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Instrument: Network of Excellence

Thematic Priority n°5 Food Safety and Quality

FINAL REPORT

Scientific part

Period covered: from 01/09/2004 to 31/10/2009

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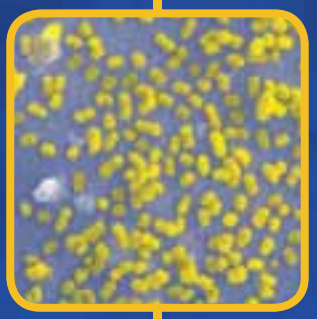
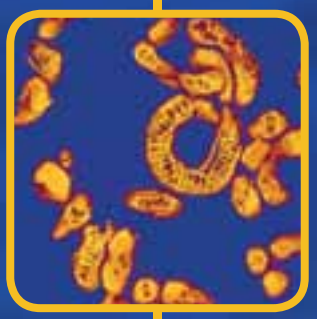
http://www.medvetnet.org

MED-VET-NET: FINAL REPORT

1 September 2004 – 31 October 2009





MED•VET•NET

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SUMMARY OF ACTIVITIES

The Network

Med-Vet-Net was a Network of Excellence mainly operated by and for scientists who, in the course of the project, belonged to 15 independent public health and veterinary institutes in 10 European countries, supported by the Society for Applied Microbiology (SfAM) and, in Year 5, by the newly appointed independent company, Science Communications Ltd (SC Ltd). SC Ltd emanated as a small-to-medium enterprise out of the Network's communications unit. In Year 4 two of the veterinary institutes in The Netherlands merged: the Animal Sciences Group of Wageningen University and Research Centre and the Central Institute for Animal Disease Control formed the Central Veterinary Institute of Wageningen UR (CVI), so that in Year 5 Med-Vet-Net comprised seven public health and seven veterinary institutes, and, through SfAM, the small-to-medium enterprise, SC Ltd.

During the five years of its existence, Med-Vet-Net developed a series of fully-integrated interactive groups of scientists. These included laboratory-based researchers, epidemiologists and risk assessors, co-ordinated by three overarching workpackages and with overall governance from a Governing Board comprised of the Chief Executives all participating institutes or their nominated representatives, with input from a representative from the European Community (EC). All the above groups worked together towards a common objective of combating diseases in humans and animals throughout the European Union (EU). The main activities of the Network were targeted at food-borne zoonotic diseases, although other non-food-related zoonoses, such as bat lyssaviruses, were investigated through Special Interest Groups operating outside the scientific workpackages but with seed-corn funding provided by Med-Vet-Net.

Aims and objectives

The overall aims of Med-Vet-Net were to improve the understanding, prevention and control of zoonotic diseases in Europe through strategic and integrated high-quality collaborative research across the food chain; raise awareness of zoonotic diseases among policy makers, the general public and other stakeholders; and enhance the skills and knowledge base of European researchers in zoonotic diseases. Other objectives included progressing the concept of a 'virtual institute', thereby promoting the integration of veterinary and medical scientific activities within Europe in the field of food safety; and ensuring durable integration of the Network through an overall sustainability plan by collaborating with other networks and exploring new funding opportunities.

Tasks and responsibilities

The tasks and responsibilities of the three overarching workpackages remained unchanged throughout the five years of Med-Vet-Net. Workpackage 1, the administrative hub of the Network, based at the French Food Safety Agency was responsible to the Co-ordinator's Representative. The team of two full-time administrators and the Co-ordinator were responsible for the implementation of financial, legal and administrative issues and for the administration of the Governing Board and Co-ordinating Forum. As such, Workpackage 1 facilitated the timely provision of reports, including financial and management reports, to the European Commission, and financial reports to the partner institutes.

Workpackage 2 was responsible for the overall scientific project management of the Network and undertook activities including the reporting of deliverables and the non-financial annual report, and preparing the scientific Joint Plans of Activities.

Workpackage 3 provided the knowledge hub of Med-Vet-Net, thereby spreading the excellence of knowledge encompassed within Med-Vet-Net to Network scientists as well as externally to the general public, stakeholders outside the core Network partners, and to the international scientific community. As part of its endeavours, the Communications Unit produced regular newsletters covering Med-Vet-Net activities, profiles of key personnel and workpackages, and accounts of meetings held throughout the Network. In Year 5 the Unit also produced a very well received glossy 34-page report entitled 'Building a European community to combat zoonoses', which showcased the results and achievements of Med-Vet-Net's workpackages and Special Interest Groups. Throughout the life of the Network, web support activities were provided by the Swedish National Veterinary Institute (SVA), based in Uppsala, Sweden.

External reviews

For each year of its existence the Network was subject to an external independent review on the basis of its annual activities and intended plans for the next period. For Years 1 and 2 the project was rated as 'good-to excellent'; for Year 3, as 'acceptable'; and for Year 4, as 'good-to excellent'. That is, for Years 1,2 and 4 the project had "fully achieved its objectives and technical goals for the period and even exceeded expectations".

Workpackages

Twenty-eight workpackages (WPs) were in operation during the lifetime of Med-Vet-Net comprising the three overarching workpackages and 25 scientific workpackages grouped into four thematic areas — Epidemiology, Host-Microbe Interaction, Detection and Control, and Risk Research. In all, the Network achieved 387 of 406 intended milestones (95.3%) and 389 of 401 intended deliverables (97.0%).

Nine scientific workpackages were completed in the first 18 months of the project; one in the first 21 months; 12 in the 42 months from April 2006–August 2009; one in the 39-month period from July 2006 to August 2009; and one in the 12-month period from September–August 2009. One workpackage, WP6, was in existence throughout the project. The subjects or themes of the workpackages were wide-ranging in terms of the organisms and research areas. The organisms studied included bacteria — *Salmonella*, *Campylobacter*, Verocytotoxin-producing *Escherichia coli* (VTEC), *Coxiella*; parasites — *Trichinella, Cryptosporidium, Giardia;* and viruses — bat lyssavirus, *Hepatitis E virus*, *Anellovirus, Encephalomyocarditis virus*. The subject areas included antimicrobial resistance, virulence, the invasive process, quantitative risk assessment, prioritization of hazards in relation to food-borne infections, serodiagnosis, development and use of geographical information systems, polymerase chain standardization, and standardization of methods for molecular subtyping (PulseNet Europe). In terms of scientific outputs, of the 319 anticipated deliverables from the scientific workpackages, 311 or 97.4% were achieved either in full or with minor modifications. Only eight (2.6%) failed. Similarly, of 360 scientific milestones, 344 (95.6%) were achieved and only 16 (4.4%) failed.

New methods for the diagnosis, enumeration and typing of bacteria, viruses and parasites were developed and ratified as a result of Med-Vet-Net work. In excess of 168 papers have been published or are in press in peer-reviewed journals, and several more have been submitted for publication. Eight authoritative reports were delivered and are available on the Network's public website, and a further document is in press. Four guidelines or recommendations have also been published as well as three critical reviews of typing methods. A strategic document outlining methods for calculation of disease burden and cost-of-illness of food-borne zoonoses in the EU has

Table 1. Milestones and Deliverables: 1 September 2004 – 31 October 2009

Year	Milestones					Deliverables				
	No.	Achieved	Percent	Failed	Percent	No.	Achieved	Percent	Failed	Percent
1	33	33	100	0	0	38	34	89.5	4	10.5
2	85	82	96.5	3	3.5	67	66	98.5	1	1.5
3	82	71	86.6	11	13.4	76	73	96.19	3	3.9
4	89	88	98.9	1	1.1	78	78	100	0	0
5	117	113	96.6	4	3.4	142	138	97.2	4	2.8
TOTALS	**406**	**387**	**95.3**	**19**	**4.7**	**401**	**389**	**97.0**	**12**	**3.0**

been adopted and publicly disseminated. Seventeen standardized and harmonized procedures have been developed for both laboratory-based and epidemiological procedures, and 23 databases or strain/DNA repositories/collections have been established, most of which are publicly available or will be made available in the near future. Four inner networks for the detection and control of specific organisms — TrichiNet, CryptNet, ZOOPNET and ZOOVIRNET — were formed and are in operation, with contributors from Med-Vet-Net institutes and other institutes both within and outside the EU. A molecular typing network developed in the first period of the project, PulseNet Europe, is in the process of being subsumed into the European Centre for Disease Prevention and Control (ECDC) and is now becoming operational within the EU, with links to PulseNet USA and other PulseNet networks around the world. A host of databases have been developed and a software package for a European consensus model for *Campylobacter* risk assessment (CRAF) has been developed and is currently being taken forward in a partnership between Workpackage 24 and various American organizations. A new method of assessing *Salmonella* and *Campylobacter* infections in the community based on serum antibody levels has been developed and is being progressed as a collaborative project that will extend beyond the EU funded period of Med-Vet-Net.

Special Interest Groups

In addition to the scientific workpackages Special Interest Groups (SIGs) were formed to develop expertise and encourage collaborations in areas with a low critical mass, explore potentially relevant developing areas and actively encourage scientists from external institutes to participate in Med-Vet-Net activities. Four SIGs were in operation during the tenure of Med-Vet-Net and a fifth on the epidemiology and control of *Campylobacter* in poultry was subsumed by Med-Vet-Net's final workpackage, Workpackage 34. The SIGs used web-based communications to establish a critical mass of expertise from within and outside the Network, retaining and curating specific information in specialized research areas, via meetings, databases and knowledge sharing.

Workshops and Special Interest Group interactions

Collaborations between scientific workpackages were encouraged throughout the duration of Med-Vet-Net and were particularly evident in the Network's final two years. In Year 5, six workpackages with common interests held joint meetings while other workpackages held joint meetings with Special Interest Groups. These meetings ensured a high level of interactions between participants and had major benefits for the Network in terms of exchanging ideas, technologies and the exploitation of methods and analyses. In several instances such collaborations resulted in either the submission of, or publication of, peer-reviewed papers with joint authorships from several different workpackages. An additional outcome of the inter-workpackage collaborations was the informal linkage of scientists from different workpackages to develop and submit applications for funding, which will continue after Med-Vet-Net.

Dissemination of knowledge

The dissemination of information to stakeholders, fellow researchers and the public was a key activity throughout the life of the Network. Workpackage 3 had overall responsibility for spreading information about the Network's aims, objectives and achievements to the general public and policy makers. In undertaking its tasks, the workpackage used the most effective mechanisms to deliver and share Med-Vet-Net information both internally with the Network's scientists and externally with the general public and stakeholders including policy makers, industry, farmers, food producers and other researchers. Information was shared through the web, the media (television, radio and the press) and directly through training, the use of e-newsletters, reports, presentations, publications and promotional material. The regular e-bulletin, Med-Vet-Net News, contained overviews of each scientific workpackage and Special Interest Group, background information on pathogens (particularly new or emerging ones), features on various outreach activities (such as exchanges, training and further collaboration), profiles of people with key roles in the Network and an events calendar. Throughout the project as results arose and milestones were reached in the scientific workpackages, the Communications Unit also prepared articles for submission to magazines and trade journals. A quarterly two-page article also appeared in *Microbiologist*, the members' magazine of SfAM. In addition, a number of advertorials were submitted to various policy publications targeting policy makers and parliamentarians. Med-Vet-Net was also subscribed to the EU-policy website, theparliament.com, allowing for the provision of key messages and information directly to Members of the European Parliament, civil servants and journalists. Workpackage 3 was also affiliated with CommNet, an informal network of communication managers in research consortia that receive funds from the European Union in the field of Food Quality and Safety (Priority Area 5) in Framework Programme (FP) 6 and, more recently, FP7. Members of the Communications Unit have been actively involved in CommNet and administer its website (see www.commnet.eu).

Additionally Workpackage 3 represented Med-Vet-Net through public engagement activities at various external meetings, such as the 'Communicating European Research' conference in 2005 and, more recently in 2008, the International Network on Public Communication of Science and Technology conference in Sweden and the European Science Open Forum in Spain, thereby promoting the aims and achievements of Med-Vet-Net to large international audiences.

Table 2. Dissemination of Information — Research and Development: 1 September 2004 – 31 October 2009

YEAR	MEETINGS			VENUES
	No.	Total audience	Audience	EU Member States
1	40*	>2,000	Research scientists, public health specialists, policy makers	EU Member and non-Member States, North America
2	85	>4,000	Research scientists, public health specialists, policy makers	EU Member and non-Member States, North America, Australasia
3	85	>4,000	Research scientists, public health specialists, policy makers	EU Member and non-Member States, global
4	50	>4,000	Research scientists, public health specialists, policy makers	EU Member and non-Member States, global
5	57	>4,000	Research scientists, public health specialists, policy makers	EU Member and non-Member States, North America
Total	**317**	**>18,000**		

* estimated.

Workpackage 3 used a Content Management System to oversee both the public and private websites of Med-Vet-Net, which were hosted on a server within the Web Support Group at the Swedish National Veterinary Institute. Statistics were recorded on the public website since its inception (Fig 1.). Visits to the site continually increased over the five years of the project: 1,500 per month (July 2005); 3,400 per month (August 2006); 4,008 per month (August 2007), 7,175 per month (August 2008) and 16,713 per month (October 2009). The total number of visitors peaked at 37,968 visits per month in May 2009 during the organization of the 5th Annual Scientific Meeting. The Communications Unit also actively promoted and implemented the use of online collaboration tools including WebEx, Moodle, and podcasting, throughout the Network.

Scientific achievements were predominantly communicated through posters and oral presentations, both offered and invited, at appropriate meetings in both Europe and countries outside the EU. In all, it has been estimated that Med-Vet-Net results have been presented at over 300 conferences and workshops to a potential audience of over 18,000, including scientists, public heath specialists and policy makers.

In addition to the dissemination of results at public meetings, each scientific workpackage held at least one, and in some cases up to three, workpackage meetings during their lifetime at which results were presented and discussed.

Public Website Visits

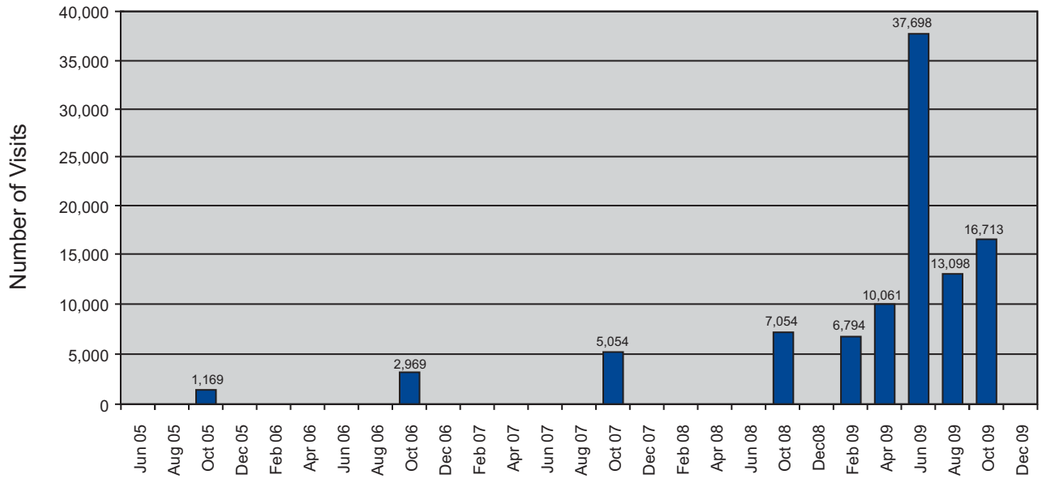
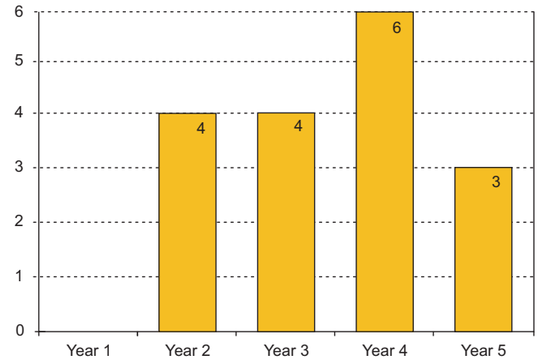


Fig 1. Visits to Med-Vet-Net website over time.

Workshops



Short-term missions

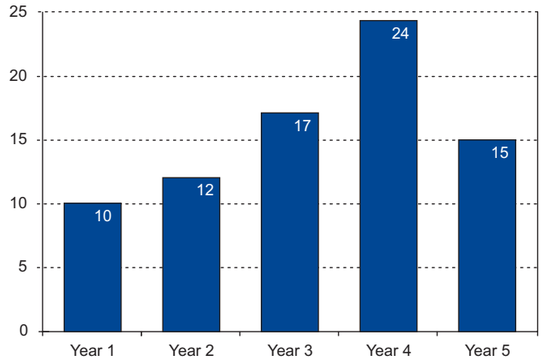


Fig 2. Throughout the Network's duration a total of 17 workshops and 80 STMs were completed.

Annual Scientific Meeting

Med-Vet-Net's three-day Annual Scientific Meeting (ASM) was the highlight of each year. The meetings gave the Network's scientists the opportunity to present their results and learn about recent activities in zoonoses research through lectures given by internationally renowned guest speakers from outside Med-Vet-Net.

There were five ASMs during the lifetime of Med-Vet-Net at different locations around Europe each year — Winchester, UK (2005), Malta (2006), Lucca, Italy (2007), St. Malo, France (2008), and El Escorial, Spain (2009). On average, between 200 and 230 participants attended each meeting, including scientists from Med-Vet-Net institutes and external delegates.

Training

The development of research skills and expertise was afforded high priority by Med-Vet-Net. A team at the Technical University of Denmark coordinated the training activities in the form of workshops and short-term missions (STMs) under the auspices of Workpackage 2. Throughout the Network's duration a total of 17 workshops and 80 STMs were completed (Fig 2.). Further training activities included workshops held within the jurisdiction of different workpackages, participation in the Med-Vet-Net Annual Scientific Meeting, and PhD posts fully or partially funded by the Network.

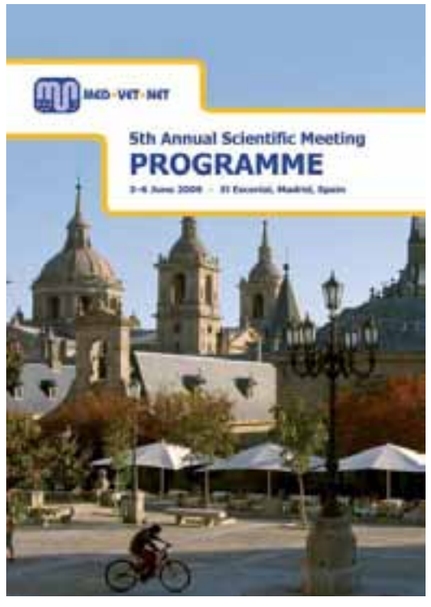
The workshops and STMs not only provided trained for the Network's scientists but also facilitated cooperation with partners outside Med-Vet-Net, thereby disseminating the knowledge gained through the Network of Excellence. It is estimated that over 180 scientists from within Med-Vet-Net and approximately the same number again from external institutes benefited from such workshops.

Another area of training, initiated by Workpackage 3 in 2005, was in science communication. By the end of Year 5, 21 scientists from eight partner institutes (and one external), representing 10 countries (Spain, UK, Poland, France, Italy, Denmark, The Netherlands, Norway, Brazil and India) had participated in Med-Vet-Net's Science Communications Internship.

Throughout the Med-Vet-Net project each scientific workpackage held at least one workshop offering training in the methods, technology and data handling relevant to the particular workpackages. Additionally, all thee operational SIGs held workshops of relevance to their areas. In Years 4 and 5 some workpackages also held joint workshops, some of which were open to external delegates, providing cross training in specific areas. In total, over 200 people received training at these workpackage-related workshops.

Five PhD students were fully or partially funded during the lifetime of Med-Vet-Net. Of these, two, funded within Workpackages 28 and 31 respectively, were recently awarded their PhDs. The remaining three students are in the process of completing their dissertations.

All of the Network's training activities resulted in a substantive dissemination of knowledge of immediate benefit to participating institutes and other institutes engaged in research in food-borne zoonoses. The long-term benefit to the EU is that over 300 scientists received training in scientific methods relating to all aspects of food-borne zoonoses. Many of those scientists subsequently moved on to positions in other institutes, within and outside the EU, thus ensuring a spread of techniques and also long-term sustainability in scientific progress.



A programme was handed out to all participants of the Annual Scientific Meetings.

Governance

The overall governance of the network has been through a Governing Board (GB), comprised of the Chief Executives of all partner institutes or their nominated representatives and a Chair elected by the GB members. The Governing Board met annually and had responsibility for the overall, direction of all activities in collaboration with a nominated representative from the EC.

The day-to-day activities of the network have been defined and redefined by a co-ordinating forum (CF), which has consisted of representatives from each partner plus four thematic representatives. The CF was chaired by the Project Manager of the network and met twice a year with every meeting being hosted by a different partner.

For the first two years of its existence the scientific activities of the Network were guided by an external Advisory Panel, which contributed to the activities of the network in its formative years and was subsequently disbanded after the second year, following internal discussions and with the agreement of the GB.

Sustainability and durable integration

The efforts to ensure the long-term stability of the Network have borne fruit with the formation of the self-funded Med-Vet-Net Association, which was officially launched in Brussels on 6 October 2009. The Association's statutes and internal regulation were registered on 1 June 2009 under the framework of French Non-lucrative Association (1901). The Med-Vet-Net Association aims to increase, capitalize and disseminate scientific knowledge on zoonoses with the main emphasis on food-borne zoonoses. It is noteworthy that all of the scientific institutes from the EU-funded Med-Vet-Net project have elected to join the new Association as full members for an initial period of three years, on a self-funded basis.

Durable integration was also addressed at the scientific level, as Med-Vet-Net continued to pursue opportunities for funding within FP7 and other areas, with the primary objective of maintaining and expanding multi-disciplinary research teams, thus incorporating external research groups and institutes into new proposals In that respect Med-Vet-Net scientists either have been or are presently involved in six other networks — EU-US SAFEFOOD, a joint American and EU-funded initiative (EU funding through the Specific Support Action); and the EU-funded networks BIOTRACER, the Pathogenic E. coli Network, ARBO-ZOONET, EPIZONE and the Disease Control Tools project, DISCONTOOLS (jointly funded with industry) Furthermore, in Year 5, at least 14 proposals involving Med-Vet-Net workpackages and scientists were submitted for consideration to FP7 or other funding bodies, or have had funding agreed All of these projects will continue beyond the life of the Med-Vet-Net Network of Excellence. It should be noted that preparatory activities for these proposals were not funded by the EC contribution to the network.

Databases and repositories of biological material

A list of databases and repositories of biological material are summarized in Table 3.

Exploitable knowledge and its use

Twelve of Med-Vet-Net's workpackages have produced material considered suitable for exploitation (see Table 4).

These opportunities include the formation of the Med-Vet-Net Association and the small-to-medium enterprise, Science Communications Ltd, various methods, repositories, databases and software packages, geographical information system tools, diagnostic platforms and training courses. Some of these outputs have been patented and others may be suitable for commercialization.

More information about the Network's exploitable knowledge is provided elsewhere in this report.

Key performance indicators

A compendium of Key Performance Indicators (KPIs) were established by Med-Vet-Net's Governing Board in Year 2. Performance against these indicators has subsequently been monitored on an annual basis. A summary of outputs in relation to KPIs is shown in Table 5.

Of particular note were the number of different multi-site teams working together to achieve a range of objectives, the clear and transparent interactions between scientific workpackages and SIGs, increased numbers of databases, repositories and shared reagents, and joint quality control standards Many of these databases and repositories have been made available to scientists and institutes outside the Network, or will be in the near future Also notable was Med-Vet-Net's growing international stature evidenced by the number of interactions with bodies such as the ECDC, the European Food Safety Authority, the Center for Disease Control and Prevention in the USA, and the World Health Organization; by invitations for Med-Vet-Net representation in other networks, programmes and projects within and outside the EU; and by the inclusion of Network experts in various capacities in programmes such as the ERANET EMIDA Delphi enquiry, the Network of Animal Disease Infectiology Research Facilities (an EC Infrastructure Programme), and DISCONTOOLS.

Acknowledgements

All participating institutes are grateful for funding and support from the EC for the duration of the Med-Vet-Net project.

The future

What of the future? Hopefully most of the activities of Med-Vet-Net will be continued in the Med-Vet-Net Association. It is important for the Association and the future of zoonoses research in Europe that activities do not stagnate. There are new challenges and new opportunities ahead. New collaborations will be forged, hopefully with the inclusion of new institutes and research groups, and with industry. Nevertheless, Med-Vet-Net can be proud of its achievements over the past five years and, in particular, of laying the foundations for collaborative inter-disciplinary research in food-borne zoonosis in Europe.

