Italian Technology Platform on
Global Animal Health

THE VISION 2020

JUNE 2008

INDEX

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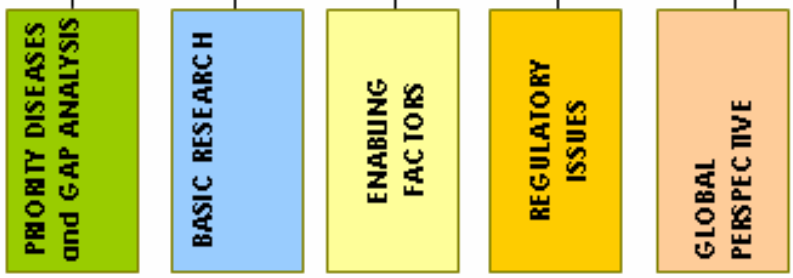

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Executive Summary

This century is characterised by an "epidemiological globalisation" on an unprecedented scale, with resulting impacts at the interface of economic, scientific, social and political forces arising from the emergence and re-emergence of animal diseases.

Epidemic diseases threaten national livestock industries with direct socio-economical effects; these include high levels of morbidity and mortality, control or eradication programme costs and restrictions to trade in livestock and livestock products. **Zoonotic diseases** have impacts on human and animal health. The effects of zoonotic infections on human health are usually greatest on livestock keepers who live in close proximity to their animals. Unlike emerging zoonoses which attract considerable international attention, **endemic zoonoses**, like brucellosis, echinococcosis, leishmaniosis and others, fall very much into neglected zoonoses. For many neglected zoonoses the incidence is often unknown and greatly underestimated, for this reason seldom reflecting the real importance in the communities in which they occur.

Food-borne infections and intoxications are a particular problem in most industrialized systems. Their incidence is likely to increase as livestock production and processing systems become more intensive. Controlling zoonotic agents in animal reservoirs reduces the challenge to the food safety systems starting from the pre-harvest phase. The impacts of endemic diseases are mainly felt at farm level, while broader economic impacts can occur with epidemic diseases that restrict trade in livestock and livestock products. Endemic diseases have impacts on livestock keepers and consumers because of productivity losses, control costs and indirect losses.

Italy shares many characteristics with other countries of the Mediterranean area, in particular in the field of climate, environment, agriculture system management, quality and typicality of agriculture productions. In relation to these similarities, Italy has more sanitary problems in common with the other Mediterranean than with northern European countries. In fact the quality and the typicality, and therefore the economical impact of productions, can be severely affected by endemic diseases as well as by the animal welfare. In this context, political considerations as well as consumer demand for **rigorous quality of products,** impose the identification and validation of biomarkers to describe the different endocrine, immune and metabolic components on the pathogenesis of a broad variety of diseases. Moreover, several endemic diseases such as brucellosis and blue tongue have to be considered as major problems in our country since there is a **growing demand for safer food, healthier and higher quality food**. Furthermore Italy, for its geographic localisation, could represent a possible access for transboundary animal diseases that can be responsible of future epidemic emergencies. All these concepts

must be taken into account when prioritizing the diseases to focus research on national requirements in the next years. It should be also underlined that even the **diseases of pets,** especially dogs, cats and wild synantropic animals, do have in many instances a **significant socio-economic impact** and some of them may pose serious **public health problems**.

In this context it must be evidenced that also pet animal diseases can be relevant in the overall concept of global animal health. Therapy of pet animals has a positive social impact: in fact preventing and treating pet animal diseases reduce their suffering and pain and meet the emotional needs of the owners. Recent research demonstrated that the human/animal interaction benefits human physical, emotional and psychological well-being.

The animal health industry has created significant socio-economic benefits for Europe, but it must remain competitive if it wants to survive.

In 2006 **the italian animal health industry showed a positive trend with a market growth of +2% compared to 2005**. In particular, a growth of +1.5% was seen for the farm animal (exp. swine and dairy cows) health products. For companion animals a growth around 4% was observed. Feed products sector registered an overall growth of 1,5%.

Europe has been at the forefront of advances in genomics and biotechnology over the past decade.

These advances provide opportunities to develop new or improved tools to control animal diseases. **Italian Biotech industry provides a bright picture for the sector**. The companies active in this sector are now 222, with 87 new ventures created in 2006 only. There is a strong predominance of companies active in health care (73%), and a prevalence of Small and Medium Enterprises (76% of total). The sector counts 14,000 employees of which a relevant number engaged in R&D (4900). The most interesting figures though, a part from the vitality of new ventures, relies in the sales of innovative biotechnological products and technologies that have generated revenues for 4 billion Euro in 2006, while expense for R&D reached 1,3 billion Euro. Forty-two new products are in an advanced stage of development, seven of which already in Phase 3. The industry performance has been outstanding, mostly for what concerns SME's that have scored an overall + 24.2% in growth rates. In a nutshell the new report definitely accounts Italy as one of the top players in this sector in the global scenario (Rep. Blossom Ass. - Assobiotec□2007).

The rate of scientific progress continues to increase and Italy like the rest of Europe must continue to use the opportunities presented by the new technologies to retain its competitive position. However, the advanced research needed to develop new

products is expensive in terms of expertise, equipment and facilities.

Besides to biotechnologies, in the recent years, there has been a general resurgence of interest in traditional health-care practices. **Mediterranean area and Italy in particular have a great background for conducting scientific studies improving phytotherapy and nutraceuticals**. Renewed interest in human environment relations, the global environmental crisis and a greater awareness of the value of traditional environmental knowledge contribute to foster this trend.

ITPGAH is aimed to create a discussion forum between different stakeholders, under the leadership of industry, since this is needed to develop research and avoid duplication for a more effective use of resources and limited funds. **The Technology Platform will provide a mechanism for focusing research on national priority** animal diseases leading to new knowledge and consequently to the development of improved therapeutics, vaccines, diagnostics and farm management control methods.

The first step will be to outline the Strategic Research Agenda that will cover a period of 10–15 years and which will allow long-term priority requirements to be identified, as well as the potential funding from the public and private sector. The Strategic Research Agenda also needs to **address the key issues of national competitiveness**, although the immediate purpose is to develop tools to prevent, recognize and control disease by using new technologies and making the most effective use of technologies currently available.

1. PRIORITIZATION OF DISEASES AND GAP ANALYSIS

ETPGAH has developed a method to prioritise animal diseases to enable funders to focus on research allowing the objectives of the platform to be met. The working model for the prioritisation must be discussed by national stakeholders and accepted by funders, to provide a list of diseases of importance determining funding priorities. The ITPGAH will then decide with all the stakeholders whether the ETPGAH methods for disease prioritization and gap analysis will be suitable for the identification of the italian research priorities.

ITPGAH will also focus on animal nutrition and develop appropriate tools directed towards assurance of high levels of safety of foodstuffs of animal origin through development of efficient preventive measures against illegal practices.

1.1 Controlling Animal Diseases

Food animal production methods underwent substantial changes over the past fifty years, but the rate of change in our country varied from north to south and from region to region with consequential differences in the nature and quality of products produced under different regimes. In the Mediterranean regions animal populations represent a very close link between human and their environment. This link is manifested in traditional farming

as well as where livestock intensification has been introduced. Improving surveillance and implementing the controls in the pre-harvest phase can be considered as the first step in controlling farm animal diseases.

