

Proposal Title:

Farm Animal Proteomics (EuFAP)

Abstract:

Proteomics offers the ability to define changes in protein expression. Whilst it has already made a significant impact on biological and biomedical research, the use of proteomic strategies to investigate animal health and production has been limited. However, there is an increasing awareness of the potential of proteomic technologies to study production animals. This COST Action will form a network of leading European scientists who are focused on animal proteomics and related areas. This network will benefit the ERA science community by providing a conduit for the rapid dissemination of knowledge on the techniques and applications of this rapidly advancing area and will benefit European economy by enhancing animal production, health and welfare as well as providing tools for assessment of food quality and safety, as well as traceability in relation to the protein in food produced of animal origin. This is beneficial to both scientists and the community.

Key Words:

Proteomics; proteins; biomarkers, sample preparation; two-dimensional electrophoresis; mass spectrometry; bioinformatics; production animals; ruminants; swine; poultry; fish; meat; milk; post-harvest alteration; animal health; animal welfare; food safety; food quality; workshops; knowledge dissemination; scientific missions.

COST Domain:

Food and Agriculture

Text of proposal:**BACKGROUND, PROBLEMS**

Proteomics defines changes in the actual protein expression in biological samples, with all its modifications, and not just genetic disposition or regulation. Proteomics has evolved into an advanced science that addresses technically challenging problems of protein characterization, quantification and measurement of proteome dynamics. It has made a significant impact over the last decade in many areas of life sciences, but not in animal science related to food and agriculture. As a consequence proteomic studies on farm animals have a very low profile in leading scientific journals and are minimally represented at international conferences. This COST Action aims at building links between European scientists who have been working in relative isolation on animal proteomics to establish the ERA as the leader in this field.

Proteomics offers considerable opportunities to assess animal health and production and to monitor quality and safety of food of animal origin. It allows early characterization of breeds on the basis of their proteomes. Extensive application of proteomics in these areas will contribute to better and more sustainable animal production systems. It will help Europe to meet contemporary agricultural and ecological issues, the criteria of the Millennium Development Goals established by the United Nations. A COST Action is the appropriate instrument as there is currently no similar initiative in or out of Europe. The Cost Action aligns with the EU policies on Agriculture and Food to achieve the objectives of the European Technology Platform on Global Animal Health in diagnosis of disease by biomarker detection (www.ifahsec.org/europe/euplatform/platform.htm) and to the new Animal Health Strategy "Prevention is better than cure" of the DG

Health and Consumers (http://ec.europa.eu/food/animal/diseases/strategy/index_en.htm) by enhancing animal surveillance and disease diagnosis. Though animal proteomics is not a current theme in FP7 it should be present in future Framework Programs to ensure that the ERA is the leader in the field. This COST Action will be the first step in this direction.

The Action is extremely timely as more animal scientists consider using these techniques as their major focus or to complement existing research interests. Specific features of proteomics research in food animals make it difficult to resort to traditional research frameworks. Notable constraints associated with these techniques are:

1. Farm animal species are more heterogeneous than laboratory species, thus preempting the use of small experimental groups.
2. Identification of farm animal proteins is hampered by lack of sequenced genomes or annotated proteins.
3. Tissues and processes studied are outwith the norm for conventionally funded bioscience, for example investigation of the milk proteome and of post-harvest changes in meat and milk are of much greater importance in farm animal science.
4. The tissues studied might have contaminants not found on commonly studied specimens, affecting the quality of the analysis and reproducibility of results.
5. Post-harvest alteration to muscle proteomes are economically important issues for proteomics in food production as is food related processing of protein of animal origin (e.g. conversion of milk to cheese).
6. Proteomics is a high-resolution, but high-cost research, and employs a combination of efficient separation technologies, state-of-the-art mass spectrometers and bioinformatic tools, which are frequently unavailable for farm animal, poultry and fish research at a national level. Networking will allow sharing facilities and knowledge.
7. In Europe there is a lack of skilled personnel, esp. in the new member states. Networking will offer the chance for additional training, particularly of young scientists. Therefore, this proposal will establish a network of European scientists, working in farm animal proteomics and funded by national research programs, to overcome these constraints.