Table 3. Repositories/databases/software tools — Years 1–5

WORK-PACKAGE	REPOSITORY/DATABASE	REMARKS
WP3	WILDLIST — online database of people working on wildlife related emerging diseases throughout Europe.	Publicly-available on Med-Vet-Net website
WP4	Linked molecular surveillance database for *Salmonella*, VTEC and *Listeria* based on pulsed-field profiles.	Taken forward by ECDC
WP5	Unique database incorporating clinical details, laboratory investigations and virus sequences of EBLV cases in Europe.	Available to interested scientists on request
WP6	Web-based 'Atlas' of the incidence of salmonellosis in Europe.	Publicly available at www.epigis.dk
WP7	Online catalogue of skills, expertise and resources related to VTEC research within Med-Vet-Net.	Publicly-available on Med-Vet-Net website
WP8	Fully updated database of CampyNet strain collection.	Publicly-available on Med-Vet-Net website
WP9	Database of validated PCR primers for amplification of most common ß-lactamases in Enterobacteriaceae.	Publicly-available on Med-Vet-Net website
WP10	Prototype database of PCR tests for detection of five of the most important food-borne bacterial enteric pathogens in Europe.	Publicly-available on Med-Vet-Net website
WP12	Dedicated website providing technical information on methodologies of choice for detection of *Cryptosporidium*.	Publicly-available at www.cryptosporidium.it
WP14	Inventory of existing pre-harvest risk assessments and available data for future risk assessments.	Publicly-available on Med-Vet-Net website
WP21	Strain collection of salmonella organisms containing SGI-1 and variants of SGI-1. Database of details of above strain collection.	Available on request
WP22	Two repositories of reference material including frozen aliquots of *Cryptosporidium* oocysts and *Giardia* cysts, aliquots of nucleic acids and frozen aliquots of plasmids carrying specific parasite sequences. Dynamic on-line database containing DNA sequence and genotype data of *Cryptosporidium* and *Giardia*, together with population genetics data.	Available on request Publicly-available
WP24	Data catalogue of information relevant for risk assessment of *Campylobacter* in broiler meat. *Campylobacter* Risk Assessment Framework (CRAF), a dynamic model catalogue for risk assessors.	Publicly-available on Med-Vet-Net website Publicly-available at www.rivm.nl/craf/
WP25	Catalogue of available data on current methodologies, methods, isolates DNA and sera available at WP25 partner laboratories.	Available for Med-Vet-Net partners on Med-Vet-Net website
WP26	Catalogue of virulotypes of *Salmonella* and *E. coli* together with information on facilities and expertise for virulotyping within WP26 partner institutes.	Available for Med-Vet-Net partners on Med-Vet-Net website
WP27	Central repository of reference material for detection and typing of *Trichinella* thereby providing fully characterized reference samples for national reference laboratories and routine laboratories.	Available for Med-Vet-Net scientists and *Trichinella* research scientists world-wide
WP30	CampyNet strain collection with associated information on strain typing markers, virulence attributes host diseases association and epidemiology.	Available on request
WP31	Comprehensive set of reagents, reference samples and protocols for HEV, Anellovirus, EMCV and TBEV.	Available on request
WP34	Evidence-based database of *Campylobacter* genes associated with colonization in chickens and their functions.	Publicly-available on Med-Vet-Net website

Table 4. Exploitable knowledge: 1 September 2004 – 31 October 2009

WORK-PACKAGE	EXPLOITABLE KNOWLEDGE	REMARKS
WP1	• Formation of the Med-Vet-Net Association.	• Self-funded network comprised initially of the 14 scientific partner institutes of Med-Vet-Net.
WP3	• Material from the Science Communication Internship has been offered as external training courses to other EC-funded projects including EPIZONE, Cascade and COST. • Formation of Science Communications Ltd as a limited company.	• Future courses using original and modified material will be further developed. Commercial exploitation is possible. • Commercial company to undertake Med-Vet-Net communications work and also communications activities for the Med-Vet-Net Association and other networks/institutes.
WP6	• The geographical information system tools and atlases will be made publicly available as a service to the European Union (EU) and research bodies.	• Subject to future funding for maintenance.
WP11	• Development of recombinant proteins for immunodiagnostic purposes or vaccination in pigs.	• Patent (under the support of TRICHIPORSE EU contract PRA AFCRST Bt01-03, ECOS ANUIES, and TrichiNet, Med-Vet-Net).
WP21	• A new sensitive and specific detection method for *Salmonella* Genomic Island 1 (SGI1) in all bacteria species. • The strain collection at the Health Protection Agency (UK) and the Federal Institute for Risk Assessment (Germany) will be sustained and made publicly available after the publication of results. • New fingerprinting method based on High Resolution Melting for molecular characterization of SGI1, which can be applied to other organisms.	• Commercialization of the developed methods has not been initiated.
WP22	• Data-sharing at the EU level through the establishment of an accessible, online database, which can be made available to external users.	• Commercialization of the developed methods has not been initiated.
WP23	• The developed software tools and models will not be commercially exploited but will be made available for external use.	• Commercialization of the developed methods has not been initiated.
WP24	• The CRAF software tool is publicly available at www.rivm.nl/craf.	• Commercial exploitation is not foreseen.
WP26	• The array used in the WP26 project is commercially available under the brand name IDENTIBAC. • The data generated may have a number of potential other avenues for commercial exploitation. • The knowledge from this project will be used to produce new iterations of diagnostic platforms in addition to providing preliminary data for grant proposals.	• Commercial availability of arrays developed by the project.
WP27	• Various French and international companies have expressed an interested in developing and producing an enzyme-linked immunosorbant assay (ELISA) test (for *Trichinella* infection in pigs) with some of the recombinant proteins that have been developed.	• Possible commercial exploitation of ELISA test.
WP32	• Refinement of the ELISA methodology and the back-calculation model for sero-epidemiological surveillance of infections with *Salmonella* and *Campylobacter*. There is an aim to establish the methodology as an additional tool for public health surveillance and offer training in the methods to appropriate staff in EU institutions. An extension to other common bacterial infections may also be possible. • The repository of the approximately 7,500 sera from eight countries generated during WP32 will be maintained. This serum bank will be made available to other European research projects within the field of enteric infections.	• Commercial exploitation is not envisaged.
WP33	• Findings have possible value for vaccine development.	• Possible commercial development.
WP34	• The survey-based tool to assess the attitudes of stakeholders to biosecurity against *Campylobacter* in poultry could be exploited by the poultry industry and policy makers to raise awareness of the issues and develop appropriate education programmes. • Development of a web-based newsletter on *Campylobacter* in poultry is currently in discussion with representatives of the poultry industry.	• Possible commercial development. • Possible commercial development.

Table 5. Key Performance Indicators, Years 1–5

KEY PERFORMANCE INDICATOR	SUB-TOPIC	ACHIEVEMENTS
Durable integration	Multi-site teams	• Four multi-site teams to develop and implement sustainability plans. • Two multi-site teams to specifically plan for the day-to-day project management and longer term development of the newly-formed Med-Vet-Net Association. • Six multi-site teams to organize and deliver training courses. • Five multi-site teams to organize and deliver Annual Scientific Meetings. • Two multi-site teams for governance and co-ordination of the Network. • Three multi-site teams to ensure liaison at all times with appropriate EC Officials, including the EC-appointed Med-Vet-Net Project Officer and Financial Officer. • Interactions between 14 of the 25 scientific workpackages, including joint workshops and training courses, joint publications, and joint applications to new calls for funding.
	Common databases	• Generation of 23 common databases, datasets, strain collections and DNA repositories.
	Multi-site funding	• Fourteen joint proposals which exploit Network integration have been submitted to FP7 or other funding bodies within EU, and four proposals have been submitted to other international funding bodies. Preparatory meetings for these proposals were not funded by the EC contribution to the Network.
	Joint training courses	• Seventeen scientific workshops have been organized, resulting in training for over 180 scientists from Med-Vet-Net institutes and approximately the same number from external institutes. Additionally, during the course of the Network each scientific workpackage held at least one workshop, offering training in methods, technology and data handling relevant to the respective workpackages.
	Short-term scientific missions	• Eighty short-term missions involving secondment of staff to different institutions were completed. Additionally, 21 scientists from eight partner institutes and one external institute participated in the Science Communications internships.
	Joint quality control standards	• Accreditation and certification for PulseNet Europe members. • Ring trials conducted for: *Trichinella* diagnosis and detection; PCR detection of *Cryptosporidium*/*Giardia*; Q-fever detection by PCR and serology; defined gene set for virulotyping (*Salmonella* and *E. coli*); *Salmonella* strain collection displaying variation in SGI1 available for reference purposes; plasmids in which specific *Giardia duodenalis* sequences had been cloned and have been produced and tested available as reference material; production and characterization of well-characterized *Trichinella* reference material; Production of standard reference positive and negative porcine sera for HEV antibody determination.
Outputs	Patents	• Development of recombinant proteins for immunodiagnostic purposes or vaccination in pigs, under support of TRICHIPORSE EU and TrichiNet (Med-Vet-Net)
	External assessment	• EC referee's report: Rating of activities: Years 1 -2: 'good-to-excellent'; Year 3: 'acceptable': Year 4: 'good-to-excellent'.
	Deliverables and milestones	• Deliverables: Achieved (fully or partially): 389/401 (97.0%). Milestones: Achieved: 387/405 (95.3%).
	Publications arising from Med-Vet-Net funded work	• In excess of 168 papers published or in press in peer-reviewed journals; several more submitted for publication. • Eight authoritative reports delivered and available on public website. • Review paper on harmonized concepts, definitions and methods utilized for the attribution of human illness to specific sources. • Critical review of *in vitro* assays and biomarkers of virulence traits in *Campylobacter* in press. • Systematic review of the molecular mechanisms for survival of *Campylobacter* in the poultry environment. • Critical review of the indirect poultry derived routes of *Campylobacter* infections. • Interactive salmonella atlas to be published in 2010.
	Presentations at international meetings	• Presentations of results from Med-Vet-Net scientific workpackages in at least 300 external international meetings with a total audience in excess of 18,000 persons.
	Special Interest Groups (SIGs)	• Four Special interest Groups (SIGs) operational during the course of the Network – Molecular Epidemiology of European Bat Lyssaviruses; Emerging and Neglected Zoonoses; Host-Pathogen Interactions; Wildlife-Related Emerging Diseases and Zoonoses (WiREDZ) . Evidence of extensive international collaborations in all SIGs. A further SIG – 'Epidemiology and Control of *Campylobacter* in Poultry' subsumed into new workpackage, WP34, in Year 5.
	Scientific Workpackages	• Twenty-five scientific workpackages within four thematic areas operational during the Network.
	Standardized procedures	• Significant contributions to two CEN documents involving quantitative real-time PCR – CEN/WG6/TAG3; CEN/TC275/WG6/TAG3 N 0103 Harmonized procedures delivered on: – ß-lactamase resistance detection and characterization – Surrogate methods of *Campylobacter jejuni* virulence – Diagnosis of trichinellosis in humans – PCRs for *Salmonella* virulotyping – PCRs for detection of *Cryptosporidium* and *Giardia* – Typing methods of *Coxiella burnetii* – Gold standard for molecular *Trichinella* typing – Molecular and serological assays for viruses – Collection of sera for s serosurveillance – Experimental models to detect early responses to salmonella infections erosurveillance – Long PCR protocol for Stx2-converting phage typing for VTEC. • Procedures for international telephone surveys for calculation of food-borne zoonoses disease burden. • Release of *Campylobacter* risk assessment software tool CRAF 1.0 in February 2009 and CRAF-2 in August 2009. • Cell culture methods for swine HEV replication monitored for viral genome and antigen synthesis.

Table 5. Key Performance Indicators, Years 1–5 (continued)

KEY PERFORMANCE INDICATOR	SUB-TOPIC	ACHIEVEMENTS
Outputs (continued)	Repositories and shared reagents	• Unique database incorporating clinical details, laboratory investigations and virus sequences of EBLV cases in Europe. • Validated PCR primers for amplification of most common ß-lactamases in Enterobacteriaceae. • Strain collection of salmonella organisms containing SGI-1 and variants of SGI-1. • Two repositories of reference material including frozen aliquots of *Cryptosporidium* oocysts and *Giardia* cysts, aliquots of nucleic acids and frozen aliquots of plasmids carrying specific parasite sequences. • Central repository of reference material for detection and typing of *Trichinella*. • CampyNet strain collection with associated information on strain typing markers, virulence attributes host diseases association and epidemiology. • Comprehensive set of reagents, reference samples and protocols for HEV, Anellovirus, EMCV and TBEV.
	Development of new diagnostics or therapeutics	• Improved fingerprinting assay for characterization of SGI1 based on RT-PCR using SYBR-green and a High Resolution Melting technique. • Development of virulotyping platforms for routine diagnostic use for *Salmonella* and *E. coli* across partner institutes in Europe. The array platform used for this purpose is commercially-available under the brand name of IDENTBAC. • Development of a new iELISA for the detection of early *Trichinella* infections in pigs.
	PhD studentships	• Five PhD students fully or partially-funded in four independent workpackages. • Award of PhD to students funded within WPs 28 and 31.
	International meetings	• Five Annual Scientific Meetings, with >1000 participants from 30 countries; approximately 200 delegates have been external to Med-Vet-Net partner institutes.
	Web sites	• Five websites independent of, but linked to the Med-Vet-Net website constructed.
Impact	Advice to policymakers	• Strategic reports to ECDC on methodological choices for calculation of the disease burden and cost of illness of food-borne Zoonoses in Europe.
	Support for policymakers	• Presentation of Med-Vet-Net work on *Campylobacter* to EU working Group on Zoonoses. • Establishment of Real-time linked surveillance database system to detect clusters of *Salmonella*, VTEC and Listeria – PulseNet Europe. • Training course for new Member States on *Salmonella* epidemiology in collaboration with GSS/WHO. • Information passed to WHO (FERG) and CDC (USA) on calculation of DALYs of infectious intestinal disease and reconstruction of surveillance pyramid. • Analysis of data from outbreak investigations for source attribution of human salmonellosis and campylobacteriosis in European countries submitted to EFSA and Member States. • Information on using outbreak data analysis for source attribution of human salmonellosis and campylobacteriosis in Europe distributed to EFSA, Member States and the European Commission. • Ongoing discussions with poultry producers on effectiveness of biosecurity measures for *Campylobacter* control in poultry. • Information and advice to EFSA Biohazards Panel Working Groups.
	European/ international reputation	• General presentations delivered to EFSA, ECDC, DG SANCO, EurAgri and WHO during lifetime of project. • Invited presentations to at least 20 international scientific meetings. • Ongoing collaboration with ECDC and CDC (USA) on serodiagnosis methodology and its application (WP32). • Future extensions of CRAF-2 in a new project together with the USA-based organization 'foodrisk.org'. • Representation on steering committee of TP-GAH. • Account of Network activities together with its achievements included in the document 'Emerging Epidemics Research: EU-funded projects, published by the European Commission, Directorate-General for Research, September 2008. • Account of Network activities published in *Parliamentary Monitor*, June 2009 (UK). • General presentations delivered to ECDC, EFSA and DG Sanco. • Ongoing scientific interactions with EFSA, ECDC, CDC, USDA, WHO, FAO, Community Reference Laboratories (CRLs), National Reference Laboratories (NRLs), and on-going and new surveillance programmes within EU Member States. • Representation on Steering council of ETP-GAH. • Representation on Governing Board of EPIZONE. • Appointment of Med-Vet-Net Coordinator's Representative to board of EPIZONE. • Appointment of Med-Vet-Net Project Director to Management Board of DISCONTOOLS.
	External collaborations and expansion of network	• Collaborations in Workpackages 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33 and 34 with scientists from institutes outwith Med-Vet-Net, including institutes in the USA, Canada, New Zealand, Finland, Romania and Japan, and with FAO-WHO. • Extensive international collaborations in all SIGs including expansion of international activities in both the Host Pathogen Interactions SIG (North Carolina State University) and WiREDZ SIG (223 scientists from 35 countries included in WILDLIST register by August 2009). • Agreement for Med-Vet-Net to be represented in DISCONTOOLS. • Continued collaborations with EPIZONE and EADGENE NoEs.
	General public information	• Regular newsletter, *Med-Vet-Net News*, electronically distributed to over 1,500 subscribers in 72 countries. • Public website updated with articles and profiles from *Med-Vet-Net News*, as well as Disease Fact Sheets. • Report entitled 'Building a European Community to Combat Zoonoses', aimed at non-scientific stakeholders provides an easy-to-read summary of the achievements of the entire project. • Throughout the Project, articles were published in various magazines and trade journals including SfAM's *Microbiologist*, The Veterinary Record, AgriWorld Vision, Science & Public Affairs, Government Veterinary Journal, FEMS bulletin, VLA's Vectro and The Parliamentary Monitor.
	Sustainability activities	• Sustainability groups. • Transfer of activities of PulseNet Europe to ECDC. • Agreement to form self-funded 'Med-Vet-Net Association', following cessation of EU funding for network. All 14 scientific institutes to be full members. • Formal approval by EC of Science Communications Ltd as a third party (June 2009). • Continuing involvement in EUPMA & ECPMA (European Project Managers' Association).

THE WORKPACKAGES

THE WORKPACKAGES

Over the five years of the Med-Vet-Net project, 25 scientific workpackages were commissioned covering four strategic research areas — epidemiology, host-microbe interaction, detection and control, and risk research. In addition, three overarching workpackages fulfilled the administration, management and communication functions of the Network.

NO.	TITLE	LEADER	LOCATION	THEME
1	Virtual Institute	André Jestin	The French Food Safety Agency (AFSSA), France	Overarching
2	Strategic Scientific Integration	John Threlfall	Health Protection Agency (HPA), UK	Overarching
3	Spreading Excellence	Peter Silley	Society for Applied Microbiology (SfAM), UK	Overarching
4	Development of a linked molecular surveillance database system for food-borne infections (PulseNet Europe)	Susanna Lukinmaa	Statens Serum Institut (SSI), Denmark	Epidemiology
5	Molecular epidemiology of European bat lyssaviruses	Anthony Fooks	Veterinary Laboratories Agency (VLA), UK	Epidemiology
6	Development and application of geographical information systems (GIS) and spatio-temporal methods in the epidemiology of food-borne bacterial zoonoses	Steen Ethelberg	Statens Serum Institut (SSI), Denmark	Epidemiology
7	Pathogenesis of verocytotoxin (VT)-producing *Escherichia coli* (VTEC) infection: a new paradigm for VTEC	Alfredo Caprioli	Italian National Institute of Health (ISS), Italy	Host-Microbe Interaction
8	Identification of molecular markers of pathogenicity for *Campylobacter jejuni*	Anne Ridley	Veterinary Laboratories Agency (VLA), UK	Host-Microbe Interaction
9	The human health implication of emerging resistance to beta-lactam antibiotics in *Salmonella* and other *Enterobacteriaceae* from food animals	Frank M. Aarestrup	Danish Institute for Food and Veterinary Research (DFVF), Denmark	Detection and Control
10	Validation and standardization of polymerase chain reaction-based methods for detection and quantitative risk assessment of food-borne pathogens	Jeffrey Hoorfar	Danish Institute for Food and Veterinary Research (DFVF), Denmark	Detection and Control
11	A European network for risk assessment, detection and control of trichinellosis — in old and future member states	Pascal Boireau	The French Food Safety Agency (AFSSA), France	Detection and Control
12	A European network for the detection and control of *Cryptosporidium*	Simone M. Cacciò	Italian National Institute of Health (ISS), Italy	Detection and Control
13	Integrating risk assessment, epidemiology and economics to support decision making in food safety	Arie Havelaar	National Institute for Public Health and the Environment (RIVM), The Netherlands	Risk Research
14	Pre-harvest Microbiological Risk Assessment	Danilo Lo Fo Wong	Danish Institute for Food and Veterinary Research (DFVF), Denmark	Risk Research

NO.	TITLE	LEADER	LOCATION	THEME
21	Molecular epidemiology of *Salmonella* Genomic Island 1 (SGI1)	Dik J. Mevius	Central Veterinary Institute (CVI), The Netherlands	Epidemiology
22	Zoonotic Protozoa network (ZoopNet) — *Cryptosporidium* and *Giardia*	Simone M. Cacciò	Italian National Institute of Health (ISS), Italy	Detection and Control
23	Prioritizing food-borne and zoonotic hazards	Arie Havelaar	National Institute for Public Health and the Environment (RIVM), The Netherlands	Risk Research
24	Comparison of *Campylobacter* risk assessment models: Towards a European consensus model?	Maarten Nauta	National Institute for Public Health and the Environment (RIVM), The Netherlands	Risk Research
25	Development and application of improved diagnostics for Q-fever	Richard Thiery	The French Food Safety Agency (AFSSA), France	Detection and Control
26	Virulotyping of new and emerging *Salmonella* and VTEC	Roberto La Ragione	Veterinary Laboratories Agency (VLA), UK	Host-Microbe Interaction
27	Harmonization of *Trichinella* infection control methods, quantitative risk assessment in pigs and an early diagnosis in humans to increase treatment efficacy (TRICHIMED)	Pascal Boireau	The French Food Safety Agency (AFSSA), France	Risk Research
28	Methods of attributing human *Salmonella* and *Campylobacter* infections with different animals, food and environmental sources	Tine Hald	National Food Institute, Danish Technical University, (DTU), Denmark	Epidemiology
29	Surveillance of emerging antimicrobial resistance critical for humans in food, environment, animals and man	Bruno González-Zorn	Complutense University of Madrid (UCM), Spain	Epidemiology
30	Towards a combined microbiological and epidemiological approach for investigating host-microbe interactions of *Campylobacter jejuni* — CampyNet III	Thomas Alter	Federal Institute for Risk Assessment (BfR), Germany	Host-Microbe Interaction
31	Food producing animals as a potential source of emerging viral zoonoses (ZOOVIRNET)	Franco M. Ruggeri	Italian National Institute of Health (ISS), Italy	Detection and Control
32	Public health surveillance for food-borne infections: Design of epidemiological studies and applying seroepidemiology to validate the surveillance pyramid	Kåre Mølbak	Statens Serum Institut (SSI), Denmark	Epidemiology
33	Early host responses to *Salmonella* and *Campylobacter*	Riny Janssen	National Institute for Public Health and the Environment (RIVM), The Netherlands	Host-Microbe Interaction
34	The prevention and control of *Campylobacter* in broilers	Diane Newell	Veterinary Laboratories Agency (VLA), UK	Detection and Control

WORKPACKAGE FINAL REPORTS

Workpackage 1: Virtual Institute

WP Leader	André JESTIN	**Name and Address**	French Food Safety Agency (AFSSA), 27-31 Avenue du Général Leclerc, 94700 Maisons-Alfort CEDEX, FRANCE
Project Start date	1 September 2004	**Project End date**	31 October 2009

Aim

Establish sustainable management-based mechanisms, procedures and processes to support the integrated scientific collaboration of European scientists from the Med-Vet-Net consortium within the context of a 'virtual institute'.

Project background and relevance

The Virtual Institute concept aimed to achieve integration among partners of the Network for all administrative and financial tasks, and sustainability of the Network beyond the European Commission (EC) funding.

The primary objectives of the Virtual Institute were to put in place effective working practices and ensure timely management of any administrative, financial, legal, planning and reporting tasks, as well as to structure the activities regarding the Network's sustainability and implement sustainability actions. These objectives and activities were achieved by the formation and co-ordination of different management bodies, comprising a Governing Board for guidance and validation; a Co-ordinating Forum, chaired by the Project Manager, for the co-ordination and monitoring of scientific and training activities; an Advisory Panel for external advice on scientific direction; and an Administration Bureau headed by the Co-ordinator's Representative located at the co-ordinating institute, the French Food Safety Agency (AFSSA), for implementation of Network structuring, administrative, financial and legal tasks. These different groups were strongly linked by means of regular correspondence and meetings, both face-to-face and teleconferences, throughout the duration of the project to ensure the overall successful achievement of the planned objectives.

The main actions undertaken by Workpackage 1 were, firstly, to commit the management bodies to the initial network structuring tasks such as scientific strategy and action plans, and then effective working practices were facilitated through the development of a book of procedures. This enabled the recurrent tasks of network management to be undertaken in a timely and effective way throughout the project's different administrative periods.

Seeking ways to sustain Med-Vet-Net beyond the lifetime of the EC project was regarded as a very important activity and was undertaken by Workpackage 1 from the outset of the project. In Year 4 this activity was taken forward by two key subcommittees operating under the jurisdiction of Workpackage 1. These were: a sustainability subcommittee that examined possible future objectives; and a legal officers sub-committee to investigate and make recommendations on the most suitable organisation to provide the legal framework for a new structure emanating from the current EU-funded network.

The work of the two subcommittees resulted in the formation of an association under French law 1901 — the 'Med-Vet-Net Association on zoonoses research', comprising all scientific partners of the EC project, and of which the primary objectives are to continue common research scientific dissemination and training activities as well as advocacy towards European stakeholders.

Objectives

Workpackage 1 was defined as an overarching workpackage. As such it had constant objectives over the different periods of the project.

- Develop and implement an effective management structure.
- Establish effective working practices.
- Manage finance and administration.
- Plan and report on finances.
- Pay partner institutes and manage cash flow.
- Investigate the sustainability of the Network.

Achievements

- Successful responses to EC requirements in terms of project management throughout the lifetime of Network.
- Provision of reports to the EC, including financial and management reports.
- Provision of financial reports to partner institutes.
- Formation of Med-Vet-Net Association, thereby ensuring continuance of research collaborations and training activities after cessation of EC funding.

Benefits to stakeholders

- Model for successful management of an international Network of Excellence established, including mechanisms for financial projection and reporting.
- Formation of Med-Vet-Net Association, which ensures the continuation of research collaborations, training activities and personnel availability to European Union organizations with an interest in zoonoses and food safety.

Workpackage 2: Strategic Scientific Integration

WP Leader	John THRELFALL	**Name and Address**	Health Protection Agency (HPA), Colindale, London, NW9 5EQ, UNITED KINGDOM
Project Start date	1 September 2004	**Project End date**	31 October 2009

Aim

Achieve effective and strategic integration of Med-Vet-Net's scientific research activities.

Project background and relevance

Med-Vet-Net as a Network of Excellence was mainly operated by and for scientists who, in the final year, belonged to 14 independent public health and veterinary institutes in 10 European countries, supported by the Society for Applied Microbiology through the recently formed independent company, Science Communications Ltd.

During the five years of its existence, Med-Vet-Net developed a series of fully-integrated interactive groups of scientists including laboratory-based researchers, epidemiologists and risk assessors all working together towards a common objective of combating diseases in humans and animals throughout the European Union (EU) The main activities of the Network were targeted at food-borne zoonotic diseases, although other non-food-related zoonoses, such as bat lyssaviruses and other wild-life related diseases, were also investigated through Special Interest Groups operating outside the scientific workpackages but with seed-corn funding provided by the Network Durable integration was addressed at the scientific level, with Med-Vet-Net continuing to pursue opportunities for funding within Framework Programme 7 and other areas, with the primary objective of maintaining and expanding multi-disciplinary research teams, thereby incorporating research groups and institutes external to the Med-Vet-Net network into new proposals In this respect at least 15 collaborative projects involving Med-Vet-Net workpackages and scientists have been developed or started, all of which are continuing beyond the EU funded period of Med-Vet-Net. Preparatory activities for these proposals were not funded by the EC contribution to Med-Vet-Net.

Using a combination of laboratory-based methods, epidemiology and risk assessment of disease potential, Med-Vet-Net scientists undertook research on a range of zoonotic organisms including bacteria, viruses and parasites. As a result, there are now epidemiological, risk assessment and attribution models available for immediate disease control use by organizations such as the European Centre for Disease Prevention and Control and the European Food Safety Authority, along with a highly trained cadre of enthusiastic scientists who can be called upon to provide advice and participate in food-borne zoonoses research across the EU.

Objectives

- Scientific co-ordination and strategic planning, including peer review of network-funded research projects.
- Development of research skills and expertise.
- Knowledge management.
- Expansion and extension of Network expertise, knowledge and facilities through external collaboration.

Achievements

- Co-ordination of 25 scientific Workpackages over Med-Vet-Net's five-year funding period.
- Provision of project management, planning and reporting, including overall co-ordination of scientific activities to ensure complete integration of the Network's overarching and scientific activities.
- Over 250 scientific milestones and 300 deliverables achieved, resulting in more than 150 peer-reviewed publications.
- Initiation and development of five Special Interest Groups encompassing areas outside the scientific workpackages.
- Expansion of interactions between existing scientific workpackages, including joint workshops and training courses, joint publications, and joint applications to new calls for funding.
- Training exchanges for 78 scientists through short-term missions.
- Over 1,000 scientists, of whom approximately 30% were external to the Network, trained in organized workshops.
- Five annual scientific conferences.
- Common databases, datasets, strain collections and DNA repositories available for use in Med-Vet-Net and other European institutes.
- Production of quality control standards for use in scientific institutes in EU.
- Submission of over 15 joint proposals to Framework Programme 7 and other funding bodies. These were prepared without Med-Vet-Net funding.
- Development of collaborative activities with other EU networks and with various organizations in the USA, Japan and Australasia.
- Collaboration with Workpackage 1 resulting in the formation of the Med-Vet-Net Association.

Benefits to stakeholders

- Common databases, datasets, strain collections, DNA repositories and quality control standards available for use by the Med-Vet-Net partnership and other institutes in Europe.
- Development of new and improved methods for the diagnosis and typing of zoonotic pathogens.
- Highly interactive and responsive scientific network with the capacity to initiate investigations into food safety issues in the EU.
- New international network in the field of wildlife-related zoonoses in the EU.
- Capacity to initiate new projects in response to current needs.
- Development of respect and trust between medical and veterinary institutes in EU.
- Cadre of highly-trained and motivated young scientists with interest in zoonotic diseases.