Farm animals can become vectors of zoonoses to humans via food consumption and contact or through parasite vectors. Mechanisms involved in the spread of infections at farm level are mainly controlled through appropriate hygienic practices (i.e. biosafety measures), ensuring that feed, water and the environment in which the animal live are free of specific zoonotic agents and that the animal parents cannot transfer the infection to newborn. Controlling animal diseases and in particular zoonoses at farm level has the effect of reducing the challenge to food safety along the food chain.

Besides zoonotic agents, growth promoting hormones (GPHs) and hormone-like substances in various combinations, used with the aim to improve weight gain and feed efficiency in cattle and sheep is considered a possible danger for public health, due to the great amounts of residues left in edible tissue. Thus GPHs are unavoidable constituents in non-vegetarian human nutrition, related to the increasing number of publications presenting epidemiological data on good farming practice regulations and systems to provide a higher level of transparency, such as quality risk management programmes, are being developed. Consumers expect the food they purchase to be safe. Governments seek to provide them with assurances of food safety through regulation, but additional steps are needed to fully address the issue. Producers have to become aware of their responsibility in this area and to work in concert with other segments of the agri-food industry. Hazard analysis critical control point-based (HACCP) quality assurance programmes have to be developed and implemented at the farm level for most species. Epidemiological surveillance consists of systematic and continuous collection, analysis and interpretation of health data in order to follow, in time and space, the health status and some risk factors associated with diseases for a given population. Its use is essential in the planning, implementation and evaluation of disease control programmes and interventions. However an overall control strategy, starting from surveillance studies to quantify the exposure to residues of the GPHs in cancer development to effective monitoring programs of their illegal use in animal fattening is needed.

Increased pressure from a critical public is moving the animal-based production towards organic production and loose-housing system which allow the focus on food safety promotes systems with a high degree of biosecurity, often associated with an increase in herd size and self-containment. The globalisation of agricultural trade and increased competition

also favours an increase in herd size and specialisation. These trends also lead to regions with livestock-dense areas, giving rise to environmental concerns. In Italy, epidemiological data on some diseases, which are endemic in certain areas, are scarce or not reliable, in spite of their socio-economic significance. Cystic echinococcosis is a clear example of this situation: official report of the cases of the disease (especially in humans) is lacking and cannot be used for epidemiological analyses or statistical purposes. However, with reference to present activities of epidemiological surveillance in Italy as a whole, negative aspects are often found making surveillance scarcely useful. Some examples are represented by: (i) lack of integration between parallel information; (ii) discordance between collected and utilised data; (iii) scarce use of new computerised information methods for a better management of data; (iv) not enough data collected and processed to obtain prevailingly statistical information.

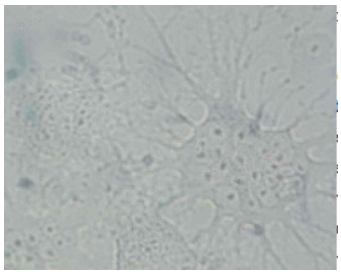
In order to improve the activities of epidemiological surveillance, different interventions are needed, either general or specifically related to a given disease. The main actions be undertaken are the following: (i) identification of people who may be charged with the responsibility for the reception, analysis and transmission of data; (ii) standardisation of information and data collected in view of their automatic processing; (iii) validation of the data at the local level; (iv) fast transmission of data; (iv) long-term planning of surveillance activities, avoiding sporadic ones; (v) improvement of the collaboration between veterinarians and physicians for the surveillance of zoonotic diseases and related problems.

1.2 Developing vaccines and therapeutics and diagnostics

In the last few years, outbreaks of major animal diseases were responsible of devastating impacts on animal and human health, food safety, animal welfare, rural communities and the environment and in the wider European economy. One of the most important goal of the Community Animal Health Policy (CAHP) 2007-2013, is to find effective alternatives to the massive culling of the animals that were adopted as a consequence of the recent epidemic outbreaks in Europe. For this reason ETPGAH prioritized the development of effective tools for controlling epizootic animal diseases of major social and economic impact, focussing on the development and delivery of vaccines and diagnostic tests in the first instance. In the longer term antiviral development and breeding for resistance may have an important role to play in controlling animal diseases. **The Italian priorities are different** and should be focussed in developing tools aimed in **reducing the economic losses caused by the endemic diseases of farm animals, pets and wild animals.**

1.3 Diagnostic tools

The diagnostic tools need to be efficient in term of usability and ability to make possible a further characterization of the microrganisms. In this view, biotechnology has potential applications in the management of several animal diseases and molecular diagnosis is assuming an important place in veterinary practice.



This is fundamental in order to distinguish, within a species, those strains with virulence traits that strongly increase their ability to infect humans and become cause of outbreaks (e.g. by food consumption). The integration of data, recorded at various steps of the food production chain, is the key for optimizing the costs and the effectiveness of mitigation (reduction of prevalence in farms/animals) and exclusion (farms disease-free). The sampling plans should be developed on the basis of previous knowledge (expected prevalence). This prevalence and its relative uncertainty can be estimated from monitoring/surveillance results, which are relative to specific and subsequent stage of food and feed production. Implementing strategies to refine the sampling and analytical protocols for the most important (for their prevalence and health risk) zoonotic agents, including Salmonella, Campylobacter and VTEC, is important in order to detect and trace their source and the main route of transmission. Effectiveness and cost optimization need to be assessed and the use of innovative tools, like biosensing devices, are to be addressed. Sensitivity and specificity of the test used to detect positive sample, uncertainty derived from analytical and sampling procedure have to be analyzed. Moreover, validation should involve not only a single procedure applied to a specific sample, but to the overall control strategy for the problem (i.e. salmonella in laying hens or broilers or hogs, VTEC in cattle, campylobacter in broilers) and used to assess the uncertainty of data and the efficiency of the control strategies. According to the "3R's concept" on animal experimentation (Reduce, Replace, Refine), a major objective in animal welfare is to reduce the use of animals in testing programmes for pharmaceutical and immunological veterinary medicine.

Tremendous progress has been made in the ability to measure particular contaminants or veterinary drugs at very low concentrations. However, rare or previously unknown compounds, metabolites and mixtures are still presenting considerable analytical challenges, while this category in particular might be relevant in terms of food safety.

Recent progress in stem cell biology and manipulation offers the opportunity to use these highly sensitive cells to develop reliable test for screening toxic molecules.

