

DRAFT REPORT
OPEN SESSION
of the
**RESEARCH GROUP OF THE STANDING
TECHNICAL COMMITTEE**

of the
**European Commission for the Control of
Foot-and-Mouth Disease (EUFMD)**

**Paphos
Cyprus**

17-19th October 2006



Summary and Recommendations

Introduction

The Research group of the Standing Technical Committee (“Research Group”) of the European Commission for the Control of Foot-and-Mouth Disease (EUFMD) met in Closed and Open Sessions in Paphos, Cyprus, between 16 and 20th October 2006.

The Session was organised by the EUFMD Secretariat in FAO, and hosted by the Government of Cyprus. In total 10 members of the Committee were present, plus 130 observers. The Session was chaired by the Chairman of the Research Group, Dr Kris de Clercq.

The Open Session accepted papers for presentation in the major fields of importance for the prevention and control of FMD free regions of the world.

The papers presented were grouped according to technical disciplines, questions and themes for the Session.

The Conclusions and Recommendations of the Session are given below.

Item 1-Lessons learnt from the recent events in FMD control in the region:

Considering that:

1. lack of early warning of the emergence of new antigenic types of FMD type A has contributed to the scale of the subsequent regional epidemic in the I. R of Iran, and Turkey;
2. incursion of an African type A virus into the Mediterranean region has occurred for the first time in Egypt in 2006, leading to a widespread and severe epidemic in the naive animal population;
3. regional or national vaccine banks do not currently exist in the countries of the middle-east and that there is often a prolonged lead time before delivery of vaccine from commercial suppliers;
4. that delay in diagnosis of the new virus incursions has resulted from the use of diagnostic methods and reagents that did not sensitively detect emergent viruses of a different type or antigenicity;
5. there is a need to identify the extent of biosecurity measures to prevent new farm infections given the cost and impact of culling and vaccination programmes, given the widespread dissemination of the type A epidemics in Turkey and Egypt, and the type O epidemic in the northern Europe in 2001 which occurred during periods of cool and humid winter conditions which favoured virus transmission;
6. significant quantities of animal products are brought by air traffic into European countries every day by passengers from FMD endemic countries in Africa and elsewhere;
7. there is an increasing trade-driven movement of livestock commodities from FMD-endemic areas in Asia.

Concludes that:

1. the level of virus surveillance and typing has not been sufficient to detect the emergent type A Iran 05 virus before spread or the circulation of the A Egypt 06 strain in East Africa in the previous 8 years before the recent incursion;

2. that the antigenic variation in type A and SAT type viruses and dynamic nature of the disease situation requires continuous monitoring and risk assessment;
3. studies on the importance of each of the transmission routes for farm to farm infection in the 2001 epidemic in the United Kingdom indicates that efficiency gains in biosecurity could be an effective means to significantly reduce transmission and could strongly contribute to the control of an epidemic.

Recommends that:

1. full genome sequencing and research on the antigenic variation in type A viruses from west Asia be conducted to define the expected extent of vaccine strains required for this virus ecosystem;
2. guidelines be developed on the rate of sample collection and virus typing required to achieve early detection of new variants in west Asia and other endemic regions where antigenic variation is expected;
3. increased effort is placed on virus type surveillance effort in east Africa and sample submission to the OIE/FAO RL network;
4. the RG/WRL at each Session provides a list of priority virus strains to which diagnostic tests in the Europe and neighbouring regions be adapted; and where required revises diagnostic reagents to ensure sensitive detection of emergent viruses;
5. a review of the impact of biosecurity measures in FMD control programs in emergency FMD campaigns non-vaccinated, and the benefits: cost of raising biosecurity performance in affected and at risk zones during epidemic;
6. that guidelines for reducing risk of transmission between dairy farms in infected areas be developed or reviewed following experience obtained in the 2001 epidemic and on the basis of changing practises;
7. studies be conducted to identify the relative importance of intentional and unintentional animal products to the introduction and release of FMD into livestock in Europe, and on the likely impact of deterrent measures.