Workpackage 3: Spreading Excellence

WP Leader	Peter SILLEY	**Name and Address**	Society for Applied Microbiology (SfAM), Bedford Heights, Brickhill Drive, Bedford, MK41 7PH, UNITED KINGDOM
Project Start date	1 September 2004	**Project End date**	31 October 2009

Aim

Spread the excellence of knowledge encompassed within Med-Vet-Net to scientists within the Network as well as externally to the general public, stakeholders outside the core Network partners, and the international scientific community.

Project background and relevance

The dissemination of knowledge and the spreading of excellence are integral requirements of the European Commission (EC) for all Networks of Excellence. It is important that research undertaken with public money is communicated to European citizens and scientists are accountable for the research they undertake with public funds.

At the same time, the sharing of information between scientists working on zoonoses in different disciplines is essential for successful collaboration to occur and be maintained. Prior to Med-Vet-Net, there was limited sharing of information and resources between health professionals, veterinarians, food scientists, epidemiologists, bioinformatists and risk researchers. There was also little sharing of data and resources across national borders.

Workpackage 3, through the Communications Unit, worked to deliver and share Med-Vet-Net information both internally with the Network's scientists, and externally with the general public and stakeholders including policy makers, industry, farmers, food producers and other researchers. Web resources and technologies were instrumental in ensuring the success of the 'virtual' Network enabling over 300 scientists in 10 countries to collaborate effectively.

A wide range of strategies was employed to disseminate information. Clear, attractive and professional documentation and reports were produced to showcase the periodic achievements and final results of the Network, including the annual reports, the Final Scientific Report and the stakeholder report.

The Communications Unit's highly successful science communication internship facilitated the training of more than 20 scientists who gained valuable skills in presentations, writing, media relations, networking and using publishing and web tools that will ultimately benefit them in their research careers, and even encourage them to undertake more engagement with non-scientists in the future. In addition, some sections of the science communication training internship were also offered as external training courses to other EC-funded projects including EPIZONE, Cascade and COST. It is expected that future courses comprising this and other science communications material will be further developed.

Databases created and hosted by Med-Vet-Net including the EBLV (Lyssavirus), CampyNet and WILDLIST databases, will continue to be updated and used after the project. For example, it is anticipated that the WILDLIST will be maintained by the new Framework Programme 7 (FP7) project, WildTech.

For the first four years of Med-Vet-Net, the Communications Unit was based at the Society for Applied Microbiology (SfAM). In 2008, a new company, Science Communications Ltd, was formed to undertake the communication activities for Med-Vet-Net, beginning from year five, through a third-party agreement with SfAM. With the formation of the company the Communications Unit has gained opportunities to join future FP7 consortia and other projects, outwith Med-Vet-Net funding, to deliver communication and dissemination activities. This is a clear example of a successful sustainable entity emanating from the Med-Vet-Net project. Science Communications Ltd has successfully secured the contract to undertake communication work for the newly formed Med-Vet-Net Association, ensuring the continuation of acquired skills, resources and contacts from the five years of Med-Vet-Net funding.

Objectives

- Develop routes and points of contact both within and outside of the Network.
- Be a point in the Network through which information can be shared.
- Establish Communication Representatives in the partner institutes.
- Identify and communicate newsworthy research results.
- Promote the Med-Vet-Net brand/corporate image.
- Assist those institutes without communications or public relations units or with limited communication resources.
- Provide Europe-wide/international exposure for the Med-Vet-Net project.

Achievements

- Formation of the company, 'Science Communications Ltd' a small-to-medium enterprise (SME) that evolved from the Med-Vet-Net Communications Unit, to work as Third Party to SfAM from 1 September 2008 — clear example of a sustainable entity produced from Med-Vet-Net project.
- The stakeholder report 'Building a European Community to Combat Zoonoses' was produced, providing an easy-to-read summary of all of the Med-Vet-Net's achievements.
- Production of regular newsletter, *Med-Vet-Net News*, which as at October 2009 was distributed to over 1,500 people in 72 countries. Articles from *Med-Vet-Net News* were placed on the public website providing continual change and additions to the site.
- Formation of the Science Communication Internship with a total of 21 individuals from 10 countries participating.
- Successful use of an online registration tool and abstract submission system (Oxford Abstracts) for the Med-Vet-Net Annual Scientific Meetings.
- Creation of the Wildlife-related Emerging Diseases and Zoonoses (WiREDZ) web pages and the WILDLIST — an online database of people working on WiREDZ throughout Europe.
- Implementation and use of online collaboration tools including WebEx, Moodle, and podcasting for workpackages, Special Interest Groups and the science communication internship.

Benefits to stakeholders

- Formation of the SME, Science Communications Ltd, with ability to act in this area for other projects, institutes or networks in the European Union.
- Participation by the Science Communication interns in communications activities following their participation in the internship, including contributing articles for *Med-Vet-Net News*, assisting at the Annual Scientific Meetings, and attending science communication conferences and public science exhibitions.
- Creation of the Wildlife-related Emerging Diseases and Zoonoses (WiREDZ) web pages and the WILDLIST — an online database of people working on WiREDZ throughout Europe.
- Regular provision of both Med-Vet-Net related achievements and current developments in zoonoses to an international audience of over 1,500 people in 72 countries through *Med-Vet-Net News*.

Workpackage 4: Development of a linked molecular surveillance database system for food-borne infections (PulseNet Europe)

WP Leader	Susanna LUKINMAA	**Name and Address**	Statens Serum Institut (SSI), Artillerivej 5, DK-2300 Copenhagen S, DENMARK
Project Start date	1 September 2004	**Project End date**	30 November 2006

Aim

Establish a real-time linked surveillance database system to detect disease clusters, and investigate outbreaks of *Salmonella*, VTEC and *Listeria*.

Project background and relevance

In Europe, for many years molecular typing results from different countries have not been comparable, even when the same method has been used. Furthermore, it is impossible to exchange bacterial strains over long distances to perform the real-time typing necessary for outbreak detection and control. However, it is possible to do molecular typing according to defined rules in many places simultaneously and to send DNA fingerprints electronically to a central database making it possible to compare profiles of strains isolated in different countries in real-time.

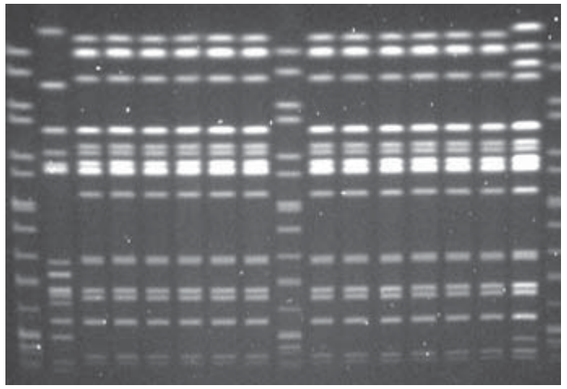
PulseNet Europe is a network of food, public health, and veterinary laboratories dedicated to molecular surveillance of food-borne infections. It is a unique multi-disciplinary structure in the EU and adds high discriminatory molecular typing and a truly 'farm-to-fork' approach to existing surveillance. Strains from ill people and food are locally typed by pulsed field gel electrophoresis (PFGE) using a standardized protocol and images of the PFGE profiles are submitted online to the PulseNet Europe central database to be compared with profiles submitted by other laboratories, enabling real-time comparisons using sophisticated image analysis software. The data is also comparable internationally through PulseNet International (PulseNet Asia-Pacific region, PulseNet Canada, PulseNet Latin America and PulseNet USA).

Med-Vet-Net partners have direct access to the PulseNet Europe central database containing specific databases for *Salmonella*, verocytoxin-producing *Escherichia coli* and *Listeria* monocytogenes. This direct access ensures a uniform naming of PFGE subtypes in all participating countries, provides portable data, and makes it easy for partners to check and compare their own data to the data stored in the database when alerts of infection clusters are posted on the communication forum. The direct access to comparable typing data for isolates from human infections as well as food and animals will significantly improve the surveillance and trace-back of food-borne infections at the national, European and international level. Furthermore, international clusters of food-borne infections that have too few cases in each country to be detected by the national surveillance systems will be detected through the central PulseNet Europe surveillance system.

PulseNet Europe partners are laboratories that have submitted typing data for one or more of the pathogens under surveillance by Med-Vet-Net, and represent public health, food, and veterinary laboratories across Europe.

Objectives

- Establishment of real-time linked surveillance database system to detect disease clusters and investigate outbreaks of *Salmonella*, VTEC and *Listeria*.
- Establishment of a database curator system and training of curators.
- Establishment of a rapid communication system.
- Establishment of a certification and proficiency testing programme, and certification of participants.



Strains from ill people and food are locally typed by pulsed field gel electrophoresis (PFGE) using a standardized protocol and images of the PFGE profiles are submitted online to the PulseNet Europe central database.

Principal methods

- Pulsed field gel electrophoresis
- Database construction
- Bioinformatics
- Ring trials

Achievements

- A real-time linked surveillance database system to detect disease clusters of *Salmonella*, VTEC and *Listeria* monocytogenes for food, public health, and veterinary laboratories.
- A rapid communication system (PNE forum) that also provides a link between food, public health, and veterinary laboratories in Europe.
- A customized, web-based PulseNet Europe central database.
- A certification and proficiency testing programme, and certification of participants.
- A memorandum of understanding between partners.

Benefits to stakeholders

The availability to the European Centre for Disease Prevention and Control and the European Food Safety Authority of a real-time linked surveillance database system to detect disease clusters of *Salmonella*, VTEC and *Listeria* monocytogenes that is fully compatible with PulseNet USA and other international PulseNet groups.

Workpackage 5: Molecular epidemiology of European bat lyssaviruses

WP Leader	Anthony FOOKS	**Name and Address**	Veterinary Laboratories Agency (VLA) (Weybridge), Rabies and Wildlife Zoonoses Group, Woodham Lane, Addlestone, New Haw, Surrey, KT15 3NB, UNITED KINGDOM
Project Start date	1 September 2004	**Project End date**	1 March 2006

Aim

Provide accurate information on the risk to human health of bat-associated rabies in Europe by forging collaborations among rabies laboratories.

Project background and relevance

Phylogenetic studies have established similarities between rabies virus strains and related these to the species of bat that they infect. In Europe, for reasons unknown, the virus responsible for classical rabies virus (genotype 1) has not been detected within native bat species. However, two related viruses fill this ecological niche, namely European bat lyssavirus (EBLV) type 1 and EBLV type 2. Evolutionary analysis indicates that there was a low intrinsic heterogeneity between EBLV-1 and 2, and that both EBLV groups had evolved into at least two genetically distinguishable lineages (EBLV-1a or b and EBLV-2a or b).

Although they were undoubtedly not the first European bats to be infected with rabies virus, during 1954–1984, 15 cases of rabies in bats were reported from Germany (7), Yugoslavia (3), Ukraine (2) and Turkey (1), Greece (1), and Poland (1). Between 1985 and 2002, that total increased to more than 673 and cases were found more widely throughout Europe — The Netherlands, Denmark, Germany, Poland, France, Spain, Switzerland, Ukraine, Czechoslovakia, Slovak Republic, Hungary and the United Kingdom UK. It is thought that the different EBLV-1 lineages were introduced into parts of northern Europe from two directions with EBLV-1a the most recently introduced strain from a North African origin via the south of Spain. EBLV-1a exhibits a west to east European division whilst EBLV-1b has a north to south distribution. All isolates were from *Eptesicus serotinus* with the exception of one from *Vespertilio murinus* in the Ukraine (1993).

EBLV-1a and 1b could then represent two variant groups adapted to the same host. The Netherlands and France are the only countries from which both EBLV-1a and 1b have been isolated, however more comprehensive surveillance in other European countries might extend our knowledge of lyssavirus prevalence and distribution.

The first isolate of EBLV-2 was from a Swiss bat biologist in 1985, who had been working on bats in Finland, followed in 1986 with isolates in Denmark and Germany from a Daubenton's bat, and in Denmark from a pond bat. In total there have been 17 records of this virus from Denmark, Finland, Germany, The Netherlands, Switzerland, UK, and Ukraine. The principal, if not sole, natural wild hosts of EBLV-2 are *Myotis dasycneme* and *Myotis daubentonii*.

EBLVs have been known to infect not only their primary hosts (insectivorous bats) but also, occasionally, other incidental animal hosts, including a stone marten in Germany and a number of sheep in Denmark.

Objectives

- Collate sequence data and archived material from EBLV isolates detected by Med-Vet-Net partner institutes. As far as possible this was also obtained from associate institutes throughout Europe and neighbouring countries.
- Establish a database of sequence data for the EBLV isolates. Primarily this database would utilize sequence data from a 400 bp region of the N gene, but could be enhanced with sequence data from other genomic regions.
- Disseminate the information electronically via the Internet to facilitate the interpretation and publication of sequence data enabling rapid genotyping of new viruses and providing a greater understanding of the geographical and host-specific evolution of the European bat lyssaviruses.

Principal methods

- Data collation and analysis
- Database construction
- Electronic dissemination of information

Achievements

- Facilitated the establishment of the first network of European scientists involved in bat lyssavirus surveillance.
- Developed a unique database incorporating the clinical details, laboratory investigations and virus sequences of EBLV cases in Europe. The database is accessible to interested scientists on request.
- Determined common approaches to both active and passive bat rabies surveillance programmes in Europe, which were subsequently published in the World Health Organization's Rabies Bulletin Europe.
- Opportunities for training and collaboration exploited by Med-Vet-Net participants.

Benefits to stakeholders

- Establishment of the first network of European scientists involved in bat lyssavirus surveillance.
- Provision of a unique database of virus sequences of EBLV cases in Europe.

Workpackage 6: Development and application of geographical information systems (GIS) and spatio-temporal methods in the epidemiology of food-borne bacterial zoonoses

WP Leader	Steen ETHELBERG	**Name and Address**	Statens Serum Institut (SSI), Artillerivej 5, DK-2300 Copenhagen S, DENMARK
Project Start date	1 September 2004	**Project End date**	31 October 2009

Aim

Establish a GIS network and build up GIS capacities within various epidemiological contexts among Med-Vet-Net participants.

Project background and relevance

Geographic information systems (GIS) are used to manage and analyse spatial data and construct maps. GIS tools may also potentially find many uses for epidemiological surveillance and analyses. The focus of Workpackage 6 was to geographically analyse important zoonotic disease agents in Europe, and, importantly, promote the use of GIS and increase the skills of participating epidemiologists.

The workpackage comprised four different projects including the construction of an online atlas containing maps of the incidence of salmonellosis for the ten most frequent *Salmonella* serotypes across Europe. A project to develop the atlas into an interactive tool that can draw European salmonella incidence maps based on specifications provided by the user is continuing after the formal end of Med-Vet-Net.

Objectives

- Supply GIS training and provide technical assistance for Med-Vet-Net participants.
- Develop an online atlas of human *Salmonella* cases in Europe.
- Develop a cluster-analysis tool and study persistent clustering of campylobacteriosis in Denmark.
- Examine the association between VTEC cases and cattle farms in five European countries.
- Perform a comprehensive analysis of clusters of reported human cases of selected *Salmonella* serotypes in Europe.

Principal methods

- Construction of an online "Atlas" using maps made with Arc-GIS software.
- Cluster analysis, including global clustering and geographical mean analyses.
- Spatial statistical analysis including buffer analysis, Moran's I and Poisson, and logistic regression models.

Achievements

- Put GIS on the agenda in the zoonotic disease community in Europe through networking, training courses and four workshops.
- Construction of a web-based 'Atlas' of the incidence of salmonellosis in Europe, available at www.epigis.dk.
- Conducted two-day training courses and four workshops in the use of GIS in epidemiology.
- Performed large, separate analyses in five different European countries comparing addresses of verocytotoxin-producing *Escherichia coli* (VTEC) cases with the underlying population, and with the location of cattle or cattle farms. The results showed an association between VTEC cases and the location of cattle farms, strongly indicating that direct transmission from cattle to humans is a significant route of infection.
- Dynamic cluster analysis tool developed using Netlogo software, which was used to analyse persistent clustering of campylobacteriosis in Denmark.
- Performed a comprehensive analysis of clusters of reported human cases of 10 selected *Salmonella* serotypes in a large number of European countries. The analysis was adjusted for surveillance differences between countries, with a number of patterns and signals, including cross-border outbreaks, detected.
- Demonstration that in Denmark, living in close proximity to cattle farms was strongly associated with Q-fever infections.

Benefits to stakeholders

- Participating Med-Vet-Net scientists have increased their GIS skills.
- The value of geographical analyses and of gathering location variables when collecting surveillance data were highlighted on a number of occasions and in a number of fora.
- Promotion of the use of GIS within the scientific zoonoses community.
- Demonstration that close proximity to cattle is a significant route of VTEC infection, which is important knowledge in the struggle to control this serious disease.

Workpackage 7: Pathogenesis of verocytotoxin-producing *Escherichia coli* (VTEC) infection: a new paradigm for VTEC

WP Leader	Alfredo CAPRIOLI	**Name and Address**	Dipartimento di Sanità Alimentare e Animale, Istituto Superiore di Sanità (ISS), Viale Regina Elena 299, 00161 Rome, ITALY
Project Start date	1 September 2004	**Project End date**	1 March 2006

Aim

Contribute to the definition of virulence genes and the mechanisms that make a VTEC strain fully pathogenic to humans, govern the evolution of commensal *E. coli* towards virulence, and contribute to the capability of VTEC to colonise the gastrointestinal tract of the animal reservoirs.

Project background and relevance

VTEC infections constitute a major public health concern because of the severe illnesses that they can cause, such as haemorrhagic colitis and haemolytic uraemic syndrome, especially among children and the elderly. The large number of outbreaks that have occurred around the world underlines the importance of these pathogens and highlights the need for cooperation between laboratories within and beyond state boundaries. Accordingly, VTEC infections have been included among the food-borne zoonoses with the highest priority for monitoring and control (EC Directive 99/2003) in animal reservoirs.

Understanding and defining the virulence genes and the mechanisms that make a VTEC strain fully pathogenic to humans is considered important particularly for the definition of the pathogenic *E. coli* clones (serotypes), other than O157. Such clones, at present, are largely unidentified and particularly need to be monitored and controlled in animal reservoirs and in foodstuffs as well as considered in legal issues (for example requirements for presence/absence in foodstuffs).

At the start of the project a Community Reference Laboratory focusing European efforts in this important food-borne disease area did not exist. As such it was anticipated that the co-ordination of European research on VTEC would raise the profile of this area within the European Commission.

Objectives

- To review research and surveillance activities on VTEC infections performed by Med-Vet-Net institutes.
- To debate, reach a consensus and generate recommendations for future research on the pathogenesis of VTEC infections, with particular emphasis on the definition of the virulence factors and the mechanisms that make a VTEC strain fully pathogenic to humans; govern the evolution of commensal *E. coli* toward virulence; and contribute to the capability of VTEC to colonize the gastrointestinal tract of the animals that act as natural reservoirs.

Principal methods

- Database construction and analysis including construction of online catalogue of skills, expertise and resources.

Achievements

- Online catalogue of skills, expertise and resources related to VTEC research within Med-Vet-Net.
- VTEC workshop involving 47 participants from 27 organizations throughout Europe.
- Report and list of recommendations published on the Med-Vet-Net website and in the journal, *Emerging Infectious Diseases*.
- Participation in a successful new Concerted Action proposal on *E. coli*.

Benefits to stakeholders

- The 'Summary and Conclusion' document with recommendations for future research produced is publicly available. A shortened version entitled, *Pathogenesis of Verocytotoxin/Shiga Toxin-producing* Escherichia coli *infection*, has also been published (see http://www.cdc.gov/ncidod/EID/vol12no08/06-0170.htm).
- Four Med-Vet-Net partners are participants in the new Concerted Action, "Pathogenic *Escherichia coli* Network".

VTEC infections constitute a major public health concern because of the severe illnesses that they can cause, especially among children and the elderly.

Workpackage 8: Identification of molecular markers of pathogenicity for *Campylobacter jejuni*

WP Leader	Anne RIDLEY	**Name and Address**	Veterinary Laboratories Agency (VLA) (Weybridge), Department of Food and Environmental Safety, Woodham Lane, New Haw, Addlestone, Surrey, KT15 3NB, UNITED KINGDOM
Project Start date	1 September 2004	**Project End date**	1 March 2006

Aim

Extend the capacity to phenotype *Campylobacter jejuni* to include virulence-related properties.

Project background and relevance

Campylobacter jejuni is the major reported cause of human bacterial enteritis in the European Union. The organism is ubiquitous in the environment and can colonize the intestinal tracts of all food-producing animals (poultry, cattle, sheep and pigs) and domestic pets (dogs and cats) asymptomatically. As a consequence, the attribution of the major sources of campylobacteriosis has been extremely difficult. However, the handling and consumption of poultry meat are considered a major source of infection. Several quantitative microbial risk assessments (QMRA) of campylobacters in the poultry food chain have been undertaken throughout Europe and the results of these models indicate that poultry meat contaminated with campylobacters is a significant public health risk. To date all the QMRA models assume all campylobacters, regardless of source, are equally virulent. Nevertheless, *C. jejuni* is extremely diverse both in terms of genetic content and phenotypic properties and, therefore potentially, disease outcome. In order to develop accurate risk assessments, the ability to distinguish between pathogenic and non-pathogenic organisms is vital.

It is widely accepted that *C. jejuni* virulence is multi-factorial, but invasion of gut epithelium and production of a cytolethal-distending toxin are considered major virulence mechanisms. As a result of post-genomic studies following the recent genome sequencing of several *C. jejuni* strains and improved genetic manipulation techniques, additional potential virulence-associated genes or genetic regions are constantly being reported but the role any of these genes play in *Campylobacter* pathogenicity mechanisms remains unclear.

This project investigated the correlation between genotype and virulence phenotype in *C. jejuni* using a well-characterized strain set and an agreed set of standard tests, enabled by a unique international standard strain set collected, genotyped and distributed worldwide in the previous EU funded CampyNet project. CampyNet II included the majority of institutes involved in the original partnership.

Objectives

- Develop standard virulotyping methods.
- Perform virulotyping and susceptibility testing of the CampyNet strains.
- Transfer appropriate technologies to other laboratories.
- Share data using a web-based database.

The handling and consumption of poultry meat are considered a major source of the* Campylobacter jejuni *infection.

Principal methods

- Pulsed-field gel electrophoresis
- Genotyping technique (fla typing) using *flaA*
- Database construction and analysis

Achievements

- Improved characterization of the internationally available CampyNet strain set, which provides a unique resource for research and routine typing laboratories.
- Public availability of a fully updated database on the Med-Vet-Net website.
- Standardized procedures for cytolethal-distending toxin and invasion assays for campylobacters.
- First international investigation, using a well-characterized strain set, of a comprehensive set of potential virulence-related genes including the recently proposed 'chicken clade marker'.

Benefits to stakeholders

The original CampyNet database, established in 2001, has been updated with all the additional information collated into a single database publicly available on the Med-Vet-Net website.

Workpackage 9: The human health implication of emerging resistance to β-lactam antibiotics in *Salmonella* and other *Enterobacteriaceae* from food animals

WP Leader	Frank M. AARESTRUP	**Name and Address**	Danish Institute for Food and Veterinary Research (DFVF), DK-1790 Copenhagen V, DENMARK
Project Start date	1 September 2004	**Project End date**	1 March 2006

Aim

Develop phenotypic and genotypic protocols for characterization of β-lactamases, their genes and associated plasmids in *Enterobacteriaceae*.

Project background and relevance

The β-lactam antibiotics are the most varied and widely used of all the different groups of antimicrobials. About 100 different β-lactam antibiotics are used clinically in the antibacterial treatment of humans and animals. The primary cause of resistance towards these drugs is the bacteria's acquisition of transferable genes that encode the penicillin-degrading enzymes, β-lactamases. In the development of resistance towards these drugs, we have witnessed one of the few cases of evolution, detected on a timescale of just a few years. Thus, from the emergence of the TEM-1 enzyme capable of degrading ampicillin about 40 years ago, this resistance mechanism has evolved to generate about 120 different TEM β-lactamases. Other important classes of β-lactamases are SHV, PSE and OXA and a similar evolution has been observed in these classes.

In addition, the emergence of β-lactamases in gram-negative bacteria is an increasing problem worldwide. This includes *Salmonella*, where either the use of broad-spectrum penicillins, in combination with a β-lactamase inhibitor or a cephalosporin (extended spectrum β-lactamases, ESBL), is standard treatment for infections in children or in cases where fluoroquinolones can not be used.

Whereas much is known about the occurrence of different β-lactamases from bacteria causing infections in humans, knowledge about the occurrence of such enzymes in bacteria from food animals is limited. Furthermore, there has been no attempt to systematically examine the occurrence of different β-lactamases, including some with activity against third generation cephalosporins, in gram-negative bacteria from food animals.

The lack of international standards for identifying and characterizing the β-lactamases makes it difficult to quantify their importance. Furthermore, most β-lactamases are located on transferable plasmids, and the spread of these plasmids is currently considered the most important mechanism of transfer of antimicrobial resistance between different bacterial strains.

With no standard methods for the purification or characterization of plasmids, comparisons between studies, laboratories and countries are not possible. Consequently Workpackage 9 aimed to initiate work that would lead to international standardised procedures for typing the resistance plasmids associated with β-lactamase resistance in *Salmonella*.

Objectives

- Develop phenotypic assays for initial characterization of β-lactamases.
- Develop methods for molecular characterization of ß-lactam resistance.
- Develop methods for standardized characterization of plasmids carrying β-lactamase genes.
- Identify reference laboratories capable of further characterization, for example, of new enzymes.
- Disseminate available knowledge on characterization of resistance plasmids.
- Create collections of reference strains.

Principal methods

- Phenotypic testing for detection of recognition of β-lactamase production
- Polymerase chain reaction (PCR) sequencing
- Database construction

Achievements

- Collection of reference strains covering all currently known β-lactamases.
- Protocols for phenotypic detection and characterization of β-lactamase positive *Enterobactericeae*.
- Protocols for purification and characterization of plasmids in *Enterobactericeae*.
- Database of validated PCR primers for amplification of the most common β-lactamases in *Enterobactericeae*.

Benefits to stakeholders

- Provision of common protocols for plasmid isolation, purification, and characterization, which have been validated using a publicly-available set of isolates.
- Use of harmonized approaches developed in collaborative studies to investigate ESBL genes in *Salmonella enterica* isolated from a variety of animals, food products and human sources.
- Detailed, publicly available description of well-validated and recommended procedures for the phenotypic detection and further characterization of β-lactamase-expressing strains, including the appropriate β-lactams to test. This document has provided guidance for a minimum procedure for initial screening in routine diagnosis and follow-up characterization.

Workpackage 10: Validation and standardization of polymerase chain reaction-based methods for detection and quantitative risk assessment of food-borne pathogens

WP Leader	Jeffrey HOORFAR	**Name and Address**	Danish Institute for Food and Veterinary Research (DFVF), Bulowsvej 27, DK-1790 Copenhagen V, DENMARK
Project Start date	1 September 2004	**Project End date**	1 March 2006

Aim

Facilitate implementation of polymerase chain reaction (PCR)-based methods, such as real-time PCR or microarray-PCR, for both detection and verification of food-borne pathogens, through harmonization and standardization of methods in Europe.