In particular, environmental pollution with persistent organic compounds known as endocrine disruptors (diethylstilbesterol, dioxin, dioxin-like polychlorinated biphenyls, the pesticide dichlorodiphenyl trichloroethane, and some other pesticides), has received much attention recently not only by environmental scientists but also by

the public, and these substances are believed to have a high impact on animal and human health. Maternal exposure to these hormone-mimicking substances may produce effects at the puberty age, since they accumulate in several tissues and have been shown to affect fertility. Moreover, these substances shows a reduced degradation rate associated with a long half-lives in animals, and subsequently they accumulate in the food from animals origin and indirectly in humans due to the slow degradation in the environment, these substances accumulate in the food chain and have long half-lives in animals, food of animal origin and humans. Thus, there is an increasing need for fast, reliable and sensitive tests to detect contamination in order to prompt evaluation of the regulatory requirements for developmental toxicity and to use these data for risk assessment. Permanent lines of pluripotent stem cells of embryonic origin or derived from adult tissues (like epidermis, central nervous system, bone marrow, etc.) might be used to develop in vitro test to investigate mutagenic, cytotoxic and embryotoxic effects of chemical substances such as endocrine distruptors also in a dose-dependent manner. Thanks to the progress in characterization and cryoconservation of these cells, it could be possible to create a 3D-devise using nanotubes as scaffold for these cells, for fast and reliable viability tests. The CAHP 2007-2013 also identifies the feed sector as an important strategic area for future policy making. With reference to this, **Italian priorities should also focus on enhancing good farming practices through development and introduction of efficient controls against use of illegal growth-promoters and/or irregular use of veterinary medicinal products.**

Areas for potential development include:

1. Testing methods based on histological analysis of target organs
2. **development of validated protocols** that can lead to ascertain treatment with illegal hormonal products;
3. Improving high sensitivity assays for detection of GPHs and their derivatives and metabolites;
4. Applying a proteomic approach to obtain protein expression maps from tissues and/or biological fluids, to identify possible markers for *post-mortem* and/or *ante-mortem* uncovering of illegal treatments.

In recent years, gas chromatography coupled with mass spectrometry and liquid chromatography coupled with mass spectrometry techniques have been developed as the most sensitive methods to detect hormone residues in tissue.

These techniques, however, need to be extended to the widest range of synthetic derivatives, as to potentially hazardous metabolites and to be further implemented with their analytical sensitivity. In parallel, an effective surveillance on illegal treatment in national herds by sensitive tools is needed to support the official controls by chemical analysis. The standardization of the sampling method and the evaluation of these techniques on a number of treated and untreated animals will be required, e.g in order to assess the accuracy of histopathology as a screening tool useful to further complement the official controls.

1.2.2 Vaccines and pharmaceuticals

Vaccination provides a promise for disease control and prevention, but in many cases it is not yet achievable and does not eliminate the need for pharmaceutical treatments in case of disease outbreaks. Furthermore, there are some scientific limitations for the production and delivery of effective vaccines against RNA viruses, that have been in most cases responsible for recent epidemics in Europe and in the world; RNA viruses, in fact, evolve rapidly, making it difficult to design long-lasting vaccines. Furthermore, vaccinations have a limited application in case of emergencies due to sudden outbreaks or bioterrorist attacks.

Antivirals can be considered as possible alternatives when vaccination is not feasible, and would offer advantages where ~~in~~ contact animals need protection during emergency vaccinations.

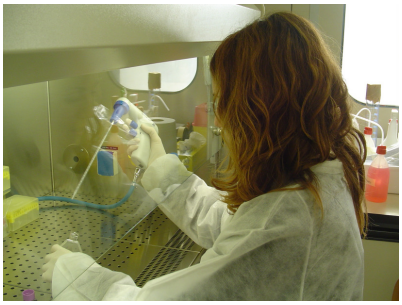
At present, antiviral therapy is limited mainly to human diseases, with only few applications in veterinary medicine. Antivirals against animal diseases may become increasingly important since antivirals can be used to treat the animals, in case of outbreaks, to limit the environmental dissemination of the pathogens and consequently limit the epidemiological spread of the disease between animal groups. Antivirals can be also used for treating pet animal diseases, thereby reducing their suffering and pain. Animal viruses can be used as surrogate models for the study of antivirals aimed to treat human diseases. Research on antivirals also represents a starting point for basic reaserch on the molecular mechanisms of host-pathogen interactions. These mechanisms are frequently identified as gaps in the knowledge of several viral diseases. For animal welfare and economical reasons, effective antimicrobial drugs, including innovative classes of compounds such as fluoroquinolones and cephalosporins, should be available in veterinary medicine. The possibility to rapidly and effectively treat clinically sick animals should always be part of, and not a replacement for, an integrated disease control strategy. There are, however, some concerns that administration of highly valuable antimicrobial drugs to animals may result in the selection of resistant bacteria, which may then be transferred to humans via the food chain and subsequently may compromise human health.

In recent years, there has been a general resurgence of interest in traditional health-care practices. In animal health, this has led to further interest in **ethnoveterinary research** a relatively new field of study that covers, among others, the ethnobotany. In 2003, the Convention "*Safeguarding of the intangible cultural heritage*" was adopted in Paris at the 32nd Session of UNESCO. In the Convention it was stated that the knowledge and practices concerning nature and universe are part of our cultural heritage. Nowadays medicinal plant used in traditional veterinary practices have been recorded but there are **few scientific studies on the evidence-based veterinary phytoterapeuticals with**

repeatable data and R&D on plant-based products is still lacking.

Phytotherapeuticals can be able to improve animal health in breeding environment raising at the same extent the quality of dairy and meat products. In the Mediterranean area and in **particular in Italy there is a great background for conducting scientific studies improving phytotherapy and nutraceuticals.**

Gene therapy for diseases of pet animals is a fast developing area because many of the technologies used in clinical trials for humans were developed in animals. Besides the studies performed with small inbred laboratory animals, the veterinary researches showed that there are biological similarities between large animals (e.g dog, cat, horses) and humans, making them appropriate preclinical models for gene therapy of many human disorders**.** For example many inherited disorders in dog are similar to those of humans. **Large animal preclinical models have the potential of being useful intermediate between rodent studies and human applications. For this reason the research on genetic diseases of animals should be enforced.**



Basic research provides the fundamental knowledge for the development of new technology and the delivery of new tools for controlling animal diseases. Research areas like genomics, proteomics, nanotechnology, fundamental epidemiology and immunology are the main research areas that are needed to fill the gaps in the knowledge of many diseases. **National research programmes need to be established in order to support basic research.**

2.1 Genomics and proteomics

Many infectious diseases of humans and animals are caused by viruses and emerging viral infections have been reported with increased frequency in the last years. Viruses affecting animals are often zoonotic agents and interspecies transmission frequently occurs (influenza virus origins from birds, HIV is a simian virus, animals like cat civets are potential source for transmission of SARS-CoV). New approaches based on computer simulation were reported for the analysis of genomic sequences of viruses. Evolutionary study of several representative viral species, chosen among RNA virus responsible for a variety of economically important diseases of animals, is a key factor. RNA viruses such as picornavirus, coronavirus, pestivirus show significant genetic heterogeneity as a result of the accumulation of mutations during viral replication. Phylogenetic methods allow the mapping of these differences by building trees, depicting the relationship similarly as in a pedigree. Also, the advances in genomics can make it easy to develop models using non-pathogenic variants from

which to extrapolate conclusions. The heterogeneity of RNA virus populations allows great adaptability and rapid evolution of RNA genomes. Genetic instability of RNA viruses might induce mutations or inter-species recombinations, allow cross-species transmission, facilitate the appearance of new viral variants characterised by high virulence and possible zoonotic potential. Several infectious diseases of farmed animals are caused by RNA viruses and our analysis will focus on them. Footh and Mouth Diseases FMDV and Bovine Viral Diarrhea Virus BVDV have great impact on the health care system and the economy in the infected areas, and it necessary to investigate their quasispecies nature and their evolutionary history.