Item 2-Contingency planning and simulation exercises

Considering that:

1. The EU requires member countries to have contingency plans against FMD and to carry out simulation exercises of outbreaks of FMD
2. Mathematical models are very useful tools for simulating outbreaks and contributing to the process of policy formulation and decision making.

Concludes that:

1. Simulation exercises vary a lot between countries in terms of their scope and purpose
2. The results of simulation exercises are not always easily available
3. The outcome of mathematical models was very are sensitive to between farm contact rates. Models in general therefore require accurate data and assumption on mechanisms of spread in order to produce reliable outputs.
4. Mathematical modelling must be carried out as a multi-disciplinary process involving modellers, field epidemiologists, virologists etc
5. Mathematical models should not be used to produce policy directly but as a part of the process of policy formulation and decision support
6. Mathematical modelling is most appropriately developed and validated in between outbreaks rather than in an emergency situation.

Recommends that:

1. An expert group on FMD simulation exercises should be established which should produce a standard for the core components that national simulation exercises should contain and a standard format for reporting the results and outputs of such exercises
2. The reports of simulation exercises should be made available on an EU website
3. Where possible, simulation exercises should include national emergency planners and representatives from neighbouring administrations
4. Data on between farm contact rates, differentiating between direct, indirect and airborne routes are required
5. The availability of weather data and a model to estimate viral spread should be included in contingency plans. It may be helped by establishing an international database of such resources
6. Mathematical models should include realistic resource constraints
7. Models can be used to help policy makers estimate the required size of vaccine banks and their distribution and allocation in the face of different outbreak scenarios
8. Systems for establishing collaboration between mathematical modellers, field operations and virologists should be established
9. Discrepancies between models should be addressed by establishing a consensus on simulation models and their parameterisation in order to improve simulation banks of possible disease spread within and between European countries for different outbreak scenarios. The QUADS process forms a good starting point for how this might be done.

Item 3 Epidemiology and Surveillance and Freedom from Disease Sessions**Considering that:**

1. There continues to be the threat of introduction of FMD into the EU with increases in Asia 1 outbreaks in Asia, new A and O strains in the Middle East and incursion of a new African A virus to Egypt
2. Africa continues to have outbreaks of SAT 1, 2, 3, O and A with low reporting across most of the continent
3. There are potentially few vaccine strains available to protect EU livestock populations from FMD
4. Molecular techniques are advancing rapidly allowing full genome sequencing
5. There are new international FMD projects in affected countries, e.g. on buffalo in Pakistan
6. Persistent infections in African buffalo is still of concern
7. NSP testing being widely used in South America and interpreted using serological profiling and cluster analysis
8. A number of newer techniques are being developed for analysing spatial and temporal clustering of outbreaks
9. There is still poor understanding of local spread of FMD

Concludes that:

There needs to be continued efforts to collect samples and report findings from outbreaks in endemic countries particularly in Africa and the Middle East with a good and harmonized record of all relevant data

1. There is great potential for full genome sequencing in FMD epidemiology, e.g. to identify the main routes of transmission between farms

2. There needs to be a much better understanding of the interpretation of NSP data and the use of serological profiling and cluster analysis for differentiating true and false positive outbreak clusters
3. There need to more study of vaccination in the face of outbreaks, both under laboratory condition and field situation

Recommends that:

1. The standardisation of all the reporting to the WRL should be encouraged, from the farms to the laboratory. This is also linked to the standardisation of diagnostic tools, methods and reagents. Comparison of data should then be facilitated and encouraged.
2. Full genome studies of selected UK outbreaks be supported to compare reported transmission routes and contacts from outbreak investigations with the most likely contacts from sequence analysis allowing prioritisation of local control activities.
3. There should be more discussions/workshop with the South American epidemiologists to exchange experiences on use of NSP tests and their interpretation
4. Collaborations with sub-Saharan Africa should be intensified and expanded to better understand the epidemiology and identify the full range of viruses circulating in the region.
5. That all the countries organise and standardise epidemiological surveillance systems and be supported in sample submission where necessary.
6. That research and data collection is intensified regarding wildlife species of potential epidemiological importance in FMD epidemiology. However, most of the risk is linked to domestic species and to their trade.