Project background and relevance

There is an increasing need to control the microbiological safety of food throughout the whole food chain through screening and certification programmes that apply highly sensitive and cost-effective methods.

Molecular methods, particularly polymerise chain reaction (PCR) and microarray, have received increasing attention throughout the world for microbiological food safety testing. Today, numerous probes and PCR-methods are available for many of the food-borne pathogens, but no consensus is available on which gene and DNA sequence should be used for reliable testing. In addition, there has been a lack of ring-trial validated protocols for the preparation of standards. Food-PCR, a project funded under the 5th Framework Programme, produced ring-trial validated, gel-electrophoresis PCR protocols for five of the most important food-borne pathogens in limited sample models. There exists a clear need to continue this standardization work on a wider range of samples and also to adopt and validate recently developed technologies such as real-time fluorescence-based PCRs and microarray platforms.

Objectives

- Real-time PCR validation through ring-trials.
- Establish European working groups.
- Hands-on workshops.
- Preparation of European Committee for Standardization (CEN) documents.

Principal methods

- Range of PCR-based methods — quantitative real-time PCR and microarray-PCR
- Database construction and analysis
- Bioinformatics
- Ring trials

Achievements

- Contributions to preparation of several European standardization documents on real-time PCR and microarray testing in collaboration with CEN workgroups.
- Collaborative real-time PCR trial on *Campylobacter* in chicken samples completed and awarded NordVal approval. The test is currently used in several Nordic countries for the certified production of retail *Campylobacter*-free chickens.
- Prototype database produced for PCR testing of five major bacterial enteric pathogens.
- Successful submission of a new EU-funded project BIOTRACER, which aims to improve the traceability of unintended microorganisms and their substances in food and feed chains. Preparatory work for this submission was not funded by Med-Vet-Net.

Benefits to stakeholders

- Development of standard operating procedures in collaboration with several CEN workgroups.
- Provision of the basis of a successful submission for the EU-funded Integrated Project, BIOTRACER.
- Provision of a NordVal-approved RT-PCR test for the detection of *Campylobacter* in chicken samples, now in use in several Nordic countries.

Molecular methods, particularly polymerise chain reaction (PCR) and microarray, have received increasing attention throughout the world for microbiological food safety testing.

Workpackage 11: A European network for risk assessment, detection and control of trichinellosis in old and future member states — TrichiNet

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Project Start date	1 September 2004	**Project End date**	1 March 2006

Aim

Establish a European network for risk assessment, detection and control of trichinellosis.

Project background and relevance

In Europe, *Trichinella* is an emerging and re-emerging food-borne agent and four species have been involved in the domestic and/or sylvatic cycle. In Western Europe, horse meat, wild boar meat and pork have been identified as the most important source of infection for humans whereas in Eastern European countries, pork is the main source of infection. Over the past two decades more than 1,800 trichinellosis cases, traced back to outdoor pigs, were notified from EU member states (Spain, France, Italy and Germany) but during the same period, several thousand human cases were reported in the newly acceded and future states.

Although digestion methods used for routine meat inspection in pigs are considered suitable for avoiding clinical trichinellosis in humans, it has been suggested that the indirect enzyme-linked immunosorbant assay (ELISA) methods, which are presently only used for surveillance, have a better sensitivity under specific conditions. Meat juice (tissue serum) offers an interesting alternative matrix because it is easier to collect than drawing blood to process for serum. Given that monitoring programmes based on meat juice ELISAs have been successfully implemented for *Salmonella* diagnosis in pigs in Denmark, it is timely to review the direct and indirect tests to define their respective limits and sensitivity/specificity as the diversity of the techniques is important and no preference was indicated in the latest European regulation on zoonoses.

In spite of the low number of domestic animals produced in EU countries with *Trichinella* infection, direct and indirect costs to detect it at the slaughterhouse make trichinellosis one of the most costly of all parasitic zoonoses in EU (approximately €570 million per year). Furthermore, the high prevalence of infection in Eastern European countries in both production animals and wildlife represents a high risk. The inadequacies of the officially accepted surveillance methods (trichinoscopy and artificial digestion of meat), which are based on the visual detection of the parasite, are well recognised, and there is a clear need for improvements in the control strategy, in particular the sensitivity and rapidity of the test methods. Such improvements were proposed in TrichiNet's predecessor, the EU project TrichiPorse.

Objectives

- Develop a central database of prevalence and epidemiology of *Trichinella*.
- Assess available technologies for meat inspection.
- Establishment of a central repository for standardization.
- Disseminate research information to stakeholders.
- Develop a road map for future research on *Trichinella* and trichinellosis.

Principal methods

- ELISAs (enzyme-linked immunosorbant assays)
- Immunology
- Database construction and analysis
- Ring trials

Achievements

- Establishment of a Central Repository for the collection of *Trichinella* isolates.
- Publication of a review of direct tests to control *Trichinella* infections in animals.
- Development of novel methods for indirect tests for *Trichinella*.
- Technical developments undertaken within TrichiNet have supported the submission of the patent 'Validation of recombinant peptides for early immunodetection in pigs of *Trichinella* infection'.
- Submission of two further research projects, one of which, TrichiMed, was undertaken as Med-Vet-Net Workpackage 27. Preparatory work for these submissions was not funded by Med-Vet-Net.

Benefits to stakeholders

- Together with the previous EU-funded project, TrichiPorse, a strong network has been created enabling physicians and veterinarians to collaborate on a range of topics relating to the investigation and control of *Trichinella* infections.

Workpackage 12: A European network for the detection and control of *Cryptosporidium* — CryptNet

WP Leader	Simone M. CACCIÒ	**Name and Address**	Istituto Superiore di Sanità (ISS), Department of Infectious, Parasitic and Immunomediated Diseases, Viale Regina Elena 299, 00161 Rome, ITALY
Project Start date	1 September 2004	**Project End date**	1 March 2006

Aim

Implement detection and identification of the protozoan pathogen *Cryptosporidium* through harmonization and standardization of methods, including molecular methods, at the pan-European level.

Project background and relevance

Cryptosporidiosis, the disease caused by the protozoa *Cryptosporidium*, represents a major public health problem in both developing and developed countries. The infection can be severe and life threatening among immuno-compromised individuals, particularly AIDS patients and those with primary immunodeficiency diseases. In Europe, serosurveys suggest that the prevalence of infection in the immuno-competent population is close to 15%. In young animals, especially in farm animals, cryptosporidiosis is a frequent cause of diarrhoea, associated with significant morbidity and mortality.

Several characteristics of *Cryptosporidium* influence the epidemiology of infection, and direct and indirect transmission between infected hosts and susceptible individuals is favoured by high population densities (for example during lambing or calving), and by close contact, such as during recreational bathing or consumption of contaminated water. The existence of multiple transmission routes (person-to-person, animal-to-person, water-borne, food-borne and air-borne), and the difficulties in identifying the different species using conventional criteria, such as oocyst morphology, has made the epidemiology of human infection difficult to unravel.

CryptNet provided a framework for the integrated activities of five public health institutes and five veterinary institutes across Europe enabling the identification and discussion of the current problems and challenges posed by *Cryptosporidium*. Through the Med-Vet-Net training programme modern detection and typing techniques were also implemented to harmonize the approaches used to identify the pathogen In addition, the repositories of reference materials established by the workpackage provided CryptNet with access to a well-characterised source of the most common *Cryptosporidium* species, which were used for validation studies, spiking experiments and to standardize protocols.

Further, a dedicated online database developed by CryptNet, provides access to scientifically rigorous information on the epidemiology (with specific information for each participating countries), detection methods (with detailed information on microscopic, immunologic and molecular techniques), and control measures for cryptosporidiosis not only to Med-Vet-Vet partners, but also to the general public.

Objectives

- Develop a database of prevalence and epidemiology of *Cryptosporidium*.
- Establish two repositories of reference material for *Cryptosporidium*.
- Plan future common research on *Cryptosporidium*.

The existence of multiple transmission routes, including consumption of contaminated water, and the difficulties in identifying the different species using conventional criteria has made the epidemiology of human infection difficult to unravel.

Principal methods

- Database construction and analysis
- Bioinformatics

Achievements

- A dedicated website (see www.cryptosporidium.it) delivering timely and robust scientific information on *Cryptosporidium* and its importance at the European level along with technical information on the methodologies of choice for the detection and control of cryptosporidiosis.
- Development of strategies for harmonization of methods, particularly molecular methods, for the detection and identification of *Cryptosporidium* (ZoopNet).

Benefits to stakeholders

- Repositories established at two participating institutes to collect, characterize and distribute *Cryptosporidium* reference material to relevant partners.
- Establishment of a European research network representing 10 institutes from eight different countries focused on *Cryptosporidium* and providing opportunities for training and a source of expert advice.
- Public availability of a dedicated *Cryptosporidium* website (www.cryptosporidium.it).

Workpackage 13: Integrating risk assessment, epidemiology and economics to support decision making in food safety

WP Leader	Arie HAVELAAR	**Name and Address**	National Institute for Public Health and the Environment (RIVM), PO Box 1, 3720 BA Bilthoven, THE NETHERLANDS
Project Start date	1 September 2004	**Project End date**	1 March 2006

Aim

Develop an integrated scientific approach, combining veterinary and medical epidemiology; risk assessment for the farm-to-fork food chain; as well as agricultural and health economy, to assist decision-making on food safety at the European level.

Project background and relevance

Decision-making on food safety regulations involves consideration of a wide range of concerns including the health impact of food-borne illness, the economic importance of the agricultural sector and the related industry, and the perception of stakeholders such as farmers, industry and consumers of risks and interventions. Which of these concerns dominates the decision in a particular case is difficult to predict because a structured framework for decision-making is currently not available.

The aim of the Workpackage 13 review was to examine how an integrated approach, based on epidemiology, risk assessment and economics, could support food safety decision-making on microbial hazards. To that end, the review looked at the process of scientific advice to food safety risk managers and the critical scientific questions within the three disciplines that should be addressed in order to provide better support for decision-making. Questions were asked about the specific areas in which scientific methods should be developed and which data should be obtained in order to answer crucial risk management questions, and to what extent data, models or results obtained in one country could be transferred to other countries or to the European community as a whole.

Through the review, recommendations for improved interaction between scientists and decision makers in the field of food safety were made, and research questions that could promote integration of the fields and facilitate the development of more comprehensive models of the efficiency of food safety interventions were identified. The workpackage also aimed to identify the most important data gaps and suggest ways to address those priority needs, including recommendations on continuous surveillance and focused studies.

The approach focused solely on existing public health problems and not emerging infections or signals from the food safety system, such as the emergence of antibiotic resistant organisms, as there is not yet a measurable disease incidence.

Objectives

- Provide an estimate of the disease burden and cost of illness of (selected) food-borne zoonoses in (selected) European Union countries.
- Evaluate the effectiveness and efficiency of selected interventions to reduce food-borne zoonoses in Europe.
- Compare different methods for the economic evaluation of food safety regulations.
- Integrate risk assessment, epidemiology and economics for food safety activities.

Principal methods

- Information analysis.
- Collation and use of standardized metrics on incidence and severity of food-borne illness, for example, disability adjusted life years, and quality adjusted life years.

Decision-making on food safety regulations involves consideration of a wide range of concerns and the perception of stakeholders such as farmers.

Achievements

- Delivery of a report, 'Towards an integrated approach in supporting microbiological food safety decisions'.
- Recommendations to decision makers on how epidemiology, risk assessment and economic evaluation can be used to support decision-making in all stages of the policy cycle.
- Successful submission of a new Med-Vet-Net scientific workpackage on prioritization of zoonoses.

Benefits to stakeholders

- A report, 'Towards an integrated approach in supporting microbiological food safety decisions', of interest to scientists in Med-Vet-Net and in other institutes in related fields, and to risk managers at both the national and the European level.
- Creation of a multi-disciplinary European network of food safety scientists with an integrated understanding of risk assessment, epidemiology and economics.

Workpackage 14: Pre-harvest Microbiological Risk Assessment

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Project Start date	1 September 2004	**Project End date**	1 March 2006

Aim

- Catalogue existing pre-harvest models and evaluate the applicability of the various modelling methods already applied in a wide range of disciplines for pre-harvest risk assessments.
- Define pre-harvest model pathways for major food-animal productions in Europe.
- Assess data availability for parameter estimation, determine data requirements for specific pre-harvest processes and link pre-harvest risk assessment and economic modelling.

Project background and relevance

Risk analysis has been used for decades to support decisions in areas of major uncertainty such as in engineering (for example nuclear power plants, chemical and construction industries); management; and finance (for example project management, stock market, and insurance). More recently, risk analysis in food safety issues has taken an increasingly important role.

Currently, risk analysis is widely recognised as the fundamental methodology that should support the development of food safety standards. Traditionally, food safety risk assessment has been developed in respect of chemical hazards but it is increasingly applied to assess microbiological hazards with Quantitative Microbiological Risk Assessment (QMRA) becoming an internationally recognised concept and tool to evaluate food related health risks.

Risk assessments may be initiated for various purposes such as estimating risks and changes in risks resulting from management interventions; risk ranking for setting priorities; guiding future research to fill data gaps; and improving our understanding of complex systems. Although approaches have been used to model a range of pathogen-commodity combinations and slaughterhouse procedures, examples of pre-harvest QMRA are sparse.

Although approaches have been used to model a range of pathogen-commodity combinations and slaughterhouse procedures, examples of pre-harvest QMRA are sparse.

This is likely due to a lack of data and modelling techniques that can account for the complexity of non-linear processes and numerous possible interactions, a variety of management procedures, and production forms and traditions that occur in primary production.

The newly established risk assessment community is in agreement that 'farm-to-fork' models are a valuable tool to evaluate alternative risk management interventions along the food chain, but few assessments have included the farm phase in great detail, creating a pressing need to evaluate the various methods that might be useful to modelling primary production processes and their strengths and weaknesses.

Workpackage 14 aimed to catalogue the current expertise of pre-harvest risk modelling in Europe, and identify knowledge gaps that may require a collaborative research effort between partner institutes and disciplines in the future.

Objectives

- Establish pre-requisites for pre-harvest microbiological risk assessment (MRA) models.
- Catalogue existing or ongoing work on pre-harvest MRA.
- Develop interactive and multidisciplinary approaches for pre-harvest MRA.
- Test the developed methods through specific case-studies.

Principal methods

- Data collection and analysis
- Method evaluation
- Assessment of data availability for parameter estimation, pre-harvest risk assessment, and economic modelling

Achievements

- An inventory of existing pre-harvest risk assessments and available data for future risk assessments.
- An evaluation of modelling techniques and approaches for pre-harvest microbial risk assessment.
- Report on model pathways and data requirements for microbial risk assessment of major animal production types in Europe.
- Report on economic modelling and pre-harvest microbial risk assessment.

Benefits to stakeholders

A European network of scientists has been created with expertise in risk assessment in the pre-harvest phase of food-animal production and using interdisciplinary approaches including epidemiology and economics.

Workpackage 21: Molecular epidemiology of *Salmonella* Genomic Island 1 (SGI1)

WP Leader	Dik J. MEVIUS	**Name and Address**	Central Veterinary Institute (CVI), PO Box 2004, 8203 AA Lelystad, THE NETHERLANDS
Project Start date	1 March 2006	**Project End date**	31 October 2009

Aim

Study the distribution and characteristics of SGI1 in enteric bacteria, particularly *Salmonella*, *Shigella* and *Escherichia coli* in a large collection of animal and human isolates.

Project background and relevance

SGI1 has been recently detected in other, epidemic *Salmonella* serovars than the pandemic *S.* Typhimurium DT104, indicating a relationship between potentially enhanced virulence and multi-drug resistance and the presence of this gene cluster. Because SGI1 seems to spread horizontally it poses a public health risk to the future treatment of salmonella infections. Therefore, a study for the distribution and prevalence of enteric isolates harbouring this gene cluster or parts of it, is of particular relevance.

The results of this project show the importance of SGI1 in multi-drug resistant salmonella serovars. The island was predominantly present in *Salmonella* Typhimurium, but evidence of spread to other serovars was demonstrated. Studies on virulence of isolates with SGI1, and on those where the island was removed, indicate a clear relationship between the island and virulence.

Med-Vet-Net's research activity has generated a strong network of European research centres on the topic of multi-drug resistant *Enterobacteriaceae*, resulting in numerous collaborations and a new EU-funded project on a related topic.

Objectives

- Establish a database of strains harbouring (parts of) SGI1, which will become the basis for future virulotyping studies.
- Develop molecular tools to analyse SGI1.
- Study the overall resistance characteristics of SGI1-positive isolates from the database.
- Study the mobility of SGI1.
- Study the virulence of isolates associated with SGI1, in collaboration with Workpackage 26.
- Link with the virulotyping project (Workpackage 26) to include isolates from SGI1 in the analysis.
- Establish durable collaboration on the molecular epidemiology of multi-drug resistant (MDR) *Enterobacteriaceae*.
- Promote training activities aimed at the development and use of molecular techniques for the study of MDR *Enterobacteriaceae*.

Principal methods

- Antimicrobial susceptibility testing
- Phage typing
- Pulsed field gel electrophoresis
- Polymerase chain reaction (PCR), and real-time PCR
- Restriction fragment length polymorphism
- Southern blotting
- Sequencing
- Integron typing
- Amplicon mapping (new method)
- *In vitro* and *in vivo* virulence testing
- Gel based fingerprinting using High Resolution Melting analysis (new method)
- Bioinformatics

Achievements

- Successful joint workpackage workshop with WP29 on molecular epidemiology of SGI1 and MDR *Enterobacteriaceae*.
- New methods for identification and characterization of SGI1.
- Demonstration of the association between SGI1 and virulence.
- Durable integration of research aimed at MDR strains.
- Approval of direct spin-off project involving four Workpackage 21 partners — the EU SAFEFOOD-ERA project, 'The role of commensal microflora of animals in the transmission of extended spectrum beta-lactamases', which commenced in September 2009.

Benefits to stakeholders

- New methods developed for identification and characterization of SGI1.
- Well-characterized strain collection with SGI1 and variants, virulence, resistance genes and plasmids, together with a readily-available database of strain characteristics.

Workpackage 22: Zoonotic Protozoa network (ZoopNet) – *Cryptosporidium* and *Giardia*

WP Leader	Simone M. CACCIÒ	**Name and Address**	Istituto Superiore di Sanità (ISS), Department of Infectious, Parasitic and Immunomediated Diseases, Viale Regina Elena 299, 00161 Rome, ITALY
Project Start date	1 March 2006	**Project End date**	31 October 2009

Aim

Implement expertise on the detection and control of *Cryptosporidium* and *Giardia* at the European level.

Project background and relevance

The epidemiology of human infection for *Cryptosporidium* and *Giardia* is complex, and the relative roles of the anthroponotic, zoonotic and environmental routes of transmission need to be understood in order to implement control measures. The economic losses caused by these infections remain considerable, particularly because of the significant mortality and morbidity they cause in young animals. In humans, risk categories include the young and, for *Cryptosporidium*, all immuno-compromised individuals.

The low infective dose and the capability of these pathogens to survive for weeks or even months in the aquatic environment account for the large number of water-borne outbreaks, which have been linked, in many European countries, to the consumption of drinking water or to exposure to surface or recreational waters. As the lack of morphologic differences among strains precludes differentiation of human from non-human strains by microscopy, the source of contamination in both sporadic and outbreak cases often remains unknown. Indeed, only some species and genotypes of *Cryptosporidium* and *Giardia* cause infection in humans, whereas many other members of these two genera only infect animals.

A reliable discrimination of the pathogens can only be obtained through their genetic characterization. However, the lack of standardized methods, reference materials and dedicated resources for data storage and analysis hampers the comparison of data from different laboratories, and the establishment of an unequivocal approach to trace back the infection from fork-to-farm. To address these issues, ZoopNet developed a common polymerase chain reaction (PCR)-based platform for the detection and identification of the parasites, and a database for the storage and analyses of epidemiologic and DNA sequence data collected across Europe. The results confirmed the complex picture of the infections, underlined the necessity to integrate data from public and animal health institutes, and pointed to the need to develop more sensitive detection methods, such as microarrays and real-time PCR, which can be more easily incorporated into a molecular platform that allows a simultaneous detection of multiple pathogens from defined animal or environmental origin.

Objectives

- Develop harmonized methods for the molecular detection of *Cryptosporidium* and *Giardia*.
- Collect and produce reference material.
- Perform validation studies aimed at distributing methods across laboratories.
- Collect and genotype *Cryptosporidium* and *Giardia* isolates from humans and animals.
- Develop online resources to store and share data.

Principal methods

- Ring trials
- Restriction fragment length polymorphism
- PCR
- Real-time PCR (quantitative PCR)
- DNA sequence analysis

Achievements

- Two repositories of reference material including frozen aliquots of *Cryptosporidium* oocysts and *Giardia* cysts, aliquots of nucleic acids extracted from isolates of human and animal origin, and frozen aliquots of plasmids carrying specific parasite sequences.
- Harmonized PCR-based methods for the detection of *Cryptosporidium* and *Giardia* implemented in the participating laboratories through validation studies. At least two targets, one to detect species and one to detect genotypes, were tested and are now routinely used.
- A common platform developed for the PCR-based identification of species and genotypes of human and animal relevance.
- Epidemiologic DNA sequence data collected, on a voluntary basis, from Med-Vet-Net countries and external research groups.
- Development of dynamic online database containing DNA sequences and genotype data linked to epidemiological data. The database is unique because it is not based on representative sequences but contains population genetics data for both *Cryptosporidium* and *Giardia*.

Benefits to stakeholders

- Harmonized schemes for monitoring and reporting of *Cryptosporidium* and *Giardia*.
- Availability of reference samples: organisms, nucleic acids, plasmids carrying specific sequences.
- Establishment of a European network of public and veterinary health institutions, thereby improving communication between international institutes, and providing a critical mass of European scientists working on *Cryptosporidium* and *Giardia*.

Workpackage 23: Prioritizing food-borne and zoonotic hazards at the EU level

WP Leader	Arie HAVELAAR	**Name and Address**	National Institute for Public Health and the Environment (RIVM), PO Box 1, 3720 BA Bilthoven, THE NETHERLANDS
Project Start date	1 March 2006	**Project End date**	31 October 2009

Aim

Develop strategies and models to provide stepwise and transparent approaches to estimating priorities in a number of zoonotic diseases at the European level, with the model based on the (actual or expected) disease burden and cost of illness.

Project background and relevance

At the strategic meeting of thematic representatives in the Med-Vet-Net project in 2004, a need was expressed to develop methods for priority setting of existing and emerging food-borne and zoonotic pathogens to provide an objective basis for decisions on future projects. Such methods are also more generally useful to support decision making on zoonoses research and control.

This workpackage was based on methods developed by the National Institute for Public Health and the Environment in The Netherlands, and included an assessment of the burden of food-borne and zoonotic pathogens expressed in Disability Adjusted Life Years (DALYs), source attribution, assessment of trends in incidence, and an evaluation of the cost-of-illness.

The methods can also be applied at a European scale to help set priorities. Data for evaluating these criteria are continuously collected in all European member states but the comprehensiveness and representativeness varies considerably. As such, it is important to design new strategies to improve the availability of validated data on disease incidence in Europe.

Objectives

- Agree on the criteria and methods for priority setting of food-borne and zoonotic hazards, including emerging and re-emerging pathogens.
- Collect and evaluate existing data on the incidence, health outcomes and costs of food-borne and zoonotic illness.
- Produce a preliminary estimate of the current disease burden and cost of illness of selected food-borne and zoonotic pathogens in Europe.
- Identify the major uncertainties in the data used to produce these disease estimates.
- Develop recommendations for future studies and prepare projects for additional funding.

Principal methods

- Outcome trees for pathogens of interest
- Assessment of disease burden based on disability adjusted life years
- Incidence reconstruction tool to modulate the surveillance pyramid of infectious intestinal disease
- Data tables to calculate burden of disease
- Telephone surveys

Achievements

- Joint international conference with Workpackage 28 and the US Food Safety Research Consortium on 'Priority setting of food-borne and zoonotic pathogens'. A summary report is available from the Med-Vet-Net website (see www.medvetnet.org/pdf/Reports/Report_07-001.pdf).
- Report 'Methodological choices for calculating the disease burden and cost-of-Illness of food-borne zoonoses in European countries' has been adopted and is publicly available (see www.medvetnet.org/pdf/Reports/Report_07-002.pdf).
- Telephone survey based on the Second Study of Infectious Intestinal Disease in the Community set-up in four countries — Denmark, Germany, Poland, Italy. Country-specific interim reports have been prepared.
- Calculation tool to estimate DALYs of infectious intestinal disease developed and integrated into the modelling tool to reconstruct the surveillance pyramid. Preliminary results for seven bacterial pathogens in eight European countries were obtained.
- Workshop on 'Disease burden and sero-surveillance of food-borne pathogens in the EU' jointly held with Workpackage 32 with participants from the European Centre for Disease Prevention and Control (ECDC), the World Health Organization's (WHO) Food-borne Disease Burden Epidemiology Reference Group, and the USA's Center for Disease Control and Prevention (CDC) contributing views on Europe's future research needs.

Benefits to stakeholders

- The developed incidence reconstruction tool that enables current estimates of the DALYs of infectious intestinal disease will help to fulfil the need expressed by the ECDC and EU member states for better estimates of the burden of communicable disease for planning and prioritizing.
- Results of the telephone surveys may be used to address under-reporting of infectious intestinal diseases to national surveillance systems, and will also help to compare differences in reported incidence between member states.
- WHO and CDC have expressed interest in using the developed outcome trees for their burden of disease estimates.
- A training course, 'Reconstructing the surveillance pyramid and assessing the burden of food-borne disease', held for interested parties.

Workpackage 24: Comparison of *Campylobacter* risk assessment models: Towards a European consensus model?

WP Leader	Maarten NAUTA	**Name and Address**	National Institute for Public Health and the Environment (RIVM), PO Box 1, 3720 BA Bilthoven, THE NETHERLANDS
Project Start date	1 March 2006	**Project End date**	31 October 2009

Aim

Build a consensus framework for risk assessment of *Campylobacter* in broiler meat to support countries with limited experience in risk modelling, and to further aid harmonization of European risk assessment.

Project background and relevance

Over the past decade, microbiological risk assessment (MRA) has developed into an important tool for food safety control. *Campylobacter* is the most commonly reported gastrointestinal bacterial pathogen in Europe, and *Campylobacter* on broiler meat is one of the food-pathogen combinations for which several different MRAs have been performed worldwide.

In Workpackage 24, risk assessors who developed four different European *Campylobacter* MRAs, collaborated to compare existing models and discuss the feasibility of constructing a single European consensus model, resulting in the development of the *Campylobacter* Risk Assessment Framework (CRAF).

CRAF was implemented as a web tool offering a dynamic model catalogue of five existing *Campylobacter* MRAs for risk assessors aiming to develop their own models. CRAF is available on the internet, supports the development of MRA, and is a significant step forward from separate, regional MRAs to a harmonized European approach. Furthermore, it may set a standard for providing easy access to MRAs performed around the world.

The workpackage outcomes also emphasise MRA's added value as an integrated food chain approach for food safety control that can be used to assess the effects of control measures at different stages of the chain in a uniform, transparent way. European risk managers can benefit from the shared conclusions that the prevalence of false negative flocks is expected to be high, that logistic slaughter for *Campylobacter* to prevent cross-contamination between flocks has minimal impact on human health risks, and that targeting meat products with high *Campylobacter* concentrations on meat is expected to be more effective than targeting prevalences.