Viral genetic instability can induce severe outbreaks in spite of the application of prophylaxis strategies. This is mostly due to the appearance of new viral variants, characterized by high virulence and ability to elude the host immunologic surveillance system. Phylogenetic analysis provides a powerful user-friendly interface to study the molecular evolution of pathogens.

The acquired genetic information may be useful to set up new diagnostic tools, vaccine and antiviral drugs to control infectious diseases.

Part of the problem in finding effective strategies for diseases control lays in the quasispecies nature of the RNA viral agents. Quasispecies offer alternatives for improving disease prevention and treatments. For example, there is evidence that RNA viruses replicate near the error threshold, the minimal fidelity compatible with maintaining their genetic information. It is possible to target this high mutation frequency by mutagenic antiviral drugs in order to destroy the virus using mutagenic antiviral drugs that might exploit it to destroy the virus.

In general, the technology and information available for genomics and immunological research today could facilitate a step-change in the rate knowledge discovery. However, the availability of genomic tools suited for the dissection of disease related traits differs between species. Nevertheless there is still a considerable amount of work to do: genome sequences need to be completed, the assembly of genomes needs to be corrected, relevant polymorphisms need to be identified, and the annotation of genes and regulatory elements needs to be verified and completed. Use of the genome sequence and related data has facilitated the construction of tools for assaying genome-wide expression, while annotation of the genome will facilitate the interpretation of proteomic data. However all these tools represent only the starting point: the next challenge will be to design studies for using the information to understand the regulation of gene expression and the influence of external factors, such as disease, on modulating the regulatory mechanisms through newly described factors such as epigenetic modification and micro-RNAs.

With the availability of the genomic tools, research efforts have increasingly turned to quantifying the genetic control of the host-pathogen interaction. However, as the response of the host will be linked to variations in the pathogen, **future basic research must fill the gaps in the knowledge regarding the interactions**

between host and pathogen. There are also considerable gaps in our knowledge regarding the individual response to vaccination, even though very often vaccination is the best prophylactic tool available. Little is known about the mechanisms behind the host response to vaccines that are important for successful protection against subsequent disease challenge. It is thus of great importance to dissect, at the molecular level, the host responses to vaccination and the responses to live infection.

Research on genetic resistance to infectious diseases is a high priority for the increasing consumer pressure for antibiotic-free and "naturally" produced foods, the increasing attention on animal welfare and the producer's interests. The principal task of the host defense is the ability to cope with the high evolutionary potential of pathogens; this is done through the genetic variability of specialized cells and their capacity to co-ordinate action within the immune system and within the organism. Thus, genes involved in specific or non-specific immune response are the principal targets to highlight resistance mechanisms: genes whose variability is a primary attribute and a prerequisite for their function; genes whose variability is secondary.

Outcome of research on genetic resistance may be the implementation of breeding strategies, which may play an important role for diseases in which vaccines and pharmaceuticals have not been successful tools. On this basis, the European Union has looked at genetics as a tool to control scrapie in the sheep population. This is at present the only effective strategy, but it needs to be continuously re-evaluated on the basis of the concern raised by the emergence of new prion strains: the likely involvement of other regions of the genome that contain elements with roles in determining the disease phenotype needs to be investigated.

A genome-wide approach to study gene expression is useful to identify regulatory pathways and genetic factors involved in disease pathogenesis and in host-response, which can be used to develop pharmaceuticals or diagnostics. To identify the factors and to understand the movements involved in the physiological and pathological pathways of an organism it is also important to **study the end product of the genome defined proteome**. Advances in genomics as well as technologic advances have made it possible to apply the proteomic approach to reveal all expressed proteins (proteome) within a given organelle, cell, or even organism.. Proteome derives from the words "PROTein" and "genOME": as the set of genes of an organism is its genome, the set of protein expressed in a cell is its proteome. While the genome is comparatively static, the proteome is a highly dynamic entity, as the protein content of a given cell will vary with respect to changes in the surrounding environment, physiological state of the cell, stress, drug administration, health and disease. Indeed, proteomics encompass evaluation of protein expression, activation, modification, degradation and hopefully aim to disclose protein function. Therefore, **proteomic technologies will play an important role in drug discovery, diagnostics and**

molecular medicine because of the link between genes, proteins and disease. Identifying unique patterns of protein expression, or biomarkers, associated with specific animal diseases is one of the most promising areas of clinical proteomics. For instance, the application of this approach to prion diseases could help to identify new molecular markers for in vivo diagnosis, at present not available; to elucidate their pathogenesis; to address therapeutic treatments and to define the molecular features of the different agents involved in the infection.

The enormous analytical potential of proteomics can now be used to reveal, at the protein level, the molecular basis of diseases states, complementing transcript and genomics data. Consequently, the proteomic approach may target: basic research designed to further understand the molecular mechanisms underlying animal disease, discovery and validation of diagnostic and prognostic disease biomarkers, discovery of novel drug targets as well as development of new drugs and control of their use in clinical trials.

Proteomics combines bioinformatics and sophisticated analytic methods such as two-dimensional electrophoresis and mass spectrometry for the expression profiling of proteins and the elucidation of functional relationships among proteins. Finally, application of proteomic analysis to virology allows to establish the structure and the functions of many viral proteins, to identify biological consequences of mutations in the amino acid sequence, understanding the nature of virus-host interactions and identifying viral variants and the set of possibly immunogenic proteins of a pathogen.

These data may allow to predict how viral populations might respond to future vaccines and drug intervention programs, and what evolutionary processes underpin viral emergence.

Although the present time has already been referred to as the post-genomic era, our opinion is that both proteomics and genomics will provide clinically useful and complementary information that will enhance scientific understanding of main diseases in animals and will advance the health of both animals and humans. Indeed, although the focus of proteomic studies has been on human pathologies, diseases that occur in other mammalian species may provide additional perspectives on the pathophysiology of human disorders. As a result, **veterinary research aimed at promoting animal health may lead to concomitant improvements in the characterization, clinical management and treatment of human diseases.**

The development and transmission of pathogens by ticks represents a classic example of vector-host interaction. The expression of surface proteins in rickettsial pathogens, has been shown to vary with environmental conditions or host (both tick and vertebrate) cells. Selected surface proteins have been found to be involved in host cell invasion and in the generation of

antigenic variants that contribute to the establishment of persistent infection. Current proteome investigations are basically focused on two major areas: i) the expression proteomics, which aims to measure up-and down-regulation of protein levels, and ii) the functional proteomics aimed at the characterization of cellular compartments, multiprotein complexes and signaling pathways. Typically, **expression proteomics** studies are addressed to the investigation of the expression protein patterns in abnormal cells in comparison with normal cells. In biomedical applications, this comparative approach is usually employed to identify proteins that are up- or down regulated in a disease specific manner and it is used as diagnostic markers or therapeutic targets. **Functional proteomic** approaches are addressed towards two major targets, the elucidation of biological functions of unknown proteins and the definition of cellular mechanisms at the molecular level. Many cellular proteins display their biological functions through the rapid and transient association within large protein complexes. Understanding protein functions as well as unravelling molecular mechanisms within the cell is then depending on the identification of the interacting protein partners.