Item 4-Virus transmission, the art of understanding FMD spread

Considering that:

1. Contingency plans should consider the role of all relevant susceptible species in FMD outbreaks, there is a lack of data regarding inter- and intra species transmission of FMDV in wildlife and camels;
2. There is a need for improved knowledge of transmission and spread livestock populations, especially those at high risk of infection (cattle).

Concludes that:

1. Regarding susceptibility of selected North American wildlife to FMD:
 Bison (*Bison bison*), developed severe clinical FMD and could become infected from cattle, they did not transmit to calves within the studied time frame and there was no conclusive evidence of long term (>28 d) infection or shedding.
 Elk (*Cervus elaphus nelsoni*) are susceptible to FMD, but clinical disease is mild. There is little clinical or laboratory evidence of transmission between elk or elk and cattle.
 Pronghorn (*Antilocapra Americana*) are susceptible to and capable of transmitting FMD; lesions can be severe and would likely result in death.
 Mule deer (*Odocoileus hemionus*) are highly susceptible to FMDV and develop both oral and foot lesions. FMD would cause at least moderate mortality in wild mule deer. Intra and interspecies transmission occurred.
2. Regarding susceptibility of dromedary camels to FMD:
 Dromedaries appear to be of very low susceptibility to infection with FMDV serotype O. Although they may become infected at low level after direct inoculation, they appear not to transmit infection even by close direct contact; therefore dromedary camels are unlikely to play any significant role in the natural epidemiology of FMD.

Dromedary camels appear to only develop a limited initial antibody response to FMDV and no antibodies to NSP were detected.

3. Regarding FMDV transmission between cattle:
Transmission occurred between inoculated to donor animals (incubation period varied between 1 and 5 days) and FMDV infected cattle have been infectious for 4 days. No occurrence of transmission by the indirect contact route was observed, indicating the difficulty of airborne transmission;
4. Regarding FMDV excretion and transmission between dairy cows and calves:
Dairy cows showed more severe clinical signs than calves and excreted virus longer in cows, this also depended on mode of infection. No significant difference in virus transmission in groups of calves and dairy cows was observed;
5. Modelling airborne spread of FMDV is very complex and valid estimates require combining laboratory findings, good field work, modelling and experience of past outbreaks.

Recommends that:

1. More research needs to be done on the inverse age effect of FMD in cattle, including looking at susceptibility and differences in infectivity, and a possible association with strain-dependency. The relevance of the findings for contingency planning should be evaluated;
2. Continued systematic and well-planned experiments in dromedary and also in Bactrian camels with other serotypes and isolates should be encouraged and funded by relevant authorities and should in due time lead to a re-evaluation of the significance, if any, of FMD in camels;
3. In relation to airborne spread, that more work on current serotypes including Asia1, Sat2, and A be carried out; to immediately initiate experiments on any new outbreak strain from Europe;
4. Skills on clinical diagnosis and ageing of FMD lesions should be regularly up-dated.
5. The possibility of using model ensembles should be explored;
6. Further studies on the role of wildlife in FMD outbreaks relevant to a range of geographical regions are needed.

Item 5-Vaccine development, production and selection

Considering that:

1. Whereas existing vaccines can suppress clinical signs and limit the spread of disease, they cannot prevent the carrier state. They also cover only a limited number of strains and after several months to a year revaccination is required to maintain protection. In order to be able to develop improved and new vaccines, we need a better understanding of the immune mechanisms protecting an animal from FMDV infection. In particular, the roles of cellular immunology and cytokines need to be investigated;
2. In a field situation, the “challenge strains” circulating in a population will mostly deviate to some extent from the vaccine strain used. FMD-free countries maintaining a vaccine bank, which can only contain a limited number of strains, will have to use an existing vaccine when FMD is introduced. It takes several months to adapt a field isolate to a production system and perform the necessary tests on the new seed strain and the vaccine derived from it. From many field isolates satisfactory master seed strains for vaccines can not be produced at all. Since the decision on which vaccine strain should be used – or whether vaccination is not an option due to the lack of a

vaccine suitable for the strain that was introduced - has to be made within days, it has to be based on in-vitro methods. However, the results of existing in-vitro methods for the choice of vaccines (e.g. ELISA- and SNT – based r-values) currently can only be interpreted according to “rules of thumb” lacking a sound scientific basis;