With free trade in the EU, the effectiveness of national control measures taken at primary production or during industrial processing is limited because the *Campylobacter* contamination of meat from other member states is not affected by such control measures. It requires European level MRA to adequately evaluate the effects of control measures throughout the Union, and to evaluate the impact of setting uniform risk based targets. The results of this project show what challenges have to be met before such a European MRA can be established, but CRAF could be a valuable tool for that purpose.

Objectives

- Exchange modelling experiences and compare existing risk assessment models related to *Campylobacter* in broiler meat.
- Publish a review paper on the comparison of models and the feasibility of a European consensus model for *Campylobacter* risk assessment.
- Discuss the possibility and desirability of developing a software package for a European consensus model that can be used as a harmonized European decision tool to support campylobacteriosis risk management.
- Prepare a catalogue with relevant data applied in the risk assessments available to date.
- Develop plans for research required to harmonize and improve risk assessment of *Campylobacter* in Europe.
- Develop a European consensus framework for risk assessment of *Campylobacter* in broiler meat that will provide risk assessors easy access to existing models.

Principal methods

- Modelling analysis
- Risk assessment analysis
- Software development and application

Achievements

- Two public scientific meetings on *Campylobacter* risk assessment.
- Five expert group meetings for in depth analysis of existing models and development of ideas for the harmonization of models.
- Review paper on the comparison of European *Campylobacter* risk assessments.
- Composition of a data catalogue relevant for risk assessment of *Campylobacter* in broiler meat.
- Development of the *Campylobacter* Risk Assessment Framework (CRAF), a dynamic model catalogue for risk assessors, publicly available on the internet.
- CRAF training course and workshop.
- Submission of joint research proposal with America's Joint Institute for Food Safety and Applied Nutrition to the US National Institute of Food and Agriculture.

Benefits to stakeholders

- Bringing together European risk assessment specialists to compare existing models and develop risk assessment methodologies contributes to the development of an EU consensus approach for *Campylobacter* control.
- Outputs are directly beneficial to any European *Campylobacter* risk assessment assignment, thus contributing to European food safety risk management.
- The CRAF tool offers significant help to risk assessors. It sets an example for similar tools to be developed for other food-pathogen combinations, which may bring international food safety risk management one step further, enhancing food safety control in Europe.

Workpackage 25: Development and application of improved diagnostics for Q-fever

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Project Start date	1 March 2006	**Project End date**	31 October 2009

Aim

Improve understanding of the epidemiology of Q-fever in Europe by the development and application of improved diagnostics for the causative organism, *Coxiella burnetii*.

Project background and relevance

Coxiella burnetii is the causative agent of Q-fever, a worldwide but well-recognized neglected zoonoses, and a potential biological weapon. Its epidemiology in Europe is largely unknown and European expertise in Q-fever is sparse. There is no EU-based surveillance mechanism and the little surveillance undertaken is primarily outbreak associated. Thus, existing data tends to be localized and poorly harmonized. Ruminants are considered the main reservoir as they shed bacteria through placenta, milk and faeces, emphasising the need for rapid diagnostic methods of the disease in livestock and the environment to limit human contamination.

Serological surveillance of animal disease was based on complement fixation test (CFT), which have limited sensitivity and specificity. Now, in-house or commercially indirect immunofluorescent assay (IFA) and enzyme-linked immunosorbant assays (ELISAs) are available, but their relative performance needed to be assessed in terms of sensitivity and specificity, in order to attain harmonization between EU member states. Similarly in human medicine, serological tests, including ELISA, had to be standardized and assessed in reference to IFA, which is considered the gold standard and method of choice for detection of Q-fever in humans.

Despite their usefulness, serological methods do not provide data about the excretion status of the animals. As such molecular techniques are widely used due to the difficulty of isolation of the agent with cell culture. Indeed, polymerase chain reaction (PCR) assays using primers specific to *C. burnetii* allow a simple and reliable detection of this bacterium in a variety of samples. There is also a lack in harmonization and data on surveillance throughout Europe.

The implementation and application of typing methods, such as multi-locus variable number of tandem repeat analysis (MLVA), multi-spacer sequence typing (MST) and random amplification of polymorphic DNA (RAPD), proved another important challenge for the workpackage. These methods were successfully used for the typing of several strains and samples from different partner countries including The Netherlands, Poland and France, resulting in recommendations for best practice in typing of *C. burnetii*.

Workpackage 25 also successfully isolated new *C. burnetii* strains, which will enable more fundamental studies, such as investigations of their virulence or their sensitivity to antibiotics.

Objectives

Improve understanding of the epidemiology of Q-Fever in Europe as follows:

- Organize ring trials of detection and diagnosis methods including PCR and serology.
- Organize ring trials of PCR-based typing methods.
- Compare the sensitivity and specificity of serologic diagnosis methods in humans, and in animals.
- Compare PCR detection methods.
- Develop, evaluate and apply typing methods.
- Organize a workshop on PCR-based methods and genotyping of *C. burnetii*.
- Establish a critical mass of expertise and dissemination of knowledge through publications and participation in conferences.
- Isolate new *C. burnetii* strains.
- Promote exchange of data, materials and staff members between partner institutes.
- Promote collaborations beyond Med-Vet-Net by responding to different proposal calls.

Principal methods

- Serology using CFT, IFA and ELISAs
- PCR
- MLVA
- MST
- RAPD
- Bioinformatics

Achievements

- Survey of available data on current methodologies used and isolates, DNA and sera in partner laboratories.
- Review of molecular typing of *C. burnetti*.
- Description of RAPD for the discrimination of *C. burnetii* strains.
- Improvements in understanding the molecular epidemiology of *C. burnetii* infections following development and use of MST typing.
- Comparison of typing methods used on *C. burnetii*.
- Best practice recommendations for serologic diagnosis of *C. burnetii*.
- Recommendations for best practice for PCR detection of *C. burnetii*.

Benefits to stakeholders

- Improvement of technical capabilities for detection, diagnosis and typing of *C. burnetii*, both in humans and livestock, enabling more efficient detection of *C. burnetii*. This means:
  - treatments for people could start quickly
  - the source of contaminations could be easily identified
  - control strategies could be implemented.
- Improvement of data sharing between public health institutions and veterinary health partners resulting in:
  - case reporting, which would be made known across sectors
  - enhanced collaborations leading to better control of the disease at different levels.

Workpackage 26: Virulotyping of new and emerging *Salmonella* and VTEC

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Project Start date	1 March 2006	**Project End date**	31 October 2009

Aim

Gather genetic data from participating institutes relating to specific virulence determinants in order to determine their distribution in *Salmonella* and *Escherichia coli* within Europe; harmonize data sets; exploit such data by devising appropriate platforms for rapid analysis in routine diagnosis (for example, microarray type).

Project background and relevance

The project aimed to evoke collaboration and harmonize research in the area of host-pathogen interactions within Europe. Risk assessors and risk managers within the European Food Safety Authority, the European Commission and EU member states have identified a need for further harmonization of research activities. With the development of national control plans and the implementation of community reference laboratories across Europe it has become of paramount importance that research undertaken is of a comparable standard and meets the objectives of all stakeholders.

This project also aimed to address the issues arising with regard to new and emerging zoonotic pathogens, and the emergence of antimicrobial resistance and how this may affect pathogen fitness.

Objectives

- Establish a core group of institutes with expertise in polymerase chain reaction (PCR) and microarray areas.
- Link with Med-Vet-Net's *Salmonella* Genomic Island 1 (SGI1) project (Workpackage 21) and include isolates from SGI1.
- Evaluate array platforms that are in development for future applications in rapid molecular detection and diagnosis of enteric pathogens in the food chain.
- Identify suitable methods for data analysis and collate generated data into a database.
- Identify gaps within the virulotype database that could be exploited in future studies within Med-Vet-Net.
- Perform targeted and functional virulotyping of VTEC and atypical *E. coli* O157:H7.
- Study the effect of specific mutations on the *Salmonella* virulence plasmid and pathogenicity islands using a day-old chick model.
- Identify differences at the genomic level to define the virulence genes for VTEC pathogenic to humans.
- Develop PCR tools for Stx2-converting phage typing.
- Identify possible virulence predictors for the early detection of VTEC of public health significance.
- Perform specific virulence arrays on an extended subset of *Salmonella* isolates in order to study pathogenicity and epidemiology.
- Perform analyses of generated data and undertake ad hoc analysis of the micro and nano array analysis on selected VTEC and *Salmonella* isolates.

Principal methods

- PCR, Long PCR
- Microarray analysis (comparative genomic hybridization microarray)
- Virulotyping
- Cluster analysis
- Construction of knockout mutants
- Vero cell assays
- Sequence analysis
- Bioinformatics and database construction

Achievements

- Five successful workshops, including one on virulotyping of *E. coli* and *Salmonella*, held in three different EU countries.
- Development of virulotyping platforms across partner institutes in Europe, for routine diagnostic use for *Salmonella* and *E. coli*.
- Possible virulence predictors for VTEC of significant public health impact identified.
- Comparison of OI genes present in the top non-O157 VTEC serotypes compared to those found in VTEC O157.
- Microarray comparison of VTEC seropathotypes B, C, and D, with seropathotype A (O157).
- Collection and virulotyping by PCR of 1 021 *E. coli* and *Salmonella* isolates, using a harmonized and standardized set of PCRs for virulence-associated genes.
- Comparative virulotyping analysis across partner institutes in Europe, of *Salmonella*, atypical O157 and VTEC.
- Long PCR protocol for stx2-converting phage typing developed.
- Eight short-term missions facilitated.
- Database specifically developed and PCR data curated.
- Criteria established for the selection of isolates for microarray.

Benefits to stakeholders

- Provision of rapid diagnostic capabilities through the use of virulotyping platforms.
- Increased collaboration between European institutes in the host-microbe interaction field.
- Online availability of information for stakeholders, and a database of facilities and expertise on Med-Vet-Net website.
- Expert group in the area of host-pathogen interactions established.

Workpackage 27: Harmonization of *Trichinella* infection control methods, quantitative risk assessment in pigs and an early diagnosis in humans to increase treatment efficacy (TrichiMed)

WP Leader	Pascal BOIREAU	**Name and Address**	French Food Safety Agency (AFSSA) – LERPAZ, 23 avenue du Général de Gaulle, 94700 Maisons-Alfort, FRANCE
Project Start date	1 March 2006	**Project End date**	31 October 2009

Aim

To develop methods for the control of *Trichinella* infection in Europe, focusing on three major areas: human surveillance, veterinary control and risk assessment.

Project background and relevance

Since its inception, the TrichiNet consortium, which was established by Med-Vet-Net and the earlier TrichiPorse project, has expanded to include scientists from China, Canada and the newly acceded EU states, which have serious Trichinellosis contamination. And its impact over the past three years, demonstrated by the numerous presentations in international conferences, has been significant.

Med-Vet-Net, through TrichiNet, enabled the focused study of *Trichinella* epidemiology in poorly investigated areas, particularly the newly associated EU states and candidate countries. Those studies described the higher prevalence and consequence in human health; demonstrated the presence of sylvatic *Trichinella* in domestic pigs in different areas and identified and analysed emergences of *Trichinella*.

Objectives

To enhance the control of *Trichinella* infection in Europe as follows:

- Harmonize veterinary control methods.
- Compare and improve existing tools for *Trichinella* diagnosis.
- Validate a molecular typing method as a tool for *Trichinella* identification.
- Develop a method for the detection of *Trichinella* DNA from faeces.

Principal methods

- Serological methods (Western blot, ELISA, indirect ELISA)
- Polymerase chain reaction (PCR) including nested PCR, real-time PCR, Multiplex-PCR
- Microsatellite analysis
- Variable Number Tandem Repeat
- Risk assessment
- Geographic information system mapping
- Ring trials
- Bioinformatics

Achievements

- Harmonization of veterinary control methods and treatment of trichinellosis in humans at the European level with new technologies — ring trial, gold standard for direct tests, reference serum and material.
- Development of harmonized schemes for monitoring and reporting of *Trichinella* in animals and foodstuffs in the EU.
- Transcriptomic analysis of the physiology of *Trichinella* at the major antigenic stages of the parasite using the cDNA libraries already established.
- Various indirect and direct methods have been developed and/or improved (Excretory/Secretory ELISA, recombinant early antigen of *Trichinella*, digestion method and PCR from faecal material), which will improve detection of the parasite.
- Genetic markers at the larva level have been identified, which will become useful for tracing back *Trichinella* infections.
- A central repository of reference material produced by the workpackage has been established, thereby providing fully characterized reference samples both to Med-Vet-Net scientists and researchers around the world.
- Various maps based on epidemiological data on humans and animals have been established for EU and associated countries, and dose response studies performed to understand the infectivity and persistence of the parasite on a model rat.

Benefits to stakeholders

- Publication of epidemiological data obtained in numerous European countries.
- TrichiNet participation in an EFSA expert zoonoses report.
- Production of reference samples and gold standards such as European *Trichinella* strains: infective larvae, nucleic acids, antigens for national reference laboratories and routine laboratories.
- Contribution to implementation of EU legislation regarding the use of new pepsin form and determination of sensitivity for the direct test.
- Publication of guidelines to perform *Trichinella* typing and sample sending, and a standard for *Trichinella* genotyping.
- The improvement of diagnosis methods of trichinellosis in pigs has a direct impact on consumer health by enabling the production and distribution of safe pork on the EU market.
- The improvement of the diagnosis methods also has a net economic impact, as *Trichinella* is one of the most costly of all parasitic zoonoses in EU.
- Farming improvement in endemic areas will eliminate a high number of infected carcasses with a decrease of the *Trichinella* biomass both at the farm level and among wildlife.

Workpackage 28: Methods of attributing human *Salmonella* and *Campylobacter* infections with different animals, food and environmental sources

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Project Start date	1 March 2006	**Project End date**	31 October 2009

Aim

Attribute human zoonotic infections to the responsible sources in order to identify and prioritize effective food safety interventions.

Project background and relevance

To prioritize food safety interventions and evaluate the effectiveness of implemented control programs, it is essential to identify the most important sources of human illness and estimate the relative contribution of each source. A variety of source attribution methods are available, but thus far few countries have made efforts to attribute human food-borne illness to the responsible sources. Additionally, estimates from a country or region should be interpreted in light of the local risk management policies in place and the pathogens' epidemiology in that specific country. Extrapolation of source attribution methods and results from one country to others is further complicated in the absence of standardized data collection and methods.

In this project, four different approaches for source attribution were developed and applied for two different pathogens, in different settings and populations. Methods were compared and discussed, and recommendations on how to choose the appropriate source attribution method to address different public health questions were presented. Approaches can be easily adapted to data from other countries or regions. The developed methods also proved useful in the presence of variable amounts and quality of data, making them suitable for a wide application in different countries throughout the world.

The workpackage's outputs are useful and relevant in the context of European research on food-borne diseases, particularly food-borne zoonoses, and will contribute significantly to the evaluation and adjustment of mitigation strategies by enabling new data becoming regularly available to be incorporated.

Objectives

- Estimate the number and/or proportion of human *Salmonella* and *Campylobacter* infections attributable to various food sources using four different approaches: microbial subtyping; comparative exposure assessment; systematic review of case-control studies; and analysis of data from outbreak investigations.
- Compare and discuss the results obtained using the four different approaches.
- Formulate recommendations on the best and most versatile approach, taking into consideration data requirements, data availability, pathogen characteristics and requested public health interventions.
- Formulate recommendations on how the results can be used for prioritizing sources for control in the risk management process.

Principal methods

- Source attribution analysis based on microbial subtyping, comparative exposure assessment, analysis of studies of sporadic infections, data from outbreak investigations, and systematic review.
- Development and use of "source attribution toolbox".

Achievements

- Development of a three-dimension Bayesian model for the attribution of human salmonellosis to specific sources, and the estimation of the public health impact of different salmonella subtypes.
- Systematic review of case-control studies of sporadic salmonellosis and campylobacteriosis.
- The identification and prioritization of appropriate interventions in the farm to consumption continuum, as well as the evaluation of the effectiveness of already implemented control measures.
- Production of a toolbox for source attribution that guides risk managers and researchers in the process of choosing the appropriate method to attribute human illness to the responsible sources on the basis of the pathogen of interest, data availability, and the advantages, limitations and characteristics of the method, which influence its ability to answer the question.
- Review paper produced on harmonized concepts, definitions and methods utilized for the attribution of human illness to specific sources.
- Completion of a PhD thesis entitled 'Attributing human salmonellosis and campylobacteriosis to food, animal and environmental sources'.

Benefits to stakeholders

- The European Food Safety Authority, the European Commission and EU member states have expressed a need for better understanding of the main sources and pathways of food-borne infection, which this project has helped to fulfil.
- Source attribution estimates assist the identification and prioritization of appropriate interventions in the farm to consumption continuum, and the evaluation of the effectiveness of implemented control measures.
- The source attribution toolbox is available to assist risk managers and researchers in the process of choosing the appropriate method to attribute human illness to the responsible sources.
- Transparent science-oriented decision tools will be beneficial to stakeholder compliance on implementation and adjustment of selected mitigation strategies.

Workpackage 29: Surveillance of emerging antimicrobial resistance critical for humans in food, environment, animals and man

WP Leader	Bruno GONZÁLEZ-ZORN	**Name and Address**	Universidad Complutense de Madrid (UCM), Departamento de Sanidad Animal Facultad de Veterinaria, Avda. Puerta de Hierro s/n, 28040-Madrid, SPAIN
Project Start date	1 March 2006	**Project End date**	31 October 2009

Aim

Analyse bacterial collections throughout Med-Vet-Net for emerging and existing antimicrobial profiles focusing on emerging antimicrobial resistance determinants, which pose a high risk of spreading between humans and animals through bacterial populations and/or genetic transfer and to respond to and focus on antimicrobial resistance determinant of importance.

Project background and relevance

Antimicrobials are the molecules used against infections caused by bacteria in animals and humans. With alarming frequency, bacteria are becoming resistant to the antimicrobial molecules, even to those of last resort. Thus, antimicrobial resistance remains a milestone in the battle against infectious diseases in the developed world. The Med-Vet-Net partnership provided a unique opportunity for collaborative research on human and veterinary infectious diseases. In particular, the Network had access to bacterial strains isolated from all sources along the food chain, including animals, man, and the intermediate niches, environment and food. The bacteria isolated from these four reservoirs need to be investigated together as a pool of microorganisms that share genetic information giving them the evolutionary advantage that facilitates their spread within Europe.

In line with this concept, Workpackage 29 focused on the emergence of antimicrobial resistance determinants in the EU that are of special concern to human health. The current project had the advantage that it united bacteria that had been isolated in different ecological niches, which assisted the determination of the precise mechanisms that are spreading between humans and animals in Europe.

A significant outcome of the project is the continuing collaboration of partners and research groups beyond the formal end of the Med-Vet-Net partnership. Some Med-Vet-Net members are National Reference Laboratories for antimicrobial resistance and collaborate with the Community Reference Laboratory. Others work in the field of human medicine and are participants in the European monitoring programme. Med-Vet-Net was a successful bridge between these networks. In addition, some workpackage partners are also party to proposals for Framework Programme 7 and other European or national funding projects.

Objectives

To focus on the emergence of antimicrobial resistance determinants in the EU that are of special concern to human health, as follows:

- Identify and characterize 16S rRNA methyltransferases conferring high-level aminoglycoside resistance.
- Study fluoroquinolone resistance in *Escherichia coli* of human and animal origin.
- Review, nomenclature and detection of aminoglycoside resistance determinants.
- Diversity study of *tet*(A) in *Salmonella*.
- Identify and characterize:
  - Aminoglycoside-modifying enzymes in *Pseudomonas* and *E. coli*
  - Plasmid-mediated fluoroquinolone resistance in *Salmonella*.

Principal methods

- Antimicrobial susceptibility testing
- Polymerase chain reaction
- Pulsed field gel electrophoresis, restriction fragment length polymorphism (plasmid and chromosome)
- Southern blotting
- Sequencing
- Electroporation
- Transposon mutagenesis
- Bioinformatics

Achievements

- Harmonization of 16S rRNA methylstransferases identification.
- Identification in Poland of human isolates as a major reservoir of 16S rRNA methyltransferases.
- Evidence that animals do not appear to be involved in the spread of 16S rRNA.
- First identification in the EU of the *rmtC* methylstransferase.
- First identification of a 16S rRNA methylsranfersase in a food isolate.
- First identification of *armA* in a food isolate.
- First identification of *qnr* in a *Salmonella* Bredeney animal isolate.
- First identification of a *qnr* gene in *Salmonella* in Spain.
- Identification of *qnrS1* in animal isolates of *E. coli* in Italy.
- Evidence of diversity of *tetA* in salmonellae in Europe.

Benefits to stakeholders

- Major contribution to the awareness of policy makers, general public and other stakeholders of antimicrobial resistance in zoonotic pathogens in Europe.
- Clear demonstration of how medical and veterinary institutions can work together on antimicrobial resistance, which, with few exceptions, was inconceivable before Med-Vet-Net.

Workpackage 30: Towards a combined microbiological and epidemiological approach for investigating host-microbe interactions of *Campylobacter jejuni* — CampyNet III

WP Leader	Thomas ALTER	**Name and Address**	Federal Institute for Risk Assessment (BfR), Diedersdorfer Weg 1, 12277 Berlin, GERMANY
Project Start date	1 March 2006	**Project End date**	31 October 2009

Aim

Complete the outstanding tasks of CampyNet II and extend our knowledge about virulence-related properties of selected CampyNet (CNET) strains.

Project background and relevance

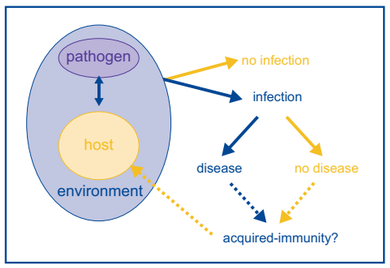
Campylobacter is the most commonly reported gastrointestinal pathogen in humans in the European Union with approximately 200,000 laboratory confirmed cases recorded in member states in 2007. Although strains are highly diverse by phenotypic and molecular typing methods, little is known about diversity in virulence. The host-pathogen interactions of campylobacters, and diversity thereof between subtypes, likewise, are poorly understood, largely resulting from absence of appropriate *in vivo* disease models. This knowledge gap hinders accurate risk assessment for campylobacters in the food chain and the development of relevant intervention strategies.

The CampyNet II project developed standard methods for measuring *in vitro* invasiveness, toxin activity and detection of putative virulence genes on a *C. jejuni* strain set originally collated for phenotypic and genotypic typing harmonization. The application of these virulence detection tools and strain typing methods, however, has not brought the scientific community much closer to understanding human disease epidemiology, which may be due to a too limited strain set under investigation. Alternatively, genotypic typing is unable to group the strains in a way that correlates with virulence. As such, other methods of characterization needed to be explored.

This workpackage built on CampyNet II by working with epidemiologists to match epidemiological requirements for investigating human campylobacteriosis with microbiological and molecular tools for investigating host microbe interactions.

Since CampyNet III was initiated, there have been major advances in the number of available *Campylobacter* genome sequences. Consequently, a clearer understanding of *C. jejuni* population structure has been developed, notably by multi-locus sequence analysis (MLST) in elucidation of allelic markers for host-attribution based on core housekeeping genes, and by pan-genomic analysis using DNA microarrays (genomotyping).

A high density *Campylobacter* pan-genome microarray has been created based on all genes found present in currently available genome sequences, and includes a core set of genes present in all strains as well as many genes found in particular strains only. Additionally, an MLST scheme has been added to the panarray, consisting of tiling probes.



A high density* Campylobacter *pan-genome microarray has been created based on all genes found present in currently available genome sequences.

Objectives

- Apply a pan-genome microarray analysis to perform array comparative genomic hybridization (aCGH) and additional genotyping assays.
- Design a pan-genome microarray to cover the currently known pan-genome of the *Campylobacter* genus, and, after hybridization with selected CNET strains, define a subset of genes with potential virulence predictive value.
- Further characterize CNET strains by applying pan-genome microarray analysis and MLST analyses in conjunction with maintenance of the web database.
- Ensure sustainability of CNET strain sets by providing general access to strains and associated information on strain typing markers, virulence assays, host diseases association, and epidemiology.

Principal methods

- Database construction and analysis
- MLST
- Pan-genome microarray analysis
- aCGH
- Bioinformatics

Achievements

- Inclusion of allelic markers for host attribution into well-characterized *Campylobacter* strain set established and made publicly available.
- Pan-genome microarray analysis on the *Campylobacter* strain set and additional strains performed.
- State-of-the-art review on host-pathogen interactions in *Campylobacter* infections has been published in Clinical Microbioal Reviews summarizing the current understanding of host mechanisms involved in the defence against *Campylobacter*.
- Novel information on virulence characteristics of *Campylobacter* strains in relation to disease in humans.

Benefits to stakeholders

- Well-established CampyNet strain set with details of virulence attributes.

Workpackage 31: Food-producing animals as a potential source of emerging viral zoonoses (ZOOVIRNET)

WP Leader	Franco M. RUGGERI	**Name and Address**	Istituto Superiore di Sanità (ISS), Department of Food safety and Veterinary Public Health, Viale Regina Elena 299, 00161 Rome, ITALY
Project Start date	1 March 2006	**Project End date**	31 October 2009

Aim

Generate knowledge and methodologies on *Hepatitis E virus* (HEV), *Anellovirus*, and *Encephalomyocarditis virus* (EMCV) strains circulating in pigs, and on *Tick-borne encephalitis virus* (TBEV) mainly in relation to goat milk transmission.

The development of intensive farming practices favour the circulation of viral pathogens and contribute to creating new circuits between domestic and wild animals and humans.

Project background and relevance

The medical and veterinary scientific literature is providing regular evidence that zoonotic infections are continually increasing worldwide, and suggests that animal viruses, particularly those containing highly mutating RNA genomes, may represent a significant problem to human health in the coming years. This was recently reinforced by the epidemic diffusion of influenza strains of avian and swine origin, several flavivirus and bunyaviruses. Compared to other pathogenic micro-organisms, RNA viruses can adapt easily to novel hosts, rapidly overwhelm a naive immune system, and spread efficiently through food, water and the environment, taking advantage of their high physical resistance to unfavourable conditions and low infectious dose. The development of intensive farming practices, the global dimension of the animal and food market, international travel and considerable movement of animals, all favour the circulation of viral pathogens and contribute to creating new circuits between domestic and wild animals and humans.

The importance given to zoonotic agents emerges from the European Commission directive on the monitoring of zoonoses, which also specifically encompasses a number of vector-borne or food-borne viruses, such as rabies, influenza, calicivirus, and arboviruses, for which epidemiological role and detection methods are sufficiently consolidated to allow surveillance and control plans in member states.

Based on the scientific literature, the swine viruses investigated by ZOOVIRNET may frequently infect herds around the world but their significance for both human and swine pathology is still largely unknown. For TBEV, its role as a serious vector-borne agent of disease in humans is well established but the significance of animal food product, mainly ovine milk and cheese, as a vehicle of infection deserves more attention. Besides the sometimes largely incomplete knowledge at the disease level in humans and animals of importance for food production, the attention paid to these and other viruses in Europe has been held back by the unavailability of reliable technical methods for sensitive and specific detection and characterization, often worsened by the absence of cell culture systems. This was the impetus for ZOOVIRNET.