Nutrigenomic is another novel field of research that is gaining importance also in veterinary science. Some nutrients can affect the expression of genes involved in metabolic pathways important for the prevention of metabolic diseases, i.e. some categories of fatty acids can affect the expression of genes involved in the peroxysomial oxidation of fats in the liver reducing the occurrence of fatty liver syndrome in dairy ruminants.

2.2 Nanobiotechnology

Nanobiotechnology and nanomaterials have the potential to provide new tools for different veterinary and medical application. Delivery of medicines is one of the possible applications: nanoscale devices are envisioned that will have the capability to detect and treat an infection, nutrient deficiency or other health problems before symptoms become evident. This type of treatment can be targeted to the affected area. These so called “smart delivery system” have also the capacity to monitor the effects of the delivery of pharmaceuticals, nutraceuticals, vaccines, chemicals, etc. Advances in the field of nanotechnologies will have the capability to treat and monitor farm animal and pet interventions, develop nucleic acid delivery systems as an alternative to viral vectors. Furthermore nanotechnologies are being applied to develop identity preservation (IP) systems providing stakeholders and consumers an access to informations regarding farm of origin, environmental practices and animal welfare. Nanoscale IP has the potential to track the history of food products.

The development of nanosensors that can monitor some physiological parameters in farm animals is a promising field. The rapid

knowledge of variation of some physiological parameters allows to prevent the occurrence of pathologies. Design and development of the sensing probes for monitoring of rumen parameters is an example of possible application of nanotechnology in order to prevent metabolic diseases in cattle.

Furthermore, nanotechnology is the basis of the construction of new compact, high throughput diagnostic devices both for genetic and biochemical analyses. It is expected to play a pivotal role in designing and producing new diagnostic tools for biomedicine in general, and thus in veterinary diagnostics as well. Moreover, tests are strongly needed in this field, thus nanotechnology application to veterinary diagnostics should be envisaged as a technical priority.

2.3 Fundamental Epidemiology

The role of epidemiology in the surveillance and control of animal diseases is essential. In Italy, a better use of epidemiological data, concepts and methods in the preparation, updating, monitoring and evaluation of activities and interventions of veterinary services seems to be necessary, in order to evaluate their effectiveness and efficiency. For this purpose, the following fields must be strengthen:

- specific training of veterinarians in the field of epidemiology at University and post-graduate levels.
- **Cooperation between veterinarians and physicians** with special reference to zoonoses.
- Consolidating and validating livestock disease decision support methods. **Developing enhanced and validated tools to aid decision-making relating to the control of the most important endemic diseases in Italy.**
- Cost benefit/studies; enhanced methods of presentation; improved simulation models; animal disease databases, improved analytical frameworks. All these aspects are necessary for decision support to farmers and other stakeholders in connection with disease prevention and control activities.

In addition to the control of established pathogens regarded to as the current threats to both animal and human health, epidemiological studies should also be aimed **to evaluate the role of emerging or re-emerging infectious agents**, particularly those involved in possible zoonotic transmission. Non-exhaustive examples of these are the swine hepatitis E virus that appears to be widespread in Italian farmed pigs and may be transmitted to humans via food of animal origin, bovine and swine (but also pet animal) rotaviruses which may spill over to humans and re-assort with human strains, and enteric caliciviruses of swine origin. Special attention should also be dedicated to vector borne and tick-borne diseases, e.g. Rickettsiosis, Ehrlichiosis, Anaplasmosis, and Babesiosis.

The increasing urbanisation has favoured the spread of zoonoses with urban cycles which find in cities the proper conditions for their transmission and/or perpetuation in nature; this is the case, among others, with cryptosporidiosis, skin conditions by fungi and mites, botonneuse fever and other tick borne disease, larva migrans, leishmaniosis, leptospirosis, cat's scratch disease, and toxoplasmosis. Many families keep animals for companionship or recreation. In the recent years, the number of pet-transmitted zoonoses have increased and this resulted in the development of the aforementioned veterinary urban hygiene. Of special importance is also the development of pet medicine. Applying preventative measures such as vaccinations, antiparasitic and antimycotic treatments, reduces the risks associated with the coexistence of humans and animals. Among diseases of wild animals, domestic large animals, pets and cetaceans having a serious zoonotic potential a considerable number is represented by those capable of causing severe neurological affections in animals. As neurological zoonoses in the Italian animal population have not yet been properly investigated to date, much information is lacking about their real prevalence which is probably underestimated and their clinical and pathogenic features. Given the need to assess their global impact on both animal and human health, they must be addressed as a major health issue that our country should properly taken into account.

2.4 Immunology and Blood Biochemistry

The knowledge of the role of cytokines connecting the immune and inflammatory systems is crucial to setup new therapeutic strategies that are aimed to: inhibit the synthesis and the release of cell mediators; to stimulate the production of anti-inflammatory cytokines; to remove the circulating inflammatory molecules; to block their binding to the cellular receptors or, finally, to inhibit the transduction signals. The aim of research in this field is to **investigate the immunological mechanisms by the study of cytokine profiles, and implement effective prophylactic and therapeutic strategies for several disorders.**

These molecules are promising targets for the immune manipulations of the udder that could help to reduce the susceptibility of the cows to clinical mastitis. In fact, the cytokine profile locally evoked in the mammary gland may influence T helper cell differentiation toward Th1-type, which is responsible for the cell-mediated immunity, or toward Th2-type response and the subsequent antibody response. Because the Th-1 response is one of the key mechanisms to control the invading bacteria during mastitis, the use of recombinant cytokines enhancing Th1-type response can be considered as a “natural adjuvant” offering the hope for the development of efficacious vaccines against mastitis.

Studies should include viral immunology (e.g. RHD, EBHS, Myxomatosis, etc) with particular importance to the mucosal immune system. Many viral surface antigens are involved in eliciting a protective antibody-mediated immune response, in addition to cell-mediated immunity, often due to secretory IgA (and IgM) immunoglobulins produced by the

Mucosal-associated Lymphoid Tissues (MALT). Understanding the antigenic site map of outer capsid proteins of viruses, and in general protective antigens of microrganisms, should be implemented by generation and/or study with panels of specific polyclonal sera or monoclonal antibodies.

Blood biochemistry analyses are valuable tools for evaluating health of farmed and wild animals. However, proper interpretation of these parameters requires appropriate reference values for each species. Due to the large number and the heterogeneity of animal species of veterinary interest, there is a lack of information on reference blood biochemistry parameters. Thus, there is a great need for defining standard profiles for healthy animals to cover their expected heterogeneity; moreover, the development of new diagnostic tests tailored for each species is a priority in order to monitor animal health.

It is well recognized that the relationship between malnutrition and infection is very intimate, and it is often assumed the cause is an impaired immune function. For example Zinc is a leading trace metal in assuring a correct functioning and maintenance of the immune functions. There are a couple of major challenges for effective supplementation in animal diets. Because the form by which trace elements are fed is crucial, affecting the **bioavailability of minerals,** studies should be aimed to define high available mineral sources in order to minimize the inclusion in the diet and maximize the availability in the tissues, reducing the excretion of potential contaminants in the environment.

The antioxidant system is an integrated system and deficiencies of one component can affect the anti-oxidant efficiency of the others. Nutrition has a major influence on balance of pro-oxidants and anti-oxidants because several antioxidant system components are micronutrients or are dependent on dietary micronutrients. Vitamin E, beta-carotene, and selenium are known to be effective dietary antioxidants essential for immune function.