3. Since the number of available vaccine doses is limited and also due to the costs and logistic problems of a vaccination campaign, the question whether or not (and when) a revaccination has to be performed requires careful consideration, for which - especially in a “heterologous” situation - a satisfactory data base may be missing;

Concludes that:

1. The immune response to an infection and the mechanisms providing protection must be studied in more detail;
2. There is an urgent need to test the ability of vaccine strains to protect against heterologous strains and correlate it to the results of in-vitro methods like r-values, sequences and mab-binding profiles;
3. There is insufficient knowledge on the duration of immunity, in particular in respect to heterologous strains.

Recommends that:

1. Research projects should be funded to improve the scientific basis for the development of new vaccines as well as the improvement, selection and usage of existing vaccines.

Item 6-Vaccine control: Validation, Quality Control and Quality Assurance

Considering that:

1. Vaccine control remains essential especially in the framework of emergency vaccination;
2. A study on the variability of the European Pharmacopoeia FMD vaccine potency test clearly indicated wide confidence intervals around the obtained PD50 result. Therefore, it is not possible to discriminate between a vaccine with a PD50 of 3, 6 or 10 based on the outcome of a single potency trial;
3. The relationship between vaccine potency and the proportion of protected cattle is influenced by serotype, type of adjuvant, valency and method of potency test;
4. A positive correlation was found between IFN-gamma response in cattle and protection against clinical disease;
5. Novel proteomics techniques can be used for in process control of vaccine antigens leading to faster process development and cost efficient manufacturing.

Concludes that:

1. The design of the Ph.Eur. FMD PD50 potency test leads to low in vivo repeatability and reproducibility;
2. The potency of a vaccine might be better represented by estimating the proportion of protected animals rather than the amount of PD50;
3. Preliminary findings on cell-mediated immunity related to protection against FMD are promising.

Recommends that:

1. Statistical validation of alternative potency methods is needed to make any further revision of the FMD Ph.Eur. Monograph possible;

2. Further studies are required to verify whether changing to proportion protected animals will make it easier to replace vaccine potency tests by serological tests;
3. Confirmation of the preliminary positive correlation between IFN-gamma response in cattle and protection against clinical disease is needed, also regarding other serotypes;

Item 7-Vaccine application

Considering that:

1. Following regulatory revision in the EU, FMD emergency vaccination without subsequent slaughter of vaccinates is an option in emergency disease management.

Concludes that:

1. Presently available FMD vaccines promote levels of antibodies in susceptible species, which are likely to provide protection from challenge providing adequate time is allowed for the response to develop. The time required to develop an adequate response depends on the intensity of the challenge;
2. Vaccination reduces virus replication (and therefore virus excretion) in cattle pigs and sheep, which would potentially reduce transmission during an outbreak;
3. FMD vaccines licensed for use in Europe do not induce antibodies against non-structural proteins, allowing the use of FMD emergency vaccination during an outbreak and the consecutive testing for spread of virus using ELISAs that can detect antibodies against non-structural proteins;
4. Recombinant antibody fragments are still unable to protect pigs completely although virus excretion was reduced;
5. Dendrimer peptides including B and T cell epitopes show potential for providing protection in pigs;
6. Development of IgA responses following vaccination may provide for a more effective protection.

Recommends that:

1. In order to rapidly apply vaccination in crisis situations, governments should identify areas where FMD emergency vaccination will be necessary if an FMD outbreak occurs;
2. Further studies on the correlation between IgA response after vaccination and protection are needed.

Item 8-Diagnostics: Detection and Typing of Infection

Considering that:

1. Early detection and typing of FMD viruses may reduce the number and severity of FMD epidemics;
2. Antigen detection and antigen typing assays may benefit from the use of monoclonal antibodies;
3. In addition to laboratory-based molecular diagnostic assays with high throughput and sensitivity, more user friendliness devices based on genome detection (portable PCR technology, isothermal techniques) or antigen detection (ELISAs, Lateral flow chromatography) are being developed.