Objectives

- Harmonize molecular methods, including real-time and quantitative polymerase chain reaction (PCR) assays, suitable for detection and characterization of these viruses in animals and food.
- Improve knowledge of the epidemiology and zoonotic role of viral pathogens confirmed to be widely present in farm and wild animals and similar to strains found in humans.
- Implement a virus and genome database for HEV.
- Clone and express recombinant HEV and EMCV proteins, and generate immune reagents for virus diagnosis and typing.
- Implement and harmonize serological assays for TBEV, HEV and EMCV in animals, and also through (HEV) ring trials.
- Develop immunocytochemical methods for swine HEV detection in cell cultures or tissues using hyperimmune sera and monoclonal antibodies.
- Implement cell culture systems for *in vitro* replication of swine HEV by combined use of organotypic cell culture, confocal and electron microscopy, immunocytochemical staining, and real-time reverse transcription (RT) PCR methods.

Principal methods

- Reverse transcription PCR, real-time RT-PCR
- Nested PCR
- Immunostaining, confocal, transmission and scanning electron microscopy
- Ring trials
- Bioinformatics

Achievements

- Production of comprehensive set of reagents, reference samples and protocols for HEV, *Anellovirus*, EMCV and TBEV.
- Polyclonal and monoclonal antibodies generated towards HEV and EMCV recombinant proteins.
- Cloning and expression of HEV and EMCV recombinant proteins.
- Development of cell culture methods for swine HEV replication monitored for viral genome and antigen synthesis.
- Development of state-of-the-art molecular diagnostic assays, including real-time PCR, and serological tests with recombinant antigens for the viruses investigated produced.
- Serological data produced on EMCV in swine and TBEV in goats.
- Harmonization of HEV diagnostic procedures between Med-Vet-Net partners.
- Effective integration between several workpackage partners has generated growing multi-lab activity and exchange, and collaboration on new European projects is ongoing providing the potential for durability.
- PhD on HEV detection and cell culture studies completed by partially Med-Vet-Net-funded student.

Benefits to stakeholders

- The knowledge gained on viruses within Med-Vet-Net can be made available to stakeholders for consultancy, and through teaching courses and professional development organized by partner laboratories.
- A comprehensive set of reagents, reference samples and protocols for HEV, *Anellovirus*, EMCV and TBEV (including immunodiagnostics, antisera and antigens) is available on request.
- Cell culture methods for swine HEV replication may be exploited into assays for assaying HEV infectivity in food.
- Virological and serological data on HEV in swine and wild boars can be used to evaluate risks associated with farming activities and pork production. This also applies to EMCV but with a greater degree of uncertainty regarding zoonotic impact.
- Serological data on TBEV in goats and the risk assessment model proposed for milk-borne viral transmission can be used to evaluate risks associated with farming and sales activities, adapting to national scale.

Workpackage 32: Public health surveillance for food-borne infections: Design of epidemiological studies and applying seroepidemiology to validate the surveillance pyramid

WP Leader	Kåre MØLBAK	**Name and Address**	Statens Serum Institut (SSI), Artillerivej 5, DK-2300 Copenhagen S, DENMARK
Project Start date	1 September 2006	**Project End date**	31 October 2009

Aim

Provide estimates of the population incidence of *Salmonella* and *Campylobacter* infections, which are independent of the sensitivity of the respective country's surveillance system, in order to allow unbiased international comparisons of the population burden of infections.

Project background and relevance

The most commonly reported human bacterial infections through contaminated foodstuffs of animal origin are from *Salmonella* and *Campylobacter*, and the severity of infections ranges from asymptomatic infections or mild, self-limiting illness to death.

National and European agencies working in food safety and public health need reliable information on the incidence of these infections. Currently the data on human infections are usually derived from passive public health surveillance systems, where physicians or clinical microbiology laboratories report cases diagnosed by positive stool cultures. Such surveillance systems capture only a fraction of all cases occurring in the population, and their sensitivity is influenced by many factors, from patients' perceived severity of illness, health-seeking behaviour, clinical practices regarding collection of stool samples, laboratory testing practices, and sensitivity of laboratory methods to compliance with reporting requirements. These factors also vary considerably between member states.

Across Europe, *Salmonella* and *Campylobacter* are by far the most frequently reported bacterial enteric pathogens. Due to variable sensitivities of the surveillance systems, one reported case of, for example *Salmonella* infection, in two separate countries may indicate two different numbers of infections in the population. Hence the reported incidence rates are inadequate as the basis for comparisons between countries, and the calculation of overall burden and cost of disease, priority settings, validation of risk assessment models and miniaturization of the impact of control measures.

The method of estimating incidence rates based on serological surveys developed by Workpackage 32 is a novel approach with the distinct advantage of being independent of the variable sensitivities of the respective countries' surveillance systems for *Salmonella* and *Campylobacter*, thereby generating comparable estimates.

Objectives

- Develop and pilot-test a novel method of estimating incidence rates of *Salmonella* and *Campylobacter* infections in the general population that is independent of the variable sensitivities of the respective countries' surveillance systems, thereby generating comparable estimates as a basis for rational decision making regarding public health.
- Establish the kinetics of the human antibody response to *Salmonella* and *Campylobacter* infections as measured by in-house developed enzyme-linked immunosorbent assays.
- Refine a mathematical back-calculation model that allows generation of population incidence estimates of *Salmonella* and *Campylobacter* infections based on antibody measurements in cross-sectional sero-surveys.
- Measure serum antibodies against *Salmonella* and *Campylobacter* in population-representative serum collections from several member states representing different regions of the EU.
- Generate sero-incidence estimates for each participating country and compare with incidence of reported cases and other available data on human and veterinary epidemiology of *Salmonella* and *Campylobacter* in these countries.
- Explore if more easily accessible sera, for example, from pregnancy screening programmes, can substitute for rare and expensive serum collections from the general population.

Principal methods

- In-house enzyme-linked immunosorbent assays
- Mathematical modelling
- Development and use of a back-calculation model of the likely time-since-infection for a given set of IgA, IgG and IgM concentrations
- Development and use of annual infection incidence — sero-incidence estimation

Achievements

- Antibody decay profiles after human infection with *Salmonella* and *Campylobacter* determined by in-house-developed serological assays.
- Development of a mathematical model for the back-calculation of incidence rates from antibody measurements in cross-sectional sero-surveys (sero-incidence).
- Cross-sectional serological population surveys of antibody levels against *Salmonella* and *Campylobacter* in eight EU member states completed, and sero-incidence estimates generated.
- Correlation of sero-incidence estimates for the eight countries with surveillance data and other available data on human and veterinary epidemiology of *Salmonella* and *Campylobacter* in Europe.
- 'Proof of concept': It is feasible to apply serology to perform a baseline survey for human infections with *Salmonella* and thus complement the series of surveys conducted by the European Food Safety Authority and the European Commission.

Benefits to stakeholders

- Demonstration of the feasibility of a new method to determine the incidence of infections with the two most frequently reported bacterial food-borne pathogens in a way that provides comparable data, unbiased by the variable sensitivity of routine surveillance systems. In the case of *Campylobacter*, the estimates can even substitute for non-existent reporting of microbiologically confirmed cases.
- One limitation was the use of sera that had been purposefully collected from the general population for research purposes. Such serum collections are expensive and not available or accessible in all member states. It is therefore recommended to study the feasibility of more easily accessible sera, for example from blood donors, screening programmes in pregnant women or certain groups of patients. Using such sera would enhance the usability and cost-effectiveness of the sero-incidence method for routine application.
- A major stakeholder, the European Centre for Disease Prevention and Control, has recently issued a call for tender to follow up on this approach, thus demonstrating the sustainability of this Med-Vet-Net workpackage.

Workpackage 33: Early host responses to *Salmonella* and *Campylobacter*

WP Leader	Riny JANSSEN	**Name and Address**	National Institute for Public Health and the Environment (RIVM), Laboratory for Health Protection Research, PO Box 1, 3720 BA Bilthoven, THE NETHERLANDS
Project Start date	1 March 2007	**Project End date**	31 October 2009

Aim

Identify host-factors that are regulated in the intestine at early time points in response to infection with *Salmonella* and *Campylobacter*, using microarray analysis, (confocal) microscopy and conventional immunological techniques.

Project background and relevance

Salmonella and *Campylobacter* are successful pathogens as exemplified by the burden of disease they cause in humans. Farm animals can be colonized with these pathogens, and, to date, attempts to eliminate *Salmonella* and *Campylobacter* from the food chain have only been partially successful.

Detailed insight into pathogen factors and highly sophisticated diagnostics and typing of these bacteria has shown that, although this knowledge has contributed to detection and epidemiology, it is not sufficient for optimal infection control. A better insight into host-factors involved in the elimination of these pathogens will allow a more complete understanding of the interaction between *Salmonella* and *Campylobacter* in the host. Such insight will eventually improve the relevance of diagnostics to disease status; contribute to our understanding of epidemiological observations, and the development of vaccines and therapeutics; provide input into risk-assessment research; and enable a better understanding of individual susceptibility to infection.

Objectives

- Compare early host immune responses to *Salmonella* in highly susceptible and relatively resistant mice.
- Compare early host immune responses to wild-type *Salmonella* and *Campylobacter*, and to (mutant) strains that have enhanced capacity to replicate in the host.
- Analyse early host-immune responses in a colitis model of infection.
- Analyse early host-immune responses in a chicken model.
- Analyse the response of murine or chicken cell lines to infection.

Principal methods

- Microarray analysis using a custom-made (Agilent) chicken-microarray
- Immunology
- *In vivo* and *in vitro* studies of infection process for *Salmonella* and *Campylobacter*
- Bioinformatics

A better insight into host-factors involved in the elimination of these pathogens will allow a more complete understanding of the interaction between* Salmonella *and* Campylobacter *in the host.

Achievements

- Establishing that *in vivo* the response to *Salmonella* and *Campylobacter* in the intestine is very weak, whereas *in vitro* the response of cell-lines is much stronger.
- Gene profiles seen upon *in vitro* infection of rectal epithelial cells are clearly distinct from those seen in the ileum upon *in vivo* infection.
- Those strains of bacteria that replicate better in the host induce stronger responses.
- Together, these data indicate that responses to *Salmonella* and *Campylobacter* in the intestine are tightly controlled by the host, which would protect the host from potentially harmful inflammatory responses to pathogens that cause relatively mild disease.

Benefits to stakeholders

- Further insight into the host-response provides input for epidemiologists and risk assessors.
- The finding that the response measured in *in vitro* cell-culture models is distinct and thus not representative of the *in vivo* response is of importance and benefit to the scientific community.
- The results may offer value for vaccine development.
- Dissemination of the generated expertise to other Med-Vet-Net members and members of the scientific community involved in *Campylobacter* research.

Workpackage 34: The prevention and control of *Campylobacter* in broilers

WP Leader	Diane G. NEWELL	**Name and Address**	Veterinary Laboratories Agency (VLA) (Weybridge), Woodham Lane, New Haw, Addlestone, Surrey, KT15 3NB, UNITED KINGDOM
Project Start date	1 September 2008	**Project End date**	31 October 2009

Aim

Develop and expand knowledge of *Campylobacter* in poultry.

Project background and relevance

Campylobacter jejuni and *C. coli* are the most common causes of human acute enteritis in Europe. Estimation of the prevalence of disease, is problematic because many EU member states do not undertake effective surveillance and, even in those countries with adequate surveillance, only approximately one in every eight cases is reported.

At the time of initiating this project, epidemiological studies and quantitative risk assessment models indicated that between 20–40% of Campylobacteriosis cases were attributable to the handling or consumption of contaminated poultry meat. More recently, population studies based on multi-locus sequence typing indicated that up to 85% of cases could be attributed to *Campylobacter* derived from poultry. The disparity between these prevalences may reflect a general contamination of the environment with poultry campylobacters.

Campylobacters are a common asymptomatic colonizer of broilers and in many EU countries up to 100% of tested broiler flocks are colonized at least during the summer months. Modelling studies clearly indicate that although interventions post-harvesting could be cost effective, a further effective public health measure would be prevention of colonization on the farm.

Currently it is difficult, if not impossible, to develop recommendations for practical intervention strategies at the farm level. The epidemiology of colonization indicates that *Campylobacters* are horizontally transmitted to the flock from sources within the farm environment. Many potential on-farm sources and routes of transmission have been reported, nevertheless the control and prevention of *Campylobacter* colonization in poultry by biosecurity measures has proved fraught with difficulties. This failure reflects the ubiquitous nature of the organisms within the environment and their ability to survive in many hostile environments. Such survival mechanisms could be targets for the development of novel interventions but little is known of the molecular basis of the mechanisms involved. And, despite considerable studies, the molecular mechanisms of colonization and the roles of *Campylobacter* colonization factors in birds are largely unknown.

Workpackage 34 was a multidisciplinary project that utilized the skills of epidemiologists, geneticists, bioinformatists and microbiologists to further understand the interaction between the organism, its environment and its host, and exploit the information to develop intervention strategies.

Objectives

- Collate, manage and archive the information base in Europe.
- Develop and collate knowledge of the molecular basis of colonization of the avian gut disseminating knowledge on the epidemiology of poultry colonization and of the survival of *Campylobacters* in the poultry environment.
- Critically evaluate the indirect poultry derived routes of *Campylobacter* infections.
- Investigate and develop understanding of effective methods of control and prevention.

Principal methods

- Database construction and analysis
- Metagenomic analysis
- Bioinformatics

Achievements

- An international workshop on vaccination of poultry against *Campylobacter*.
- A systematic review of the molecular mechanisms for survival of *Campylobacter* in the poultry environment.
- A review of *in vivo* models of *Campylobacter* colonization in poultry and recommendations for standardization and harmonization.
- A critical review of potential indirect (non-poultry meat-borne) routes of transmission of 'poultry campylobacters' to humans.
- A draft survey-based tool for determining stakeholder attitudes to biosecurity to prevent *Campylobacter* colonization at the farm level.

Benefits to stakeholders

- The survey-based tool to assess the attitudes of stakeholders to biosecurity against *Campylobacter* in poultry could be exploited by the poultry industry and policy makers to raise awareness of the issues and develop appropriate education programmes.
- The development of a web-based newsletter to present and interpret scientific information for industry representatives on *Campylobacter* in poultry is currently in discussion with representatives of the poultry industry. A small-to-medium enterprise is exploring this commercial opportunity.
- An evidence-based database of *Campylobacter* genes associated with colonization in chickens and their functions.

DISSEMINATION OF KNOWLEDGE

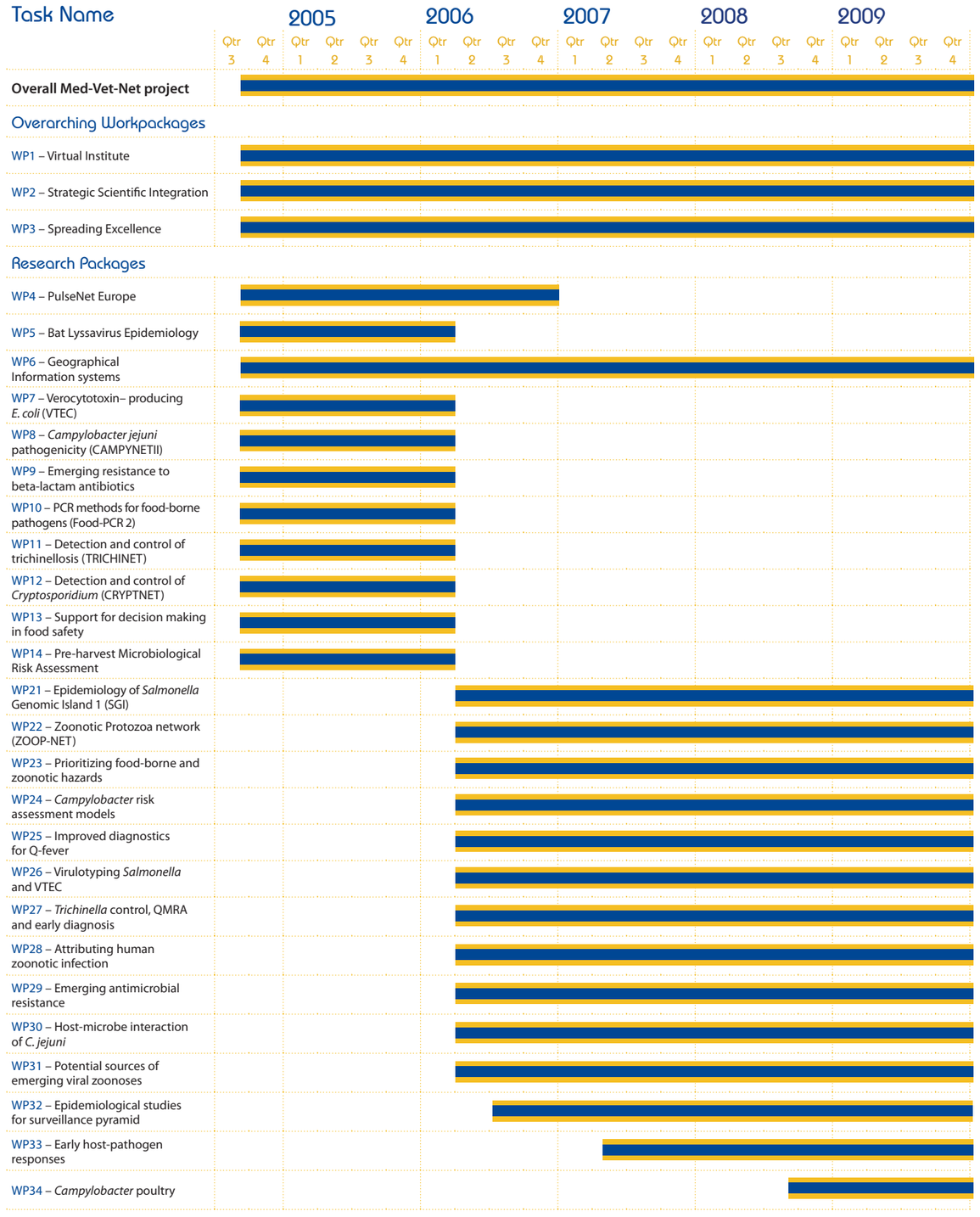
Exploitable knowledge

Exploitable knowledge	Exploitable product(s) or measures	Sector(s) of application	Timetable for commercial use	Patents or other IPR protection	Owner and other partner(s) involved
Self-funded network initially comprised of 14 Med-Vet-Net scientific partners	Med-Vet-Net Association	Medical Veterinary Food science	No commercial use envisaged	The Med-Vet-Net Association was officially registered in June 2009 as an Association under French law 1901	Med-Vet-Net Association partners
Material from the science communication training internship	Training material	Medical Veterinary Food science	Commercial exploitation possible	None as yet	EU (Med-Vet-Net) SC Ltd
	Science Communications Ltd (SC Ltd)	Medical Veterinary Food science	Approved by EC (Sept 2009)	Commercial company to undertake Med-Vet-Net communications work and communications activities of the Med-Vet-Net Association and other networks/institutes	SC Ltd
Geographical information system (GIS) information on zoonotic pathogens in the EU	The GIS tools and atlases will be made publicly available as a service to the EU and research bodies	Medical Veterinary	No commercial use envisaged	Not applicable	EU (Med-Vet-Net)
Improvements in traceability of unintended microorganisms and their substances in food and feed chains	EU-funded BIOTRACER project	Food science	No commercial use envisaged	Not applicable	EU (Med-Vet-Net)
Recombinant proteins for immunodiagnostic purposes or vaccination in pigs	Recombinant proteins for immunodiagnostic purposes or vaccination in pigs	Veterinary	In use since 2008	Patent (under the support of TRICHIPORSE EU contract PRA AFCRST Bt01-03, ECOS ANUIES, and TrichiNet (Med-Vet-Net)	TRICHIPORSE EU TrichiNet (Med-Vet-Net)
Methods for detection and characterization of antimicrobial resistance islands in enteric bacteria	New sensitive and specific detection methods for *Salmonella* Genomic Island 1 in all bacteria species.	Medical Veterinary	No commercial use envisaged	Not applicable	EU (Med-Vet-Net)
Strain collections of drug-resistant bacteria	Strain collections of drug-resistant *Salmonella* bacteria			The strain collections at the UK Health Protection Agency (HPA) and the German Federal Institute for Risk Assessment (BfR) will be sustained and made publicly available after publication of results	Strain collections maintained by HPA and BfR
Two repositories of standards for *Giardia* and *Cryptosporidium*	Two repositories of standards for *Giardia* and *Cryptosporidium*	Medical Veterinary	No commercial use envisaged	Not applicable The strain collections at the Istituto Superiore di Sanità (ISS) and the Technical University of Denmark (DTU) will be sustained and made publicly available after publication of results	EU (Med-Vet-Net) Strain collections will be maintained by ISS and Vet-DTU
Data-sharing at the EU level through the establishment of an accessible, online database, which can be made available to external users	Dynamic database where sequence and epidemiologic data for *Giardia* and *Cryptosporidium* pathogens can be stored and analysed			Databases are currently being tested offline and will soon be accessible via the internet	
Software tools and models for calculation of disease burden	The developed software tools and models will not be commercially exploited but will be made available for external use	Medical Veterinary	No commercial use envisaged	Not applicable	EU (Med-Vet-Net) National Institute for Public Health and the Environment (RIVM), The Netherlands
Document entitled 'Methodological choices for calculating the disease burden and cost-of-illness of food-borne zoonoses in European countries'				Document available from the Med-Vet-Net public website (see www.medvetnet.org/pdf/Reports/Report_07-002.pdf)	
Consensus framework for risk assessment of *Campylobacter* in broiler meat implemented in a software tool — *Campylobacter* Risk Assessment Framework (CRAF)	CRAF 1.0 CRAF 2.0	Medical Veterinary	No commercial use envisaged	Not applicable CRAF 2.0 is publicly available online (see www.rivm.nl/craf)	EU (Med-Vet-Net) RIVM
Virulence gene array	Virulence gene array	Medical Veterinary	In use	The array is commercially available under the brand name IDENTIBAC	Veterinary Laboratories Agency (VLA)
Enzyme-linked immunosorbant assay (ELISA) test for *Trichinella* in pigs	Recombinant proteins developed that can be used for an ELISA test for detection of *Trichinella* in pigs	Veterinary	Various French and international companies have expressed an interest in developing and producing the ELISA test	Awaiting commercial exploitation	EU (Med-Vet-Net) French Food Safety Agency
Refinement of the ELISA methodology and back-calculation model for sero-epidemiological surveillance of infections with *Salmonella* and *Campylobacter*	ELISA methodology and back-calculation model for sero-epidemiological surveillance of infections with *Salmonella* and *Campylobacter*	Medical Veterinary	No commercial use envisaged	Not applicable. Method taken forward by relevant agencies in countries outside the EU, for example the Centers for Disease Control and Prevention, Atlanta, USA	EU (Med-Vet-Net) DTU
	Repository of approximately 7,500 sera from eight countries will be maintained. The serum bank will be made available to other European research projects in the field of enteric infections		No commercial use envisaged		DTU
Findings in relation to infection process for *Salmonella* and *Campylobacter*	Possible vaccine development	Medical Veterinary	Possible commercial exploitation	Not yet applicable	EU (Med-Vet-Net) RIVM
Survey-based tool to assess attitudes of stakeholders to biosecurity against *Campylobacter* in poultry	Tool could be exploited by the poultry industry and policy makers to raise awareness and develop appropriate education programmes	Veterinary	Possible commercial exploitation	Not yet applicable. In discussion with representatives of the poultry industry	EU (Med-Vet-Net) VLA
	Web-based newsletter on *Campylobacter* in poultry	Veterinary	Possible commercial exploitation		EU (Med-Vet-Net) VLA

Dissemination of knowledge

Planned/ actual dates	Type	Target audience	Countries addressed	Size of audience	Partner responsible/ involved
2004–2009	Press release (press/TV)	• Media • General public Policy makers	• EU	>100,000	Workpackage 3
2004–2009	Media briefing	• General public	• EU	circa 50	Workpackage 3
2004–2009	Conferences/seminars/ workshops (general)	• General public • Med-Vet-Net participants including Governing Board (GB) and Co-ordinating Forum (CF) • EC officials • Policy makers • Media	• EU • Global	circa 20,000	Workpackage 3
2004–2009	Conferences/seminars/ workshops (scientific, including oral presentations and posters)	• Research community (public health, veterinary, food science) • Med-Vet-Net participants including GB and CF • EC officials • Policy makers	• EU • Global	>20,000	Workpackages 2,3, 4–14, 21–34
2004–2009	Exhibitions	• General and scientific	• EU • Global	>5,000	Workpackage 3
2004–2009	Med-Vet-Net website	• General and scientific	• Med-Vet-Net institute countries • EU • Global	circa 200,000	Workpackage 3
2004–2009	Posters	• General and scientific	• Med-Vet-Net institute countries • EU	circa 10,000	Workpackage 3
2004–2009	Flyers	• General and scientific	• Med-Vet-Net institute countries • EU	20,000	Workpackage 3
2004–2009	Direct emailing	• General and scientific • Policy makers	• Med-Vet-Net institute countries • EU	circa 5,000	All Workpackages
2004–2009	Overarching reports	• General and scientific • EC officials • Policy makers	• Med-Vet-Net institute countries • EU • Global	>2,000	Workpackage 3

Overview of Med-Vet-Net tasks



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PROJECT OBJECTIVES SUMMARIES 2004–2009

The overall aim of Med-Vet-Net was to develop a Network of Excellence for the integration of veterinary, medical and food sciences, in the field of food safety, at the European level, in order to improve research on the prevention and control of zoonoses, including food-borne diseases, while taking into account the public health concerns of consumers and other stakeholders throughout the food chain. This was achieved through the following yearly objectives.

Year 5 (2009 annual report)

***Objective 1:** To continue to develop and improve Network management in response to the recommendations of the external review*

The Network was subject to an external independent review on 12 December 2008 on the basis of its Year 4 activities. The project was rated as 'good-to excellent' – i.e. 'the project has fully achieved its objectives and technical goals for the period and even exceeded expectations'. Recommendations in relation to Workpackages 6, 23, 28, 30 and 33 have been implemented. CRAF-2, an output from Workpackage 24, is being taken forward with collaborators in the USA, and the eventual outcomes may be applicable to organisms other than *Campylobacter*. Workpackage 30 has linked the results of pan-genomic analyses of *Campylobacter* with epidemiological information; and Workpackage 34 has been supported in achieving its stated objectives.

***Objective 2:** To develop and support strategies for the long-term objective of network sustainability through the Sustainability and Legal Officers subcommittees.*

The efforts to ensure the long-term stability of the Network have borne fruit, with the formation of the 'Med-Vet-Net Association', which was officially launched in Brussels on 6 October 2009. Details of the Association are provided elsewhere in the report, but it is noteworthy that all present scientific institutes have elected to join the Association as full members for an initial period of three years, on a self-funded basis.