Probiotics can affect intestinal morphology, histology and local immune response, and new generations of probiotics, selected from the animal intestinal flora, are currently object of research. Studies aimed to generate more detailed knowledge on their mode of action would prove useful in controlling intestinal pathogens.

2.5 Design and Synthesis of New Drugs

Current and emerging infections will continue to pose a risk to human and animal populations. A limited assortment of antimicrobial drugs is currently available for treatment of most zoonotic infections, including neglected and underreported zoonoses (e.g. leishmaniasis with its 2 million new cases / year), and the development of new selective drugs is a key issue for therapy also in view of the increasing population of domestic animals.

Efforts should be undertaken to screen thousand of structurally diverse compounds

for selection of molecules that can be eventually optimized into drugs. This represents the basis of the high-throughput screening (HTS) and currently stands alongside design- and product-based methods for the identification of foundational structures from which focused programs of medicinal chemical optimization can be launched. The principal aims in this field are thus to **develop strategies to make large libraries of small molecules, characterized by chemical diversity,** focused on specific biological targets. Computer-assisted molecular studies are recommended in order to obtain computational models for the rational design of selective compounds (QSAR, virtual screening, ligand-based or structure-base drug design), and synthesis of selected scaffolds is envisaged to identify lead compounds for specific biological targets.

3. ENABLING FACTORS

Success in developing new diagnostics, therapeutic and epidemiological tools, new products, and, definitively, new added value in this field, largely depends, nowadays, on the full availability of the novel high-performance, high throughput technologies and related platform/expertise today dominating and leading research. **Italy like other European countries currently has a good scientific research base** from which to take advantage of the new genomics and technologies but **the translation of scientific discoveries into authorised veterinary medicines (vaccines or pharmaceuticals) and diagnostic tests needs to be significantly improved**.

Strong, competitive and big-project oriented platforms are rare, and usually, if any, are episodically built on around a particular single project. Actually other countries are strongly equipped with high throughput platforms and facilities, and they are able to provide a high quantity of data as well as to manage several big projects at the same time are today leading the genomics and proteomics field,. Such approach in Italy is still lacking, and should be viewed as a preliminary, conditioning factor to expect success in paving the way to the discovery and application of biomarkers, putative drug target, epidemiological surveillance, scientific validation of traditional products, new models, and so on, which are the very aim of the platform. Due to the resources already existing, to the need to foster rapidly this process, and to create a collaborative endeavour as well, a national strategy could be based on mapping, **networking and co-ordinating existing facilities and expertise to common purposes and shared projects**, rather than duplicate, centralize and re-found one o a few such big facilities as a first step. **Connecting a fragmented, yet operating, complementary set of facilities and centers** can be a rapid and economically convenient way to enable the national scientific and industrial community. Nevertheless, the general aim to design and build up such centralized platform(s) should also be actively pursued as a goal of the Italian platforms dealing with biotech projects in general. ITPGAH offers a unique occasion toward this purpose. **The concentration of resources and the consequent creation of a critical mass to compete on the international scenario,**

represent a must that cannot be delayed. However, a start-up program leading to this goal through shared resources and platforms, whilst providing an immediate availability of technologies, can be also viewed as a smart and straightforward approach to orient such rationalization efforts through a policy based on clustering and cooperating. Furthermore, this strategy can contribute to the creation of a national system, long overdue and hindered by fragmentation and lack of coordination.

Such strategy should be extended to technology, namely nanotechnology and IT resources and capabilities as well. Indeed, a significant proportion of the application of research in biomedicine, i.e. in veterinary as well, passes through more and more sophisticated nanotechnology-based research, development and fabrication. In Italy, a high-level of expertise in this field already exists, cross-talking and common projects must be encouraged and structured, through common projects and coordination of facilities. The "network approach" to the development of a competitive biotechnological cluster should thus involve also significant public and private actors in this field, representing nanotechnology, microfabrication, IT, automation.

Private funding of Italian firms for R&D is extremely limited and there is a difficulty in translating the scientific knowledge into a product. Public-private partnerships are important to improve technology transfer chain in this view National frameworks for intellectual property protection need to reach the harmonisation of the international agreements codes standard. **Governements should enhance provisions for either transfer or license patents** of funded technology to private sector. The industry's future success depends on the ability of companies to launch and exploit innovative products not only for farm animals but also for companion animals. Science is a strategical instrument available for industry, while industrial strategies are not always clear and available for researchers, for this reason the first question to answer for R&D is "Do research data correlate with firm choices regarding drug development?". Technology creation must in fact reflect the needs of the target beneficiaries of the "creative effort".

Technology transfer is a complex process that should lead to the ability to use, replicate, improve and possibly re-sell technology. **A technology to be transferred has to be efficacious, socially acceptable and economically viable and sustainable.**

Emerging technologies are often considered "unproven" such view relate to a lack of data, information knowledge awareness meaning that there is no credible record of performance. Existence of sufficient reliable information is essential for judging the likely commercial success or other outcomes for the proposed technology investment. The delivery of new

or improved veterinary pharmaceuticals and diagnostic tests is a high-risk business that uses many different approaches Investors, expecially those in the private sector, are often adverse in financing ventures considered to carry high risks.

Limited generation and access to verified performance data is currently one of the major barrier to transfer uptake. For this reason Governement as the major funder of R&D should **incentive the adoption of quality practices in the research.**

Quality shouldn't be limited to research processes but should also be applied to the verification of the performance standards to check funded researches and results obtained with particular regard to those funded by public sector. Quality certification attests that technology and processes meets scientific standards criteria and can help Governament and companies to achieve performance goals.

Quality certification at the academic level is often voluntary and no preferential access to research funds is established for certified research labs. Incentives should be given for innovation and adoption of quality standards. Certification could help government and companies to achieve performance and add value guarantee results through external audits.

Another weakness of research and contract-research or service in Italy is the **scarcity of GMP/GLP facilities.**

This practical and cultural gap creates limits and difficulties in cross-talking with industry, especially Pharma, and reduce the possibility for competitiveness of our research on the international scenario. Furthermore, this situation contributes to add costs to local industry seeking for such facilities. Public research centers are now increasingly entering this practice, but most of them, even when scientifically highly competitive and substantially top-level, lack certification and quality policy and culture. The time requirement for completing this trend in a spontaneous, bottom-up way appears unacceptable, when considered in terms of international competition; indeed, every body acts independently and often naively, suffering from a general delay and lack of coordination of this issue in this particular setting. This aspect strongly reflects a scarce attitude and capacity of our national research and service system to set up and offer biotech, pharma etc services out of national borders to the international scientific and industrial community. **The full accomplishment of internationally-recognized, specific quality standards for research service is a key milestone both for competition and for facilitating technology transfer.** Thus a qualifying objective of ITPGAH, should be to facilitate and promote support actions for GMP/GLP programs.

4. REGULATORY AND SOCIETAL ISSUES

Following the approval of DL 193 on the use of therapeutics, which applies the EU Directive n° 2004/28, it has become very important to establish manufacture, distribution and use of veterinary therapeutics that can prevent any risk for the security of animal products and for human health. On one side **there is the need to protect animal health and welfare** by making available as many molecules as possible, and this especially for those "minor species" for which there

are limited numbers of products, conserving at the same time an economical benefit, and on the other side it is mandatory to reduce the level of risk of contamination of animal products and to give to the final consumers enough confidence on the safety of food of animal origin.