Concludes that:

1. In a further step done in the characterization of the antigenic structure of FMD viruses by using monoclonal antibodies: the G-H loop of VP1 was confirmed to contain a major antigenic determinant also in SAT 1 and SAT 2 serotypes, and in addition new conformational sites were detected in these serotypes;
2. Simplified ELISAs using pan-FMDV or type-specific monoclonal antibodies showed potential for the detection and typing of all the seven FMDV serotypes;
3. A range of sensitive molecular diagnostic techniques with different levels of automation, speed and throughput are available for use in central and regional laboratories or in the field. A new isothermal method (RT-LAMP) may be particularly suitable as sensitive, simple and cheap test at the pen-side level;
4. The thermal imaging instrument for detection of the acute temperature and heat production at the feet of pigs and ruminants during the acute phase of FMD is not specific but can be used as support device for detection of FMD suspected animals in large sick herds.

Recommends that:

1. The activities of the laboratories producing and characterizing monoclonal antibodies should continue and be sustained as one of the strategic sources for diagnostic reagents, suited for typing of emergent FMD viruses;
2. Validation, including investigations of field samples, of novel diagnostic platforms either based on genome or antigen detection should be conducted with high priority. Resources and further studies should be dedicated particularly to the development and exploitation of cheap, simplified and rapid test-devices usable in the field;
3. Guidelines for use of field-based tests, as part of contingency plans and in developing countries, should be established;
4. Further data, including measurements in field cases, should be collected with the thermal imaging instrument.

Item 9 Diagnostics: Diva tests**Considering that:**

DIVA tests are important tools in substantiating freedom from infection following an FMD outbreak. Some of them have been extensively validated and guidelines on the application of DIVA tests in post outbreak serosurveillance programmes are available. Apart from the six validated DIVA tests, new assays are being developed based either on the same NSP antigen or on alternative approaches (e.g. detection of serum antibody to FMDV-3D and FMDV-specific IgA in saliva).

Concludes that:

1. In addition to the more classical comparison of different tests, other methods, such as Bayesian analysis and the use of likelihood ratios, are being applied to compare the performance of diagnostic tests. These methods can be of assistance in the interpretation of test results.
2. The bovine serum panel that has been developed could be a valuable tool in evaluating recently developed and future NSP-based assays.
3. Detection of FMDV-specific IgA in saliva has been shown to be a supplementary source of information in differentiating between vaccinated and infected cattle; the same should be true for both pigs and small ruminants.

4. In a field study of vaccinated and vaccinated and infected pigs, infection was readily detected by each of three NSP tests although discrepancies and differences in diagnostic sensitivities and specificities were observed between tests.

Recommends that:

1. Ovine and porcine serum panels should be assembled in order to evaluate the performance of different NSP-based DIVA tests in small ruminants and pigs; an inventory should be prepared of all of the available sera which have been collected from experimental animals (small ruminants and pigs) by the different laboratories participating in these test evaluation studies.
2. Conditions attaching to the use of serum panels should be established and should be circulated in the form of “guidelines” to all potential users; participating laboratories should agree to abide by these conditions/guidelines, in advance of receiving serum panels.
3. In order to reliably estimate sensitivity and specificity parameters for different DIVA tests in pigs, more data is needed on the occurrence of subclinical infection in vaccinated pigs and on the performance of the various tests in subclinically-infected herds.
4. FMDV-specific IgA responses in saliva should be evaluated in both small ruminants and pigs, for both vaccinated and vaccinated and infected animals.

Item 10-Diagnostics: Confidence in results: Quality Control/Quality Assurance

Considering that:

1. It is essential that laboratories understand the performance characteristics of their tests and that there are common standards in testing between laboratories;
2. It is a relatively simple matter to establish the degree of confidence in a particular laboratory test result by performing repeatability studies on samples covering the entire range of test result values;
3. Inter-laboratory testing exercises provide a valuable opportunity to compare which tests are used, how they are done and how their results compare after testing a common set of coded samples. This can provide a platform for improvement and harmonisation of methods.