***Objective 3:** To develop and support strategies for durable integration, including support for the planning of integrated research by Med-Vet-Net partners extending after the projected duration of the project.*

Durable integration has also been addressed at the scientific level, with Med-Vet-Net scientists continuing to pursue opportunities for funding within FP7 and other areas, with the primary objective of maintaining and expanding multi-disciplinary research teams, thereby incorporating research groups and institutes outwith the present network into proposals. In this respect several collaborative projects have ensued which will continue outside the EU-funded period of Med-Vet-Net. These are listed elsewhere in the report. It should be noted that preparatory meetings to prepare funding proposals were not funded by the EC contribution to Med-Vet-Net.

***Objective 4:** To continue to maintain, consolidate, further develop and deliver a high quality research programme consistent with the strategic science plan, institute aims and objectives, and EC requirements.*

All Network partners have continued to be actively involved in the research programme under the leadership of the Health Protection Agency (HPA). During the final year, 15 scientific workpackages were ongoing — Workpackage 6, and Workpackages 21–34. In all, 22 research-associated meetings were held within the Network, involving over 300 scientists and including at least 100 external scientists. Three workpackages held joint meetings — evidence of the increased level interactions between different workpackages. Additionally, results from Med-Vet-Net scientific workpackages have been presented at more than 70 external meetings to an overall audience well over 1,500 people from within and outside Europe.

The presentation of results in peer-reviewed journals has continued to be afforded high priority and is an internationally-accepted recognition of scientific achievement. In Year 5 at least 78 peer-reviewed papers were published or are in press, with funding by Med-Vet-Net acknowledged, bringing the total credited to Network activities to over 150. Several other papers are either in advanced stages of preparation or have been submitted for publication.

***Objective 5:** To promote collaborative activities between scientific Workpackages, thereby increasing both scientific flexibility and output.*

Collaborations between scientific workpackages have continued to develop and become more evident in terms of transparency and outcome during the fifth year. Six workpackages with common interests held joint meetings – Workpackages 30 and 34 (*Campylobacter*), Workpackages 21 and 29 (antimicrobial drug resistance), and Workpackages 23 and 32 (Prioritizing food-borne and zoonotic hazards at the EU level/Public health surveillance for food-borne infections: application of seroepidemiology to validate the surveillance pyramid).

Additionally, other workpackages have held joint meetings with Special Interest Groups (SIGs) – Workpackages 26 and 33 and the Host-Pathogen Interactions SIG group. These meetings ensured a high level of interactions between participants and had major benefits for the Network in terms of exchanging ideas, technologies and the exploitation of methods and analyses. In several instances such collaborations resulted in either the submission of, or publication of, peer-reviewed papers with joint authorships from several different workpackages. An additional outcome of such inter-workpackage collaborations was the informal linkage of scientists from different workpackages to develop and submit applications for funding.

***Objective 6:** To develop and expand collaborations with public health and food safety agencies in Europe, such as ECDC and EFSA.*

Raising awareness of Med-Vet-Net in the international context of food safety and zoonoses continued to be an important component of the Network during the final year. Although the EUUS-SAFEFOOD collaboration ceased in Year 4, a plethora of new international collaborations were initiated in Year 5. For example, an EU SAFEFOODERA project entitled, 'The role of commensal microflora of animals in the transmission of extended spectrum ß-lactamases', was approved in February 2009 and commenced in September 2009. The project is a collaboration between five partners, four of which are from Med-Vet-Net — HPA, Veterinary Laboratories Agency (VLA), the German Federal Institute for Risk Assessment (BfR) and the Central Veterinary Institute (CVI) in The Netherlands.

The ECDC has shown great interest in the sero-epidemiological approach developed under Workpackage 32 and recently issued a call for tender for further development of "Sero-epidemiology as a tool to assess incidence of *Salmonella* and *Campylobacter* infections". Med-Vet-Net partners, RIVM, the Statens Serum Institute and Poland's National Institute of Hygiene, are collaborating with the Institute of Public Health Bucharest to submit a proposal to this call.

Efforts have also been made to increase the level of collaboration by Med-Vet-Net with other institutes and networks. Existing strong contacts with other Networks of Excellence working in associated areas have been reinforced through the provision of advice about sustainability, based on Med-Vet-Net's experiences. Med-Vet-Net has also become officially represented in the International Federation for Animal Health Europe through membership of DISCONTOOLS, the EC-funded Disease Control Tools project.

DISCONTOOLS is a joint initiative of industry and a wide range of stakeholders including the research community, regulators and users. It is actively encouraged and funded by the EC and provides a mechanism for focusing and prioritizing research that ultimately delivers new and improved vaccines, pharmaceuticals and diagnostic tests. Med-Vet-Net experts are involved in Workpackage 3 of DISCONTOOLS, which is dedicated to the prioritization of animal disease, and the Med-Vet-Net Project Manager has been appointed to both the Executive Board and the Project Management Board of DISCONTOOLS, ensuring ongoing representation within this important European initiative.

In addition to the above collaborations, Med-Vet-Net experts have contributed to the EMIDA ERA-NET programme's Delphi study (Workpackage 4) that is developing a strategic trans-national animal health research agenda; and four Med-Vet-Net members are also members of the Network of Animal Diseases and Infectiology Research Facilities (NADIR), an EC infrastructure programme. NADIR's Networking Action 1 (NA1) is, in part, aimed at developing an inventory of Europe's animal experiment facilities and laboratories, and harmonizing their procedures and models. NA1 derived from Workpackage 1's initiative to inventory the animal facilities within the Med-Vet-Net Network (see the Workpackage 1 report).

Other new international collaborations were also developed through the Special Interest Groups, and Med-Vet-Net scientists continued to support EFSA and ECDC through membership of panels, ad-hoc groups and other fora.

***Objective 7:** To continue to develop the skills and expertise throughout the partnership with a programme of workshops, training courses, short-term missions, internships and studentships.*

Training activities remained an essential element and a high priority of the Network during Year 5. With the support of several other partners, the Technical University of Denmark (DTU) continued to lead this area of the Network's activities. Applications for workshops and short-term secondments were channelled through DTU, and independently assessed by a small team.

In Year 5, three well-attended training courses were funded, which were separate to the courses independently organised within scientific workpackages were funded. These included: Bioinformatics for Laboratory Scientists; Deriving Disability Weights (DDW); and Development of a European consensus framework on risk assessment of *Campylobacter* in broiler meat. As well as participants from Med-Vet-Net, attendees at these workshops included scientists from numerous other European institutes as well as representatives from ECDC, EFSA, the USA, Japan and Canada. Together these workshops served to promote the activities of Med-Vet-Net in at least 30 countries around the world.

Short-term missions (STMs) and exchanges have continued to be well-subscribed, with 15 of 18 applications funded. Young scientists particularly benefited from the STMs, taking full advantage of the training opportunities offered and the opportunities to meet and work with established scientists in different institutes both within and outside Med-Vet-Net. The Network also continued to provide partial funding for five PhD students within four workpackages. One PhD entitled 'Attributing human zoonotic infection with different animals, food and environmental sources' was completed under the auspices of Workpackage 28. Another PhD entitled 'HEV detection and cell culture studies' was completed as part of Workpackage 31. Three further PhD students are now in their final year and it is hoped that their studies will be completed in the very near future.

***Objective 8:** To continue to support platforms for the development, management and dissemination of knowledge in areas where critical mass is poor or a specific need is clear, by the provision and support of virtual Special Interest Groups.*

In Year 5, enhanced knowledge management within the Network continued within two Special Interest Groups (SIGs) — Wildlife-Related Emerging Diseases and Zoonoses (WiREDZ) and Host-Pathogen interactions, which was initiated in Year 3.

In December 2008, WiREDZ held a meeting in Budapest with 22 delegates from 13 countries attending. WiREDZ work in European countries, in particular those countries where systems and approaches to WiREDZ work was unknown, was discussed. By August 2009, 223 scientists from 35 countries had also registered on the SIG's WILDLIST (www.medvetnet.org/wildlist). WiREDZ's achievements have been instrumental in developing a basis for others to progress the foundation of wildlife disease reporting and collaborating networks across Europe.

The Host-Pathogen SIG continued to interact closely with Workpackage 33, and also facilitated numerous meetings, workshops and STM's within and outside the Network, such as a joint zoonoses meeting with the University of Surrey (UK) and North Carolina State University (USA), which was made possible through contacts generated through the SIG. In addition to providing a platform for networking in the area of host pathogen interactions, the SIG also assisted the drafting of a number of EU and research council grant proposals.

Workpackage 34, a scientific workpackage targeted at the prevention and control of *Campylobacter* in broilers that originated from a SIG concept, commenced in September 2008. Since then the workpackage has developed an electronic communication system for debate on *Campylobacter* control throughout Europe.

Objective 9: *To continue to expand the associate/collaborative research network at the European level by involving external scientists in network research and integration activities, including Special Interest Groups, the Annual Scientific Meeting and scientific workshops.*

In Year 5 external scientists were involved in a range of Med-Vet-Net activities at an unprecedented level. For example, Dr. Ruff Lowman from Canada was a keynote speaker at the CRAF 1.0 workshop held by Workpackage 24 at the BfR. The meeting, attended by 37 participants from 14 countries, including USA and Japan, was followed by a one-day CRAF training course with 30 participants from 13 countries, including Canada, the USA and Japan. EFSA and the American Joint Institute for Food Safety and Applied Nutrition (JIFSAN) were also represented.

Twenty-two delegates from 13 countries attended the WiREDZ workshop in Budapest in February 2009, with delegates from the Republic of Ireland, Finland, Greece, Croatia, Russia, Lithuania, Romania, as well as Med-Vet-Net countries. Five external experts delivered presentations to the joint Workpackage 21 and 29 workshop in Paris in June 2009, and presentations were also made by external experts from the World Health Organization to the joint Workpackage 23 and 32 meeting in Poland in July. The Centers for Disease Control and Prevention (USA) among others have an active interest in Workpackage 23 and have participated in all meetings. Similar examples are provided in almost all workpackage reports for Year 5.

With regard to training, it is conservatively estimated that at least 40% of the more than 100 scientists who received training in Med-Vet-Net workshops in Year 5, were external to the Network. And lastly, at the Med-Vet-Net Annual Scientific Meeting in Madrid (June 2009), the number of presentations by international keynote speakers increased from six to seven, all of which were well received by delegates.

The Annual Scientific Meeting is a showcase for the Network's activities and for developing collaborations with non-Med-Vet-Net scientists. In Year 5 this was held at the Euroforum Infantes conference centre in El Escorial, Spain, adjacent to the UNESCO World Heritage site of the El Escorial Monastery. Nearly 200 delegates, comprising 150 delegates from within the Network and 49 external participants attended. In total, seven lectures from international keynote speakers, 54 oral presentations and over 172 posters were presented to delegates, highlighting various Network activities and collaborative activities with scientists in external institutes worldwide.

Representatives from each of the ongoing 15 scientific workpackages also presented their respective results and achievements. All of the presentations, both oral and poster, were of a high quality, with several subsequently delivered at international meetings elsewhere.

Objective 10: *To continue to enhance the development of stakeholders using the Spreading Excellence activities*

A significant output this year was the stakeholder report 'Building a European Community to Combat Zoonoses', which provides an easy-to-read summary for non-scientific stakeholders. The report showcases the results and achievements of Med-Vet-Net's workpackages and Special Interest Groups.

Med-Vet-Net News, the Network newsletter, was produced regularly throughout Year 5 and distributed as an e-bulletin with links to full articles on the public website. The newsletter reached more than 1,500 subscribers from a diverse range of sectors, both scientific and non-scientific, in 72 countries.

The Communications Unit also prepared magazine articles for publication in journals including Microbiologist (the magazine of the Society for Applied Microbiology), The Parliamentary Monitor, the EU-AgriNet website, and Vetro, the internal magazine of the VLA.

Objective 11: *To continue development and expansion of international collaborations outwith the EU.*

To maintain and further develop CRAF, a proposal was submitted to the National Institute of Food and Agriculture of the US Department of Agriculture, by Food DTU and RIVM, together with JIFSAN, a partnership between the University of Maryland and United States Food and Drug Administration. With respect to *Trichinella*, a consortium established in 1998 will be expanded with the introduction of Med-Vet-Net as well as Chinese and Canadian partners. The Complutense University of Madrid is currently expanding Med-Vet-Net collaborations in antimicrobial resistance activities to include India. Four partners are already part of an FP7 project (VITAL 2008–2011) on *Hepatitis E virus* (HEV) Risk Assessment, and others are discussing participation in an ERA-NET proposal on HEV.

Year 4 (2008 annual report)

Objective 1: *Develop and improve the Network management by undertaking and responding to an external management review.*

Recommendations made following a review of management activities by external consultants, received on 6 November 2007, continued to be implemented. The management review was conducted by Walker associates (UK) and Berkley associates sprl (Belgium), collaborating together for the purposes of the review under the name of BWA Project Review Services. These included training on problem identification and resolution, sustainability, succession planning and recommendations on clarity of budget summaries. Further recommendations were that the Advisory Panel be disbanded, and that the Governing Board be more focused on strategic issues, such as integration and sustainability. These recommendations were taken forward during Year 4 and Year 5.

Objective 2: *Develop and implement a plan for the long-term aim of network sustainability through a Sustainability Subcommittee.*

Med-Vet-Net continued to progress towards the achievement of its overall objective of developing a Virtual Institute in Year 4. The infrastructure required, that is governance, finance and administrative mechanisms under the responsibility of the French Food Safety Agency (AFSSA), and the project management and scientific leadership under the responsibility of the VLA until February 2008, and subsequently the HPA, were in place and working effectively with a high degree of trust between those involved.

Durable integration was also addressed at various levels within the Network. Two teams were convened to take forward sustainability of the Network after the cessation of EU funding in 2009. These were led by the Co-ordination Unit at AFSSA, and comprised a Sustainability Subcommittee and a Legal Officers Subcommittee. A key mandate of the Legal Officer's Subcommittee was to draw up a Consortium Agreement that would serve as a basis to establish the future association. Communication was by email and conference call, with full advantage taken of the Webex online conferencing tool introduced in 2006–07.

Objective 3: *Develop and support strategies for durable integration, particularly by providing opportunities for further funding through a Resource Subcommittee.*

In light of many collaborations initiated by scientists within the Network to develop collaborations leading to grant proposals, formation of a formal 'Resource Subcommittee' was not considered necessary, particularly as EC regulations do not permit the funding of meetings with external scientists specifically for the purpose of formulating grant applications. Nevertheless it is worthy to note that durable integration was addressed at the scientific level, as Med-Vet-Net pursued opportunities for funding within FP7 and other areas, with the primary objective of maintaining and expanding multi-sided research teams. It is also noteworthy that approval was received from the Med-Vet-Net Governing Board for the Communications Unit to submit to the EC a proposal for the formation of a commercial company, Science Communications Ltd, in order to sustain its work in future. This company was launched early in Year 5.

Objective 4: *Maintain, consolidate and further develop a high quality research programme consistent with the strategic science plan, institute aims and objective and EC requirements.*

All Network partners were actively involved in the Year 4 research programme, under the leadership of the VLA (from September 2007 to February 2008, and the HPA from March 2008). During Year 4, 14 scientific Workpackages were ongoing — Workpackage 6 and 21–33. In all, 22 research-associated meetings were held within the Network involving over 350 scientists, including at least 100 external scientists.

The Annual Scientific Meeting was held in St Malo, France. There were 221 participants including 150 delegates from within the Network and 73 external participants. In addition to presentations by international keynote speakers, there were over 100 high quality oral and poster presentations highlighting various activities of the Network and also collaborative activities with scientists in external institutes worldwide. Network scientists also presented Med-Vet-Net-related work in at least 14 other international scientific meetings and were involved in joint meetings with EADGENE and a European bat Lyssavirus group.

Summaries of the major achievements of the workpackages are provided within the Year 4 annual report and more detailed reports are provided as Deliverables. The outputs of research are also summarized in the Key Performance Indicators. Of note were contributions to harmonized European procedures, major reports and recommendations for policy makers, European reagent and strain collections, and repositories. Increased interactions between Workpackages were a feature of Year 4.

In Year 4 there were at least 30 publications with funding by Med-Vet-Net acknowledged, bringing the total credited to Network activities to over 100.

Objective 5: *Develop the skills and expertise throughout the partnership with a programme of workshops, training courses, short-term missions, internships and studentships.*

Training activities were a high priority and an essential element of the Network. This aspect of Med-Vet-Net activities was led by DTU with the support of several other partners. In Year 4, 11 well-attended training courses and workshops were delivered, of which two were in collaboration with outside organizations (World Health Organization and ECDC), which represented a substantive increase over previous years. Seven workshops were laboratory based and four were on epidemiological aspects. Workshops were held in nine countries and involved 12 of the Med-Vet-Net institutes either as hosts or as organizers. In all, over 150 scientists received training. A further nine science communication interns were trained in the modular training programme established in Year 3 and the Network continued to provide partial funding for five PhD students within four Workpackages. The short-term missions were well subscribed, and funding was provided for 24 such missions out of 27 applications received.

Objective 6: *Provide platforms for the development, management and dissemination of knowledge in areas where critical mass is poor, or a specific need is clear, using the concept of virtual Special Interest Groups.*

In Year 4, enhanced knowledge management within the Network continued within the Special Interest Groups (SIG). The SIG on European bat lyssaviruses continued to develop the sequence database for molecular epidemiology and organized a well-attended meeting in Madrid in December 2007 with the new SIG — Wildlife-Related Emerging Diseases and Zoonoses (WiREDZ). The SIG on host-pathogen interactions initiated in Year 3 continued to attract considerable interest from workers in the field, and a workshop was held at the VLA in February 2008 followed by a demonstration of confocal microscopy.

Objective 7: *Further expand the associate/collaborative research network at the European level by involving external scientists in Network research and integration activities, including Special Interest Groups and the Annual Scientific Meeting.*

Med-Vet-Net actively encouraged external scientist participation in the Network. This was particularly apparent in the SIG activities, which encouraged the participation of non-Network scientists in meetings. Additionally, scientists from at least 10 external institutes continued to be involved in the research activities of 10 workpackages. Such participation took the form of the supply of material such as sera, phages and data, work in specific areas where workpackages lacked the necessary expertise, and supply of information through lectures and demonstrations.

External scientists were also encouraged to attend the Year 4 Annual Scientific Meeting in St Malo with 73 external delegates participating.

It is difficult to enumerate precisely the external scientists who attended Med-Vet-Net sponsored training courses, as two courses were held jointly with external organizations. A conservative estimate is that of the 150+ scientists who received training in Med-Vet-Net workshops in Year 4, at least 50% were external to the Network. The strong contacts with the two other Networks of Excellence working in associated areas in Year 3, namely EADGENE and EPIZONE, were maintained, with members of Med-Vet-Net delivering several presentations at the EADGENE meeting in Edinburgh, in June 2008.

Additionally, Med-Vet-Net became officially represented in the International Federation for Animal Health — Europe through membership of the EC-funded DISCONTOOLS project.

The Communications Unit produced the regular newsletter, Med-Vet-Net News, as an e-bulletin, which in Year 4, was distributed to over 1,400 people in 67 countries.

Objective 8: *Enhance the development of stakeholders using Spreading Excellence activities.*

In Year 4 there were several improvements to the Med-Vet-Net website, which enhanced both access to, and the dissemination of, information. As in Year 3, the Deliverables were made available through the 'Workplace' area to the EC Reviewers.

The WebEx online conferencing tool was used extensively across the Network. In particular, the facility was used in the organization of the Annual Scientific Meeting in St Malo, and for meetings of the Sustainability and Legal Officers Subcommittees. A total of 44 web-based meetings were held involving over 200 participants.

The Communications Unit produced the regular newsletter, *Med-Vet-Net News*, as an e-bulletin, which in Year 4, was distributed to over 1,400 people in 67 countries, an extremely wide network of stakeholders working on or interested in zoonotic research. Visits to the public website peaked at over 8,000 visits per month in June 2008 (prior to the Annual Scientific Meeting).

The Communications Unit also continued to establish and maintain relationships both internal to the Network and externally with all interest groups and stakeholders by attending various conferences, meetings and workshops. It also continued to support other workpackages and Special Interest Groups by advertising, promoting and organizing conferences, meetings and training courses, and by providing web and database support, design and media support.

Four modules of the Science Communication Internship were run in Year 4. Eight new candidates participated in Module 1 and some completed Modules 2 and 4. As part of the internship, the interns attended meetings with various stakeholders as well as participating in science communication conferences and exhibitions, providing the opportunity for further dissemination of Med-Vet-Net activities.

Objective 9: *Continue development and expansion of international collaborations.*

Raising awareness of Med-Vet-Net in the international context of food safety/zoonoses was an important component of the Network. In that respect the second transatlantic meeting of the associated project EUUS-SAFEFOOD was held in Segovia in October 2007. The meeting topic was the ecology of antimicrobial resistance with special reference to the food chain, a contentious area of international concern. The group of 30 experts from nine countries (seven EU countries, Canada and the USA) were from various sectors (academic, government and industry) and disciplines (medical, veterinary, food production, microbiology, and genetics), and were invited to review current knowledge, identify consensus opinion and highlight data gaps in the ecology of resistance inside and outside the host. A major conclusion from the meeting was to encourage the engagement of all stakeholders, both nationally and internationally to develop tools to realistically assess the current and potential hazards of antimicrobial resistance in zoonotic organisms for both human and animal health.

Med-Vet-Net expertise and knowledge continued to be sought by national and European government agencies as well as non-government organizations and policy-forming groups. It is hoped that the scientific knowledge developed through Med-Vet-Net will continue to be readily available and freely exploited after Med-Vet-Net EU funding has ceased.

Year 3 (2007 annual report)

Objective 1: *Maintain and stabilize the 'Virtual Institute' management structure with the long-term aim of Network sustainability.*

Med-Vet-Net continued to progress towards the achievement of its overall objective of developing a virtual institute. To support the project management, training of Finance Officers and Workpackage Leaders was undertaken and dedicated management newsletters were developed. Durable integration was addressed at various levels; in particular a review of animal facilities within the Network was completed to enable facilities sharing. As part of the durable integration plan, Med-Vet-Net actively, and successfully, pursued new and existing funding opportunities, especially in FP7 to maintain multi-site research teams.

In Year 3, further work was undertaken to address the issue of sustainability by investigating the potential opportunities for establishing legal entities. In particular Med-Vet-Net joined with over 50 other Networks of Excellence to lobby the EC to establish mechanisms for sustainability. One research team, which developed PulseNet Europe, progressed to a sustainable future under the umbrella of the ECDC, and in a major achievement Med-Vet-Net's highly successful Communications Unit initiated negotiations with the EC to establish a commercial enterprise in order to sustain its work in the future.

Objective 2: *Deliver a high-quality research programme consistent with the strategic science plan, institute aims and objectives and EC requirements.*

All Network partners were involved actively in the research programme under the leadership of the VLA. During Year 3, 13 workpackages were ongoing from Year 2 (Workpackages 4, 6, and 21–31). Workpackage 32 was initiated in September 2006 and Workpackage 33 in March 2007 to address recognized skills and knowledge deficiencies. Workpackage 4 was completed and the final report was presented as expected at the end of 2006. In all, 25 research-associated meetings were held involving over 340 scientists including at least 50 external scientists.

The presentation of Med-Vet-Net research to other scientists was an important and primary task of the Network. The major display case for the Network was the Annual Scientific Meeting, which in Year 3 was held near Lucca in Italy. About 25% of the 195 participants were external scientists. In addition, Network scientists presented Med-Vet-Net associated work in 17 other international scientific meetings during Year 3.

The Year 3 Key Performance Indicators included contributions to harmonized European procedures, major reports and recommendations for policy makers, European reagent and strain collections and repositories and scientific publications in peer-reviewed journals. In its third year, Med-Vet-Net participants published over 30 papers, bringing the total credited to Network activities to 70.

Objective 3: *Enhance remote communications by exploitation of modern, especially electronic, tools.*

In Year 3, the overarching workpackages continued to focus on improving internal communications under the leadership of SfAM. In particular, an online contacts database was developed within the private website. In addition, the web workspace area became more accessible and actively used by the partnership. This year the project deliverables were also made available through the web to the EC reviewers.

The online web conferencing tool successfully transformed communications within the overarching Workpackages in Year 3. In particular, the tool was extensively used for the organization of the Annual Scientific Meeting. The 100 webcams purchased were distributed and facilitated the use of web conferencing within the workpackages. In all, over 65 web-based meetings were during the year involving over 200 participants.

Objective 4: *Develop the skills and expertise in all areas but particularly cross-disciplinary technologies, project management at the European level and science communication.*

During Year 3, five training courses and workshops were delivered — two workshops focused on aspects of bioinformatics/databases, with the remaining three on epidemiological aspects including outbreak investigation, source attribution and geographical information systems. Over 75 Med-Vet-Net and external scientists were trained in these workshops.

In addition, four science communication interns were trained in a new, modular training programme, and the three PhD students currently under training progressed into their second year. Also in Year 3, 16 scientists from the Network were funded to receive short-term mission training including attendance at scientific workshops and meetings, and visiting other laboratories to learn new skills and undertake additional work associated with workpackage objectives.

Management training and development was also important to the Network and the Project Management Team actively participated in the newly formed EU Project Managers Association during Year 3. Training was also provided for workpackage leaders and finance officers.

Objective 5: *Provide an environment for the development, management and dissemination of knowledge in critical areas such as new and neglected zoonotic pathogens.*

In Year 3, enhanced knowledge management within the Network continued in areas with limited critical mass using the format of Special Interest Groups (SIG). The SIG on New and Neglected Zoonoses was enormously successful by contributing leadership to a group that went on to successfully submit two proposals to FP7 as well as generate a document on research challenges for policy makers. The second SIG on European bat lyssavirus continued to maintain the sequence database for molecular epidemiology, and began to expand into other areas of wildlife zoonoses in response to EC requirements. A third SIG, on host-pathogen interactions, was also initiated in Year 3.

Objective 6: *Establish a more inclusive associate/collaborative research network at the European level.*

In Year 3, Med-Vet-Net, through all of its partners, continued to actively encourage external scientist participation, in particular by opening up workpackage and Special Interest Group activities, where possible. At least 47 scientists from over 10 external institutes were involved in the research activities of nine workpackages. In particular, collaborations by Workpackages 23, 24, 27, 30 and 32 with international research partners in the USA, New Zealand, Finland, Romania and the Food and Agriculture Organization of the United Nations/WHO provided data, models and sera.

The New, Emerging and Neglected Zoonoses SIG was particularly active in the recruitment of external interest, with 188 scientists providing information on areas of research interest to the inventory, including scientists from 74 external institutes. In addition, external scientists were encouraged to attend the Annual Scientific Meeting. Forty-five external delegates participated in the meeting in Lucca — a small increase on the previous year. Seventeen external scientists attended the five training courses/workshops.

Finally, strong contacts with two other Networks of Excellence, EADGENE and EPIZONE, working in associated areas were generated.

Objective 7: *Involvement of stakeholders by expansion of the Communications Unit activities especially the public website, publication of science stories and the production of a 'glossy magazine'.*

The monthly newsletter was modified to address primarily Network general membership and stakeholders and evolved into an e-bulletin with over 1,000 subscribers in 53 countries. The format was so successful that it replaced the need for a glossy magazine.

The public website was also highly successful at involving stakeholders. Visits to the site continued to increase to an average of about 4,000 per month. Six fact sheets, aimed at the general public and school children, were published on the website on a variety of topics including cryptosporidiosis, Q-fever, trichinellosis and campylobacteriosis. Press releases continued to generate interest with the most successful in Year 3, promoting the start of Workpackage 32, generating an interview with *Lancet Infectious Diseases* in November 2006.