In order to fulfil such requirements the EMEA has recently prepared some documents:

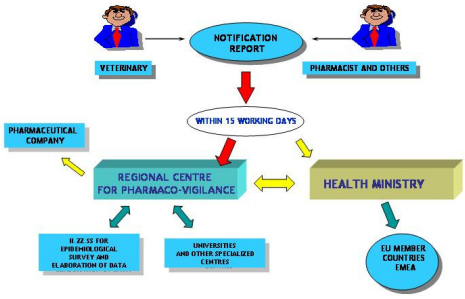
- Guideline on safety and residue data requirements for veterinary medicinal products intended for minor use or minor species 20/07/2006 EMEA/CVMP/SWP/66781/2005
- Efficacy and target animal safety data requirements for veterinary medicinal products intended for minor uses or minor species 18/04/2005 EMEA/CVMP/EWP/117899/2004-consultation
- Note regarding CVMP guidelines on data requirements for veterinary medicinal products intended for minor uses or minor species EMEA/CVMP/

Therefore one of the implications coming from such development of legislation, which indeed becomes one aim to be pursued through research studies, is the **improvement of pharmaco-vigilance** and in general the surveillance of the therapeutics market (pharmaco-surveillance).

In particular, in agreement with the indications of articles n° 92 and n°94 of the DL 196/06, the pharmaco-vigilance procedures will benefit from the application of new IT methods (e.g data linked structured system).

In fact, it is just through the application of modern methods of transferring data and communication that it will be possible to increase the efficiency and effectiveness of procedure at the national and international level.

One possibility is the implementation of a network for linking the field veterinarians and the pharmacists to the ASL and to Regional Centres and their associated Institutes (IIZZSS and University) and to the Ministry of Health for transmitting the "notification reports" and from here through EUDRAVIGILANCE to the EMEA and other EU members.



There are few available products for MUMS (Minor Use Minor Species), as consolidated products are frequently abandoned for the excessive costs of an updated dossier: epidemiological studies and studies on the safety of old products could be held with the coordination of the ITPGAH for defining a more pragmatic approach (focused on species of relevance for Italy) for the evaluation of the risk/benefit and cost/benefit ratio for veterinary products (taking into account the differences in production, distribution and use in this

sector). **Some incentives already applied for orphan drugs could be applied also for some veterinary products for MUMS**: a search of new parameters that could satisfy the need for safety in order to enlarge the opportunities of getting some incentives (reduction of costs of application, shorter time of evaluation, protection of data and new indications, etc) for the veterinary products aimed at MUMS could be supported by the ITPGAH (first study focused on Italian problems, later enlargement to the European level).


A scientific analysis of traditional veterinary products authorised in one or more Member States from a long period, both on literature and on field trials, could lead to a demonstration of "safety use" and give origin to a rapid authorisation in other countries thanks to a "fast track" procedure. The aim is to get a larger application of measures inserted into the Directive on Herbal Traditional medicines in the veterinary field.

The ITPGAH could organize periodical meetings among Regulatory Authorities for discussing their best experiences for a more rapid access to medicines: for instance, "fast track" for veterinary authorisations, ratio and criteria for the revision of old products, the cost/benefit analysis taking into consideration the dimension of the market, the risks of traditional products (even not authorised in recent years) versus the risks of Off Label use. The main aims of such meetings are to build up an informal "Open Method of Coordination" for confronting the best practices of National Regulatory Authorities, and to induce a practical "harmonisation" of the more rapid and effective measures.

(see for definition of OMC: http://europa.eu/scadplus/glossary/open_method_coordination_en.htm)

The ITPGAH could propose the appointment of a scientific team for developing "in vitro" tests and diagnostic tools specific for the animal health and the veterinary products (as the veterinary market is by far poorer than the human, it is likely that the existing scientific bodies will be focused on human products only), and start the preliminary steps for some major problems of animal health in Italy and Southern (Mediterranean) Countries, but not in other Northern European Countries. Uptake of technology for a sustainable development is too slow. A technology to be transferred has to be efficacious, economically viable and socially acceptable.

Relevant objectives are

- **Timely access to safe and effective innovative medicines**
- **Harmonisation of the registration requirements**;
- **Revise the current procedural framework** to establish the best possible environment for the provision of *scientific advice*;
- **Implement procedures foreseen by the new legislation** which allow for *more rapid access to medicines* without compromising the safety of patients and consumer (implement *special measures*

for innovative medicines, technologies and therapies, *veterinary medicines*, generic/non-prescription medicines and herbal medicines)

- **Traceability of all medicinal veterinary products** would allow Regulatory Authorities to simplify and to quick the process. It is based on common form of language associated with quicker and better structured exchange of informations and more rapid and structured change of informations.

  The substitution of the actual form of paper and triplicate prescription with electronic prescription will help to implement the process.

In parallel, the Regulatory Authorities should actively **encourage replacements of animal tests** with validated markers and "in vitro" tests and should work actively with industry to ensure their adoption. The "in vitro" testing will be more acceptable to people.

5. GLOBAL PERSPECTIVE

Italy shares many common features such as climate, environment agriculture, livestock and production management with other countries of the Mediterranean area. In the field of animal health it has more conditions in common with other Southern European, Middle East and Northern African countries, than with Central Northern European ones. Moreover some species are farmed in Italy with the aim of specific uses differing from those usual in the rest of Europe (rabbit and horses for meat, dairy sheep and buffaloes). Very often availability of medicines is scarce for such productions as they represent so called **MUMS** in the global frame.

In addition, for its geographical position, Italy represents a possible access to Europe for **transboundary animal diseases (TADs),** that can be responsible for future epidemic emergencies. TADs can represent high risk pathologies for animal health affecting productions, food trade and safety, animal welfare. Sometimes TADs can be easily spread to other countries (Bluetongue, Leishmania, honey bees diseases can be examples). This factor is enhanced by the evident and increasingly rapid climate and environmental changes that contribute to a modification of several epidemiological and pathogenetic features of infectious diseases. In particular, recent experiences have given evidence that certain arthropods as vector of viral agents can adapt to new environments if conditions allow it or viruses can adapt themselves to new vectors then gaining new areas of spread. A net of cooperation with countries that can contribute to the development of diagnostic tools, of new effective vaccines and control measures is needed in this perspective, as well as regional projects that, having an impact on Italian pattern, should be considered as a global model scheme for developing areas with similar

conditions. In the vaccine field there's also need to develop marker vaccines in order to allow the serological differentiation between vaccinated and infected animals.

5.1 Traditional food products

The farming management in Italy is mainly devoted to the production of high value food, more keen to "traditional products" (from local producers to large scale ones) than to standard products. So it is important to develop methods that help productions with a small impact on the quality and environment while keeping the highest safety standards. The environment has a strong influence on the feed sector; in Italy it is greatly dependant from external raw material providers; feed sector has to be developed accordingly to the needs in order to gain a stronger independence from external sources. Increasing lack of water is also to be kept into due consideration.