Concludes that:

1. A simple method can be established within each laboratory for correlating confidence in a given qualitative test result to the quantitative read-out of the test itself;
2. The recently conducted Phase XIX inter-laboratory comparative trial has provided information on usage and performance of many tests in a large number of laboratories within Europe and the wider world;
3. Many conclusions can be made about differences between laboratories, but one striking discrepancy was in the sensitivity of methods for virus isolation in cell culture.

Recommends that:

1. The results of Phase XIX should be further analysed and discussed in detail at the forthcoming meeting of the National EU FMD Reference Laboratories in Brussels next month and should be discussed with EUFMD;
2. It is important that participants are given individual feedback concerning their performance and consideration needs to be given to other follow-up in relation to

- discrepancies identified. In this respect there is a need for a clear procedure to be followed taking into account the relationship with the CVO;
3. Consideration should also be given to establishing small-scale, but more regular system of external quality assurance using panels of virus-free sera, possibly distributed by a company specialising in this process;
 4. Future studies should aim to harmonise serology used for monitoring the efficacy of vaccination;
 5. Phase XX should include inactivated antigens to enable PCR tests in laboratories without BSL3 facilities.

Item 11-Virus - host interaction

Considering that:

1. Local cytokine responses in cattle (during the acute stages of FMDV infection in cattle) differ between sites of viral persistence and lesion predilection sites.
2. Persistence of FMDV in the oropharynx of cattle is associated with a single amino acid change in the VP2 protein of the infecting virus.
3. Using RT-PCR, virus has been detected in tonsillar tissue of pigs at more than 28 days after experimental infection.
4. Anti-viral agents have been shown to inhibit the replication of FMDV both in vitro and in vivo.

Concludes that:

1. Both virus- and host-related factors appear to play a role in the development of the “carrier” state in cattle.
2. FMDV infection may persist in the oropharynx of infected pigs, for longer than previously thought (albeit at a much lower level than in cattle).
3. Anti-viral agents have been shown to inhibit FMDV replication both in vitro and in vivo and may have potential for use in controlling the spread of infection during an outbreak.

Recommends that:

1. Further studies on FMD pathogenesis and virus-host interactions should be considered as a high priority area for research funding.
2. Viral and host factors which may lead to persistence of FMDV infection should further investigated; the scope of such studies should be broadened to consider different serotypes of the virus and virus isolated from naturally-occurring “carrier” animals.
3. The safety and efficacy of anti-viral agents should be studied in a field (disease outbreak) situation in an FMD-endemic area; further studies should also focus on the likelihood of FMDV developing resistance to these anti-viral compounds.

Item 12-Poster Session

Considering that:

1. A platform of simple ELISA based on the selected monoclonal antibodies has been used for the specific typing of all FMDV serotypes and for the type independent detection of any FMDV strain;
2. Automated extraction methods have been developed to simplify and increase RNA isolation efficacy for effective FMDV PCR implementation;

3. A novel artificial recombinant CPMV viruses, containing sequences that can act as internal controls for the diagnostic rRT-PCR for FMDV and SVDV have been developed;
4. Development of rapid “field – portable” diagnostic equipment for RT-PCR has been described. Real time RT-PCR assay for FMDV is developed on the basis of Bio-Seq™;
5. A strain specific rRT-PCR assay for analysis of FMDV replication in vivo has been developed;
6. A sensitive real time RT-PCR method have been developed (TaqMan) for specific detection of all seven serotypes of FMD virus;
7. An Adenovirus system has been used for gene delivery system. Four different adenoviruses in cocktail inhibiting FMDV replication and clinical symptoms in vivo;
8. Molecular characterizations of FMDV virus isolates from 2002 in Korea have been done. The biology and nucleotide sequences in pig and cattle isolates were present;
9. The first generation of microarray is capable of determining different serotypes of FMDV. The second generation is now on the way;
10. FMDV was reproduced in Dr. Sneider 2 cell system for driving a non-infectious material – virus-like particles for research purposes;
11. Two types of derivatives of FMDV (differing by plaque formation, their biological characteristics and growth in cell cultures) were studied in pathogenesis in mice;
12. The mechanism of cell mediated immune response in FMDV vaccine protection was studied and the role of cytotoxic T- lymphocyte response was investigated;
13. Two dominant B–cell epitopes of FMDV were modified and the experiments for the better understanding of the mechanisms of FMDV antibody protection were carried out;
14. The efficacy of T-1105 –Na antiviral agent was evaluated by subcutaneous injection of FMDV infected pigs and measurement of the virus excretion;
15. A sensitive validated alternative batch potency test based on serology (e.g. SNT, ELISA) has been established to develop a laboratory independent statistically valid correlation between serology and protection;
16. 3D protein was cloned, expressed and used in NSP ELISA for surveillance purposes;
17. The studies on comparative virulence of SVDV from Italy 1992-1997 showed a reduced virulence but they can elicit clinical signs and lesions. This phenomenon has no explanation till now;
18. A network of FAO and OIE for FMD RL has been established for the informatics network through world web site.