Objective 8: *Continued development of international collaborations with the long-term vision of a 'global network' of food safety/zoonoses networks.*

Raising awareness of Med-Vet-Net in the international context was an important component of attempts to generate a global network addressing food safety and zoonoses issues. In the Network's third year activities focused largely on North America and China. In January 2006 the first transatlantic meeting of the associated project, EU-US SAFEFOOD, was held in West Virginia, attended by 19 Med-Vet-Net scientists. Several members of the Network had close associations with China, and it was clear that, as a growing exporter of food products to Europe, food safety and security were major issues for this country. The concept of international networking to harmonize and standardize pathogen detection was presented in meetings with food scientists in China and generated considerable interest for future collaborations.

By Year 3, Med-Vet-Net expertise and knowledge was actively sought by national and European governmental agencies, such as the UK Zoonoses Group and the EC Directorate-General for Health and Consumers, as well as non-governmental organizations and policy-forming groups, such as WHO and the European Technology Platform on Global Animal Health.

Several members of the Network had close associations with China, and it was clear that, as a growing exporter of food products to Europe, food safety and security were major issues for this country.

Year 2 (2006 annual report)

Objective 1: *Maintain and stabilize the 'Virtual Institute' management structure with the long-term aim of Network sustainability.*

Med-Vet-Net continued to progress towards achieving its overall objective of developing a virtual institute. The infrastructure required and the project management and scientific leadership were in place and working effectively in Year 2, although it was apparent that the workload would be larger than initially anticipated. Work was undertaken to address the issue of sustainability by investigating the potential legal mechanisms available. In addition, foundation work to generate structures to plan and implement processes to exploit new and existing funding opportunities was initiated.

Objective 2: *Deliver a high-quality research programme consistent with the strategic science plan, institute aims and objectives and EC requirements.*

All network partners were actively involved in the research programme under the leadership of the VLA. Of the 11 research workpackages started on 1 September 2004, nine (Workpackage 4, and 7–14) were completed in February 2006 and final reports have been delivered and published.

The major achievements of these finalized projects are given in each workpackage report but include contributions to European standard procedures, major reports and recommendations for policy makers, validation data for a patent, and European reagent and strain collections and repositories.

Scientific publications in peer-reviewed journals were key performance indicators for the Network. In the 12 months of Year 2, Med-Vet-Net participants published 22 papers crediting Network activities.

A five-year strategic science plan for the Network was completed and published in Year 2. As a consequence 11 new research workpackages were commissioned and initiated in March 2006. The new workpackages were particularly selected to extend and enhance some existing successful European networks, and address specific skills or data gaps especially in virology and Category 3 containment.

Objective 3: *Enhance remote communications by exploitation of modern, especially electronic, tools.*

The overarching workpackages focused intensively on improving internal communications under the leadership of SfAM. A subcontract commissioned to investigate the state-of-the-art in internal communications made no additional recommendations over and above the procedures that were already in place. In particular, the private website was overhauled to provide individual log-ins and password protection, which enabled the development of virtual-office-like facilities with workplaces dedicated to specific groups of collaborators. This was effectively used to store and access draft Deliverables for comment and correction.

In addition, an online web conferencing tool (WebEx) was purchased, successfully transforming communications within the overarching workpackages. The purchase and distribution of 100 webcams also enabled the tool to be rolled out to the scientific workpackages.

Objective 4: *Develop the skills and expertise in all areas but particularly cross-disciplinary technologies, project management at the European level and science communication.*

In Year 2, four training courses and workshops were delivered on topics as diverse as *Salmonella* in poultry, risk assessment, surveillance for new member states and pulsed-field gel electrophoresis, providing training for over 110 Med-Vet-Net and external scientists. In addition, two science communication interns were trained for three months full-time, and in-post training was provided for one trainee project manager.

For the first time in the project, PhD student training was initiated with 50% funding for four PhD students provided by the Network in four workpackages. Fourteen Network scientists were also funded to receive short-term mission training including attendance at scientific workshops, visiting other Network laboratories to learn new skills and undertake additional work associated with workpackage objectives.

Objective 5: *Provide an environment for the development, management and dissemination of knowledge in critical areas such as new and neglected zoonotic pathogens.*

Focus was placed on knowledge management within the Network in areas with limited critical mass by the initiation of Special Interest Groups (SIG) under the leadership of the VLA. The SIG on New and Neglected Zoonoses generated an active webpage to recruit interest from scientists both within and external to the Network, and held a meeting in Palermo in November 2006. A second SIG was also initiated as an extension of the Lyssavirus network developed in Workpackage 5.

Objective 6: *Establish a more inclusive associate/collaborative research network at the European level.*

External scientists were actively encouraged to attend the second Annual Scientific Meeting with 42 external delegates participating in the meeting in Malta. Over 70 external scientists also attended the four training courses/workshops on various aspects of surveillance and epidemiology.

Objective 7: *Involvement of stakeholders by expansion of the Communications Unit activities especially the public website, publication of science stories and the production of a 'glossy magazine'.*

The Communications Unit led by SfAM actively communicated with all external stakeholders via the public website, which was populated with news, a summary of Med-Vet-Net projects and background information on zoonoses. In order to specifically target policy makers and other scientists, articles were strategically placed in publications such as *The Veterinary Record*, *Science and Public Affairs*, and in European policy publications, such as *The Parliamentary Monitor* and *Health Director*. A glossy magazine intended to be published twice a year, began production in Year 2 but was superseded in Year 3 by the revamped Network newsletter, *Med-Vet-Net News*.

Objective 8: *Continued development of international collaborations with the long-term vision of a 'global network' of food safety/zoonoses networks.*

In Year 2 the Network, largely through the auspices of the VLA and SfAM, presented its activities at a number of major international meetings including the annual meetings of the American Veterinary Medicine Association and the American Society for Microbiology.

In November 2005, the associated project EU-US SAFEFOOD was initiated. The aim of the project was to develop collaboration between food-safety scientists in Europe and North America primarily through the involvement of two complementary networks — Med-Vet-Net and the Food Safety Research and Response Network. In addition to the formal collaboration, interactions with zoonoses-associated networks in Australia and New Zealand continued.

Year 1 (2005 annual report)

Objective 1: Establish and develop a workpackage for a durable and democratic management structure, with appropriate administrative support, written processes and procedures including mechanisms for review and assessment, based on a "Virtual Institute" as defined by a Consortium Agreement.

Objective 2: Develop and successfully implement a horizontal workpackage for Strategic Integration Activities, for the leadership of scientific activities through personal development and training, strategic review and planning in themed areas, internal communications and Network development and expansion.

Objective 3: Develop and successfully implement a horizontal workpackage for Spreading Excellence to ensure the external communication of scientific results, expertise and knowledge through state-of-the-art systems including a website, electronic journal and training in scientific communication.

Objective 4: Develop and successfully implement strategic plans for Joint Scientific Integration Activities encompassed within four workpackages (Epidemiology, Host-microbe interaction, Detection & Control and Risk Assessment) involving the initiation and resourcing of research projects related to the prevention and control of zoonoses as defined by the European Zoonoses Directive.

Objective 5: Plan, develop and implement strategies for the use and dissemination of knowledge, both among Network scientists and with other stakeholders, by exploitation of electronic communications, by the timely publication and presentation of joint research results, the successful establishment of an electronic scientific peer-reviewed journal and the organization of scientific meetings.

Objective 6: Develop, catalogue and curate available common Network resources including scientific expertise, collections of biological materials (pathogen collections, biological standards, clinical materials) and remotely accessible databases (for example for DNA sequences and fingerprinting profiles).

Objective 7: Develop and implement a strategic plan for the formal and informal training of Network graduate and post-graduate scientists including the exchange of PhD students, and for technology transfer between the participants and, where possible, to disseminate this to other European non-partner organisations.

Objective 8: Where feasible, expand the Network of Excellence to other expert scientists, by developing an extended network of associated partners, including other public health, veterinary and food scientists, both throughout Europe and worldwide, who will contribute to, and demonstrably benefit from, an association with Med-Vet-Net.

Summary of the work performed, contractors involved and major achievements for Year 1

Virtual Institute structure and Governing Board

The 16 Med-Vet-Net partners were integrated into a Virtual Institute under Workpackage 1 (supported by a legal Consortium Agreement) with governance provided by a Governing Board comprising members representing every partner at the institute director level. The Governing Board met twice (once electronically) and elected a Chair and Deputy Chair. As the role of the Governing Board became clearer, the Chair took up several management issues, in particular Performance Indicators, a Risk Register, the development of a complaints procedure, and contacts with EFSA and ECDC.

Co-ordinating Forum

The day-to-day management of the Network's scientific and integration activities was undertaken by an elected Project Manager supported by a management team of institute representatives (the Co-ordinating Forum). This Forum, with representatives from every partner, was chaired by the Project Manager and met twice in Year 1. The Co-ordinating Forum has a number of sub-committees with delegated responsibilities particularly for commissioning workpackages and training. In Year 1, the Co-ordinating Forum agreed the new Workpackage Plan and validated the newly commissioned workpackages. It also developed a cohesive and collaborative environment for discussion of Network activities. It also became evident in the first few months of the project that there was a need for scientific support and a succession plan for the Project Manager. As such the VLA appointed an Assistant Project Manager, which proved a very successful addition to the project management skills and expertise.

Administration and finance

An Administrative Bureau based at AFSSA was established and overseen by the Co-ordinator's Representative. The team was responsible for the development, presentation and implementation of processes and procedures related to financial, legal and administrative issues. It also supported the administrative tasks of the Governing Board and Co-ordinating Forum. In Year 1 the Administrative Bureau also developed experience in supporting scientific groups for meeting organization.

Issues of overlap of responsibilities between the three overarching workpackages — the Administration Bureau, Project Management Office and the Communications Unit — were addressed at monthly meetings introduced in March 2005.

Advisory Panel

An Advisory Panel comprising four senior external scientists and observers from EFSA and ECDC was convened. The Panel met once in Year 1 and provided a number of recommendations, which, were addressed where feasible.

Given the expense of management meetings in terms of travel costs and time resources, telephone conferences were regularly used by some groups. The experimental use of an electronic forum to replace for the Governing Board was unsuccessful at that time. Although such a means of communication proved unfeasible for the Governing Board it was expected that other groups could benefit from electronic methods of communication. The use of video conferencing was also investigated and considered beneficial. However, the capital costs for all partners required considerable

investment. Following an unsuccessful Specific Support Action proposal, a tender for expert advice was let to investigate and report the cost-benefits of video conferencing to the Co-ordinating Forum.

Strategic scientific integration

Strategic integration was developed and implemented within Workpackage 2, led by the Project Manager. A Thematic Representatives Group comprising up to four experts from each partner institute developed an integrated science strategy spanning the four thematic areas — epidemiology, host-microbe interaction, detection and control, and risk research. The group, which met twice in Year 1, was responsible for reviewing state-of-the-art in each of the thematic areas. The group also discussed and generated a Strategic Plan for the Network research activities.

The final strategy and reviews were published on the website in March 2006. The draft strategy determined the Network research direction and work plan for the time of the project. On the basis of the strategy, a research requirements document was developed for the next Joint Programme of Activities, which provided the basis for the online commissioning of new workpackages in open competition within the Network.

With the completion of the state-of-art reviews and the strategic scientific plan, the tasks of the Thematic Group were completed. Therefore, in the next phase of the project, the group was disbanded. However, it was considered that expertise in the core scientific thematic areas needed to be retained in the Co-ordinating Forum, thus the Thematic Co-ordinators continued to be involved in the Forum.

Development of research skills and expertise

Development of research skills and expertise was a central objective of Med-Vet-Net and a commitment by partners, and was implemented in a Sub-workpackage 2A. There were three major tasks — develop training courses, workshops, and a short-term mission programme for Network staff mobility between partner institutes. To support the programme, a Training Sub-committee of the Co-ordinating Forum was established with delegated authority to implement agreed training strategies. In Year 1, two training courses were agreed.

Nine short-term missions (STM's) were selected for funding during the first 12 months based on applications from scientists. In Year 1, although six missions were completed, it was a lower number than expected and the opportunity for extensive training was not fully exploited. As such, efforts were made during the following year to enhance both the uptake and length of the STMs.

Inter-network communications

In collaboration with Workpackage 3, inter-network communications were enhanced by a monthly newsletter and a private website that included a notice board.

The first annual Med-Vet-Net scientific meeting was organised at University College, Winchester, UK, between 29 June and 1 July 2005, and was attended by 183 delegates from across the Network.

Delegates made approximately 70 short scientific presentations and 104 poster presentations. In addition, two keynote speakers provided overviews of the past and future of zoonoses. As it was the first meeting, the presentations from the Med-Vet-Net scientific workpackages were limited with only three given — by Workpackage 4, 8 and 11.

Communications and networking were major features of the meeting, later underpinned by a communications workshop with a guest speaker from the Science Media Centre at the Royal Institute, UK.

Overall, the presentation of state-of-the-art science in the various partner institutes and the networking in the first year generated novel concepts for integration for the next year and enabled the development of existing and new workpackages.

Common resources

As a key part of integration, a number of common resources were developed such as databases for pathogen genotyping and available skills and expertise, repositories of standard strains and reagents and harmonized methodologies across the human-animal chain. Standardization of databases was considered a priority and was undertaken by the Communications Unit supported by the HPA, and resulted in an education strategy being disseminated throughout the Network. The first database generated with the strategy was the DNA sequence database of lyssaviruses developed within Workpackage 5. The formats of some databases, such as that of PulseNet Europe, were limited by prior data acquisition systems.

Several repositories of strains, reagents and standards were developed within the scientific workpackages. For example, Workpackage 12 established common resources for *Cryptosporidium* spp. reference material (oocysts and extracted nucleic acids) that could be used for standardization of protocols, validation studies, spiking experiments and so on.

Development of international collaborations

A formal EU-funded collaboration (EU-US SAFEFOOD) was established with the Food Safety Research and Response Network in the USA. Similar funding opportunities were explored with other regions worldwide. An informal association with a similar network, the Australian Biosecurity Cooperative Research Centre for Emerging Infectious Disease, was also established.

Spreading excellence

The strategy for Network communications was undertaken within Workpackage 3. A Communications Unit was established employing professional science communicators with information technology skills and expertise based in Sweden. An effective internal communication system was established including a password-protected private website, which was extensively redeveloped. The private website enabled the development of electronic discussions and meetings, including a formal meeting of the Governing Board. Although this particular electronic meeting was as successful as hoped, many lessons were learnt and improved education enabled the future implementation of successful meetings. In this way it was anticipated that the financial benefits of e-communications would enable redistribution of funds into other activities.

Integrated research programme

In the first year, 11 research workpackages were funded. The selection of which was based on several criteria, but most particularly the provision of funding to sustain several internationally renowned co-ordinated European research networks — PulseNet Europe, CampyNet, FoodPCR and TrichiNet — and to generate new networks — CryptNet, VTEC, GIS and Risk Research. This activity was considered an initial priority for European integration. In general, this was a success and several of the networks (PulseNet Europe, TrichiNet and PCR2) progressed and sought sustainable funding from alternative sources. In addition, innovative and integrated work was initiated in several zoonotic disease areas with implications for international research and statutory regulations. For example, work on lyssaviruses generated considerable international collaboration.

The involvement of the partner institutes in the workpackages varied in Year 1 from four to 11 partners, with an average of 8.5, which led to a concerted effort in the second Joint Programme of Activities to improve partnership involvement both in the research aspects of the workpackages and in workpackage leadership. To enhance and develop scientific leadership skills and reduce the risk of leadership failure, deputy leaders were appointed from Year 2.

In general, workpackage research and outputs were extremely successful. Earlier recognition of the risks may have improved the opportunities for risk management and resolution of issues. Improved procedures, including the development of an active Risk Register and improved communications between workpackage leaders, institute representatives, the Administration Bureau and the Project Management Office, were introduced from Year 2.

Partner Institutes, Administration, Management, Co-ordination, Communications & Governance

Partner institutes

01 Danish Institute for Food and Veterinary Research (DFVF) (until 2008)
Copenhagen, DENMARK

Technical University of Denmark (DTU) (from 2008)
Copenhagen, Denmark
www.dtu.dk

02 Statens Serum Institut (SSI)
Copenhagen, Denmark
www.ssi.dk

03 The French Food Safety Agency (AFSSA)
Paris, France
www.afssa.fr

04 The Federal Institute for Risk Assessment (BfR)
Berlin, Germany
www.bfr.bund.de

05 The Veterinary Medical Research Institute (VMRI)
Budapest, Hungary
www.vmri.hu

06 Italian National Institute of Health (ISS)
Rome, Italy
www.iss.it

07 National Veterinary Institute (SVA)
Uppsala, Sweden
www.sva.se

08 National Institute for Public Health and the Environment (RIVM)
Bilthoven, The Netherlands
www.rivm.nl

09 Central Institute for Animal Disease Control (CIDC) (until 2008)
Lelystad, The Netherlands

Animal Sciences Group (ASG) / Wageningen University Research Centre (WUR) (until 2008)
Lelystad, The Netherlands

Central Veterinary Institute of Wageningen UR (CVI) (from 2008)
Lelystad, The Netherlands
www.cvi.wur.nl

10 National Institute of Hygiene (PZH)
Warsaw, Poland
www.pzh.gov.pl

11 Complutense University of Madrid (UCM)
Madrid, Spain
www.ucm.es

12 Institute of Public Health Carlos III (ISCIII)
Madrid, Spain
www.isciii.es

13 Health Protection Agency (HPA)
London, United Kingdom
www.hpa.org.uk

14 Veterinary Laboratories Agency (VLA)
Surrey, United Kingdom
www.defra.gov.uk/vla

15 The Society for Applied Microbiology (SfAM)
Bedford, United Kingdom
www.sfam.org.uk

Project management

16 Veterinary Laboratories Agency (VLA) (until 28/02/08)
Surrey, United Kingdom
www.defra.gov.uk/vla

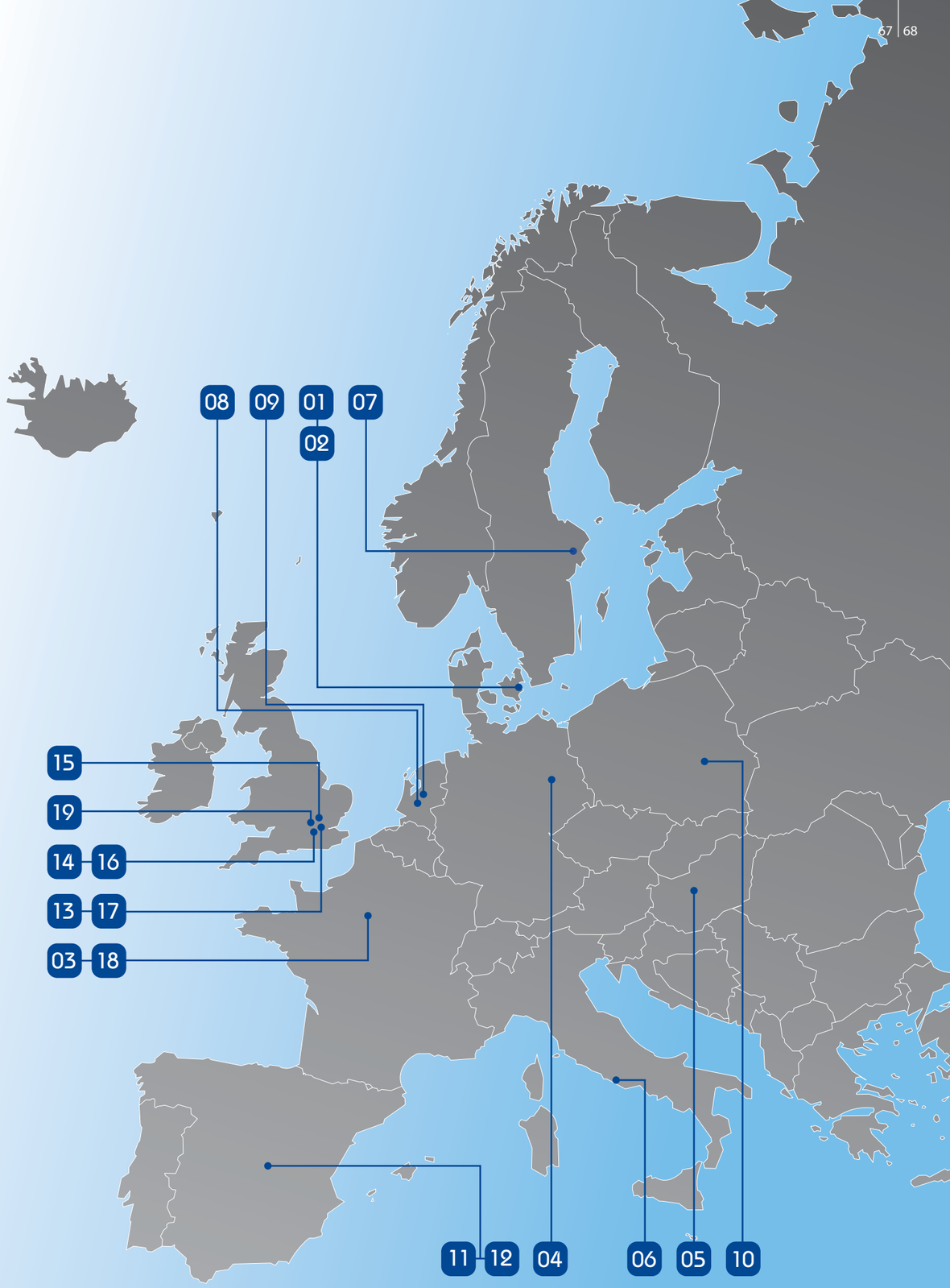
17 Health Protection Agency (HPA) (from 01/03/08)
London, United Kingdom
www.hpa.org.uk

Administration bureau & Co-ordinator's Representative

18 The French Food Safety Agency (AFSSA)
Paris, France
www.afssa.fr

Communications unit

19 Society for Applied Microbiology (SfAM)
Bedford, UK
www.sfam.org.uk
and
Science Communications Ltd (SC Ltd)
Milton Keynes, UK
www.sciencecommunications.eu



ACRONYMS

3D	Three-dimension(al)
aCGH	Array comparative genomic hybridization
AME	Aminoglycoside-modifying enzymes
AMR	Antimicrobial resistance
ASSuT/ACSSuT	Ampicillin (A), chloramphenicol (C), streptomycin (S), sulphonamide (Su), and tetracycline (T)-resistant clone of *Salmonella*
ASM	Annual Scientific Meeting
β-lactamases	Beta-lactamases
bp	Base pairs
CC	Clonal complex
CDC	Center for Disease Control and Prevention
CEF	Chicken embryo fibroblast
CEN	European Committee for Standardization
CF	Med-Vet-Net Co-ordinating Forum
CFT	Complement fixation test
CFU	Colony-forming units
CGH	Comparative genome hybridization
CIAs	Critically Important Antimicrobials
CLSI	Clinical and Laboratory Standards Institute
CampyNet	Med-Vet-Net scientific project to standardize molecular typing methods for *Campylobacter*
CNRS	National Center for Scientific Research, France
CommNet	European Communication Managers Network
CRAF	*Campylobacter* Risk Assessment Framework
CRL	Community Reference Laboratory
DALYs	Disability adjusted life years
DISCONTOOLS	EU-funded Disease Control Tools project
DNA	Deoxyribonucleic acid
DSM	German Collection of Microorganisms and Cell Cultures
EADGENE	European Animal Disease Genomics Network of Excellence for Animal Health and Food Safety
EBLV	European bat lyssavirus
E. coli	*Escherichia coli*
EC	European Commission
ECDC	European Centre for Disease Prevention and Control
EFSA	European Food Safety Authority
ELISA	Enzyme-linked immunosorbent assay
EMCV	*Encephalomyocarditis virus*
EMIDA ERA-NET	EC-funded European Research Area network on the Coordination of European Research on Emerging and Major Infectious Diseases of Livestock
EPEC	Enteropathogenic *Escherichia coli*
EPIZONE	Network of Excellence for Epizootic Disease Diagnosis and Control
ERA-NET	Networking of national programmes in European research areas
ESBLs	Extended-Spectrum β-lactamases
ETPGAH	European Technology Platform for Global Animal Health
EU	European Union
EU-US SAFEFOOD	A strategic European Union-United States research alliance on food-borne zoonoses
FDA	Food and Drug Administration, USA
fla	flagellar antigen (*flaA* tying)
FP	Framework Programme (e.g. FP6, FP7)
GB	Med-Vet-Net Governing Board
GIS	Geographical information systems
HEV	*Hepatitis E virus*
HRM	High resolution melting
HUS	Haemolytic uraemic syndrome
ICT	International Commission on Trichinellosis
iELISA	Indirect enzyme-linked immunosorbent assay
IFA	Immunofluorescence assays
IgM/IgA	Immunoglobulin M/immunoglobulin A
IHC	Immuno-histochemistry
IID-2	Second study of Infectious Intestinal Disease in the Community
ISH	*In situ* hybridization
JIFSAN	Joint Institute for Food Safety and Applied Nutrition, USA
JPA	Joint Programme of Activities
Kb	Kilobase
LEE	Locus of enterocyte effacement
MAbs	Monoclonal antibodies
MDR	Multi drug-resistant
MIC	Minimum inhibitory concentration
MLST	Multi-locus sequence typing (analysis)
MLVA	Multi-locus variable number tandem repeats
MST	Multi-spacer sequence typing
NADIR	Network of Animal Disease Infectiology Research Facilities
NCE	National Centre for Epidemiology, Hungary
NCTC	National Collection of Type Cultures, United Kingdom
NoE	Network of Excellence
OIE	World Organisation for Animal Health
ORFs	Open reading frames
okPCR	Polymerase chain reaction
PFGE	Pulsed-field gel electrophoresis
QRMA	Quantitative Microbial Risk Assessment
Q-PCR	Quantitative polymerase chain reaction
qnr	quinolone resistance gene (plasmid-mediated)
RAPD	random Amplification of Polymorphic DNA
RNA	Ribonucleic acid
RT-PCR	Real-time polymerase chain reaction
Safefood-ERA	Safefood European research area
ser	Serotype or serovar
SGI1	*Salmonella* Genomic Island 1
SIG	Special Interest Group
SME	Small to medium enterprise
SPF	Specific pathogen free
SPI	*Salmonella* Pathogenicity Island
STM	Short-term mission
TBEV	*Tick-borne encephalitis virus*
tet(A)	*tetracycline gene type A*
VTEC	Verocytotoxin-producing *Escherichia coli*
WIREDZ	Wildlife-related Emerging Diseases and Zoonoses
WP	Workpackage

Acronyms for the Med-Vet-Net partner institutes are given on page 67.

Med-Vet-Net was a European Network of Excellence that aimed to improve research on the prevention and control of zoonoses by integrating veterinary, medical and food-science research. Comprising 15 European partners and over 300 scientists, Med-Vet-Net enabled these scientists to share and enhance their knowledge and skills, and develop collaborative research projects. Med-Vet-Net officially commenced on 1 September 2004 and was funded for five years.

MED•VET•NET

A EUROPEAN NETWORK OF EXCELLENCE
www.medvetnet.org