deer farm animals is located.
- The complex of experimental stables in Uhrineves is composed of physiological stables, and experimental stable for poultry and buildings for quail, rabbits and sheep breeding and breeding of laboratory rats and mice. The experimental slaughterhouse is an integral part of this complex.
- The area for beef cattle in Kralovice primarily serves to resolve research projects for the Departments of Cattle Breeding and Ethology.
- The experimental stable for pigs is located in a remote workplace of the Department of Pig Breeding in Kostelec.

In the breeding unit of dairy cattle, methodically run by research programs in the areas of genetics and breeding, the basic herd is composed of 70 % Holstein and 30 % Czech Fleckvieh dairy cows. Further, a purebred experimental herd of the Gasconne beef cattle is bred. Pig breeding is organized as the commercial one and createa the basis for experiments of the Departments of Ethology, Animal Nutrition and Animal Products Quality. In 2008, the Division of Plant Production managed 836 ha of the agriculture land in total (including 773 ha of the arable land). The plant production was focused especially on feed production in the required quality and range for the animal production purposes.

## The range and level of animal production

### Experimental stock (average annual numbers)

Category	Stock (heads)
Cattle total	617,2
from that dairy cows	217,5
Pigs (total)	602,8
from that sows	52,6
Deer and calves	59,0
Fallow deer	19,0

Category	Stock (heads)
Laying hens	80,2
Broilers	154,3
Quail	1220,1
Sheep	7,6
Horses and foals	19,6
Rabbits	66,9

### List of experiments carried out in the experimental farm

- The use of biodiversity in dairy and beef cattle breeds and the determination of hybridization effects
- Optimizing breeding policy in a herd of Holstein breeding cows in the experimental farm
- Relationship among the movement activity of cows, their daily yields and reproduction indicators
- Ovarian activity of heifers in the beginning of breeding maturity
- The start of sexual activity of dairy cows after parturition and in dependence on their energetic profile as determined from milk
- Effect of weight changes in lactating cows during pregnancy on development of production and reproduction parameters in their daughters
- Genetic polymorphism of candidate genes for meat and milk performance indicators in cattle
- The influence of different forms of methionine in dairy cow diet
- Changes in fatty acids concentration during lactation of H and C breeds
- Basic body measurements of cattle
- Regeneration of the Bohemian Red cattle breed
- Blood metabolic profile in Gasconne cattle bred in sucker cow system
- The *in situ* and mobile bag methods in cows fitted with cannulas
- The *in vivo* method of balance experiments with wethers
- Breeding of calves with pelleted milk mixture
- Pig ovaries collection for the purpose of oocytes isolation
- Evaluation of the dressing percentage of pigs
- The synchronization of behaviour, group decision making and spatial distribution of beef cattle herd on pasture
- The role of behaviour synchronization, group decision making, recollection and learning in the spatial behaviour of beef cattle
- The influence of piglet behaviour and vocalization on sow maternal behaviour in relation to piglet mortality
- The influence of calf age at mother separation and weaning pattern on behaviour of heifers in 13 and 19 months of age
- The role of androgens in monitoring animal well-being and initiation and the modification of bone tissue growth
- Behavioural aspects in breeding of farmed red deer females and calves
- The function and significance of inter-male mounting in cattle and farmed deer
- Specification of technological and zootechnical reserves in chosen herds of high yielding dairy cows



- Complete analysis of breeding environment in veal calves housed in outdoor shelters
- Thermal-insulating qualities of hair and skin of dairy cows in winter and summer seasons
- Measurement of dustiness in stables for pigs and cattle
- The influence of lighting level on performance and behaviour of dairy cows and the composition of their milk
- Testing the functional properties of central control unit of cooling equipment for animals
- Body composition and status of reproductive organs after long-term laying period in lines of Japanese quail divergently selected for the growth curve shape
- Long-term divergent selection for shape of growth curve in Japanese quail
- The influence of laying hens' age on digestibility of calcium and phosphorus
- Activity of phytase in the digestive tract of laying hens
- Calcium and phosphorus retention in hens fed diets high in wheat
- The influence of selenium supplement to diet for fattened broiler chickens
- The influence of selenium and methionine supplement to diet for fattened broiler chickens
- The influence of caprylic acid on health condition of broiler chickens
- The influence of narrowleaf lupine supplementation to feeding mixture of growing rabbits on their performance and carcass quality
- The influence of white lupine supplementation to feeding mixture of growing rabbits on digestibility of nutrients and meat quality
- Testing utility traits of rabbit breeds' genetic resources

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