BENEFITS

Proteomics can improve the competitiveness of industry sectors by assessment of productive performance, product certification and traceability, food quality, food safety, biotechnology and development of diagnostics and vaccines. New advances in protein separation, sample pre-fractionation and identification are expected to be made publicly available through this Action and will benefit industrial applications in the livestock and food industries in Europe. Researchers involved in the COST Action will benefit from a regular international forum of discussion to exchange ideas and conduct technical and scientific updates. The establishment of international cooperation in joint projects and short-term scientific visits would be extremely valuable. Finally, proteomics offers unique opportunities for improving public understanding and acceptance of new developments in science, essential for the implementation of industrial applications.

OBJECTIVES, DELIVERABLES AND EXPECTED SCIENTIFIC IMPACT

The following deliverables will be attained:

1. Development and dissemination of efficient tools and protocols to study the proteomes of farm animals and derived products.

2. Correlations between proteomics data and physiology, health and production in farm animals and identifying disease related deviation.
 3. Characterizing protein patterns of existing breeds, to find trait-specific marker proteins (to help establishing new breeds).
 4. Characterizing the change in proteome of food of animal origin during processing in relation to safety, quality and functional food issues.
 5. Generation of fundamental knowledge on proteins and their functions in farm animals.
 6. Establishment of disease biomarkers in host and pathogens and study of their interaction.
 7. Integration of proteomic data in systems biology via bio-informatics tools.
- The scientific impact on achieving these deliverables will be felt by end-users in animal science research, in the animal health industries, in food production and processing industry and ultimately by the consumers of Europe.

SCIENTIFIC PROGRAMME AND INNOVATION

To achieve the objectives of the COST Action, the scientific program will allow regular dissemination of research on:

1. Efficient cross-species sample preparation protocols.
2. Identification of proteins from tissues of poorly characterized species.
3. More sensitive detection protocols for low abundance proteins.
4. Establishment of high throughput methods and automated protocols for production animals sample handling and protein identification.
5. Integration of proteomic results in systems biology by bioinformatic tools.
6. Increase access to high-resolution mass spectrometry for researchers through the establishment of international collaborations.
7. Stimulate exchange among researchers within the field of farm animal proteomics through the organization of international conferences, workshops, research-industry roundtables and short term scientific missions for early stage researchers.
8. Effectively communicate developments in production animal proteomics to the scientific community, economic and industrial agents and to the general public through scientific, technical and popular articles.

ORGANISATION

The flexibility of the COST Actions allows the co-ordination of nationally funded research at the European level. COST is the instrument of choice to bring together European animal proteomics specialists, an area neglected in comparison to the success of the Human Proteome Organization and organizations focused on animal genomics. A critical mass can be obtained through a consortium of different European institutes with interest in animal proteomics bringing together their collective experience.

A Management Committee (MC) and three working groups (WGs) will be established: WG1: dealing with applications to the field of agriculture with special focus on animal health, wellbeing and disease. Networks will develop for major production animal species and tissues.

WG2: dealing with the changes that take place while tissue and fluid of animal origin are processed to food. The changes in the proteome of meat, fish and milk during processing can provide a blueprint for assessing food quality, safety and identification issues.

WG3: dealing with general problems inherent to methodologies used in animal proteomics (protein extraction, separation, mass spectrometry, standardization) and in the use of bioinformatics to interrogate protein and gene databases, especially in the absence of fully sequenced genomes.

The MC and each WG will meet twice a year. The latter will lead to scientific publications in international peer-reviewed journals and monographs. A public forum website will allow discussion about technical aspects of analyses. Articles in periodicals will target general public. In all WGs, special emphasis will be put on training young researchers with short term scientific missions and practical courses being undertaken. This action is expected to lead to a long-term networking at the European level fostering the creation of an animal proteome association.

This application is composed of 73 researchers from 28 eligible countries. It includes different research interests and brings together groups of international expertise in proteomics and animal researchers with little experience on these technologies. The application combines senior and early stage researchers, with special respect to gender balance. Interaction with already existing COST Actions of this domain will be established and will bring benefits to all parties: e.g. FA0603 Plant Proteomics in Europe (EUPP); FA0805 Goat-parasite interactions: from knowledge to control (CAPARA); FA0601 Fish Reproduction and Fisheries; 861 European Network for Pig Genomics. Further, there will be scope to expand the network and establish new collaborations across disciplines.

Participants in network:

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