5.2 Animal transport

Lastly it has to be noticed that long distances transport for live animals in EU will decrease in the near future for animal health and welfare reasons, as well as for the respect of the environment the environmental issues. Italy is the larger EU member state as importer of live animals (for slaughtering and further fattening purposes). In the long-medium term, the system is foreseen to be turned into meat transport; this should be integrated by increasing local farming that needs to be encouraged; industry should develop tools for sustainable zootechnical business in this perspective.

6. FUNDINGS

In general an examination of national funding management may provide insight into "national priorities", product/market production and hopefully scientific information. This model is not completely applied for the Italian animal health research.

The national research on animal health is suffering from fragmentation due to the fact that public funding of research is scattered between different Ministries, this leads to a duplication of the research efforts and spread of the resources.

Better coordination among the funding Authorities will be required in order to maximise the effective use of the considerable existing and potential resources. Coordination is also important in order to achieve a critical mass, to overcome the scattering and duplication of their research efforts. National administrations should give incentives to join each other research projects. Incentive to collaboration among individual researchers and different research centres and the creation of national excellence and competence centres should be pursued as a preliminary condition. Funding projects based on an agreed research agenda can be a solution for the optimisation of the resources that will be focused on priority research requirements. Private funding for R&D in the field of animal health is extremely limited. Furthermore many researchers, especially at an academic

level are not yet aware of IP protection. Government should develop appropriate means of dealing with intellectual property legislation and provide funds to incentive patenting. This aspect should be part of a more general effort to develop public-private partnership, in order to improve technology transfer chain overcoming budget restrictions respecting intellectual property rights.

What is expected from Public funders:

- **Supporting innovation**
- **Appropriate and proportionate regulation**
- **Recognising the particular needs** of the national Veterinary Sector
- **Promote responsible science and public acceptance of new technologies.**

What is expected from Private funders:

- **Support innovation**
- **More communication** between interested parties academy research centres and industry
- **Share planning** with academia and other research centre
- Marketing and business planning for providing better orientation on **economical impact and sustainability of projects.**

What is expected from Academia:

- **Enforce partnership with private firms**, increase dialog with industry
- Increase awareness on IP rights
- **Ensure quality in research** and allow verification of performance
- **Create technology reflecting the needs** of beneficiaries recognising the particular needs of the national Veterinary Sector.

7. DEVELOPING THE TECHNOLOGY PLATFORM

7.1 Partnerships

The Platform brings together all the relevant stakeholders at national level. It will consist of networks involving a range of partners including industry, academia, animal production stakeholders, policy makers, consumers and other key partners including international organisations. The driving force of the platform will be the capability of all the stakeholders to work together.

A high degree of industry-academia collaboration is important, as it will improve access to expertise and put products on the market more efficiently and timely . Collaboration is particularly important for small biotech companies, but even larger companies can benefit through access to academia and publicly funded research institutes. **The platform should also create a competitive environment where many small players, both private and public, can obtain preliminary limited funding to explore ideas**.

This should be accompanied by broad funding for basic science with potential to provide new generic tools for vaccine and diagnostics development (pre-competitive research), based on a shared agenda developed by not only the best minds of academia and commercial companies, but also by all the stakeholders, including producers and consumers. This research would also support the development of effective regulatory approval processes.

7.2 Main activities

The Aim of the ITPGAH will be 1) to improve the health and welfare of animals kept by man, and to protect public health from diseases; 2) to develop animal health and welfare policy and its implementation by high quality science.

A vigorous science base and the outputs of high quality research should be capable of contributing to industry best practice and thus improving performance of the Italian animal health sector.

The key activities of the Technology Platform will be to:

- **Prepare with all stakeholders a Strategic Research Agenda** and associated implementation plan not only to identify the new and innovative solutions for veterinary pharmaceuticals and vaccines development and diagnostic tests but, also to cover broader issues relating to global animal health and improved methods to control animal disease.
- **Provide a national dimension to the plan, with the promotion of a coherent policy** to develop co-ordination of research and stimulate cross-disciplinary collaboration throughout Italy.
- **Ensure a research environment that stimulates innovation**, backed up with a critical mass of research capability including a satisfactory infrastructure, adequate funding, capacity to react rapidly to new and emerging problems and produce the tools for existing animal disease problems including zoonoses.
- **Identify mechanisms to mobilize public and private financial support for R & D** from public funders and private companies and investors.
- **Enhance the transparency** and divulgation of R&D in Italy
- **Mobilise and involve all stakeholders to develop more effective information networks**, consensus on methods priorities and values, avoid duplication and ensure a critical mass of research through the collaboration of public – private partnerships.
- **Maintain a competitive edge with industry working in partnership with academia, the public sector and regulators** to develop and improve the ability to convert innovation into the delivery of practical tools for the control of animal disease.
- **Ensure a supportive and harmonised regulatory framework** that balances risk against need, working in agreement with all concerned institutions.
- **Identify regulatory constraints** impacting on the delivery and use of authorised products at the front line.
- Improve education, skills and training for those involved in all the stages, from innovation to application.
- **Establish an ongoing communication and dialogue process with the public**.

7.3 Platform Organisation

The Technology Platform will be industry lead and enable all stakeholders including farmers to interact and contribute to the development of the long-term future. The involvement of all the key stakeholders as partners will be essential for the development of a shared vision and

Strategic Research Agenda. The Technology Platform has 5 components: -

- An Executive Committee
- A Scientific Committee
- Working groups
- Member State “mirror groups”.
- A Secretariat.

The **Executive Board** is responsible for developing and administrating the technology platform. It comprises a Chairman, two Co-Chaimen, and members from industry, academia, research institutes and end users’ associations.

The **Scientific Committee** is at the core of the platform, it comprises one Chaiman and one Co-chairman and 75 members from different public and private institution are currently involved. The Scientific Committee is a network connecting the platform to the major stakeholder and the pool of ideas. It will oversee the technology platform and act to move the platform forward.

Working Groups are set up to elaborate the future recommendations for the Strategic Research Agenda. The stakeholders are in charge to nominate their experts to these groups.

To be successful and allow coordination the Technology Platform will need the participation and commitment of the **Ministry of Health, Ministry of University and Research and Ministry of Agriculture** acting as Mirror groups.

The **Secretariat** will support the platform and it will be provided by academia sharing the costs with industry and supporters and identifying a specific source of funding. The secretariat will deal with the administrative matters of organising and running the day-to-day arrangements for the platform.

For those who are not invited to participate at meetings of the stakeholder forum it will be essential to ensure good communication channels. .A list of all potential stakeholders has been established. The extended list of stakeholders that will be involved might be downloaded from the website or the secretariat can send the file via e-mail would be involved via email and the website. **All documents will be available on the website** for information and comment.

7.4 Roadmap and Milestones

The launch of the Technology Platform has been the start of the activities. At this early stage the goal of the technology platform should be to bring together representatives of all interested stakeholders to cooperate to:

- Refine and agree the vision document.
- Determine the research requirements.
- Identify strategic priorities.
- Prepare and agree the Strategic Research Agenda.

Implementation plans will be developed to ensure the Strategic Research Agenda delivers the vision. Road maps will be produced with milestones that will need careful monitoring. The road map derived from the Strategic Research Agenda will be for all parties involved and for the private and public sectors to realise together.

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