Concludes that:

1. Application of new variants of RT-PCR method for screening of a large number of samples for FMDV diagnosis gives the guarantee for efficacy and accuracy diagnosis;
2. The novel generation of microarray assay for determining different serotypes of FMDV is a new approach of FMD diagnosis;
3. Studies on biological properties and pathogenesis of FMDV should attempt to develop new specific virus inhibitors;
4. Studies on humoral and T-cell mediated immunity of FMDV helps for the better understanding of the mechanisms of FMDV antibody protection.

Recommends that:

1. Work on optimization of and validation of a portable RT-PCR machine for the detection of FMDV should be done.

List of titles presented in Poster Session

I. FMDV diagnosis using the molecular biological methods and monoclonal antibodies as follows:

1. Santina Grazioli *et al*

“Monoclonal antibody-based multiplex ELISA for the detection and typing seven serotypes of FMDV”

A platform of simple ELISA based on the selected monoclonal antibodies has been used for the specific typing of all FMDV serotypes and for the type independent detection of any FMDV strain.

2. Katja Ebert *et al*

“Comparison of RNA extraction methods for RT-PCR diagnosis of FMDV”

Automated extraction methods have been developed to simplify and increase RNA isolation efficacy for effective FMDV PCR implementation.

3. Donald King and al.

“Development of a novel encapsulated internal control for rRT-PCR”

A novel artificial recombinant CPMV virus, containing sequences that can act as internal controls for the diagnostic rRT-PCR for FMDV and SVDV has been developed.

4. Don King *et al*

“Detection of FMDV using a field – portable PCR equipment”

Development of rapid “field – portable” diagnostic equipment for RT-PCR has been described. Real time RT-PCR assay for FMDV is developed on the basis of Bio-Seq TM. Work on optimization and validations of the reaction are on the way.

5. J. Horsington *et al*

“Development of a strand specific real-time RT-PCR assay for analysis of foot and mouth disease virus replication in vivo.”

6. Lily Polihronova and Georgi Georgiev

“Application of TaqMan real time RT PCR for diagnosis of FMDV and correlation with SYBR Green PCR data”

Sensitive real time RT-PCR methods have been developed (TaqMan and SYBR Green). TaqMan real time RT-PCR is sensitive method for specific detection of all seven serotypes of FMD virus. Application of this assay will increase the capacity of the laboratory to process larger number of samples and to get the results in one working day. This is very convenient for screening of large number of samples and will guarantee our diagnostic ability for FMDV laboratory confirmation in case of FMD outbreak in Bulgaria.

II. Studies on biological properties and pathogenesis of FMDV

1. Kwangnyeong-Lee

“Antiviral strategy for FMD control in pig using adenovectors”

Adenovirus system has been used for gene delivery system. Four different adenoviruses inhibiting FMDV replication in vitro and in vivo.

2. Kwang – Lee

“Molecular characterization of FMDV isolates from Korea 2002”

Molecular characterization of FMDV virus isolates from 2002 in Korea has been done. The biology and nucleotide sequences in pig and cattle isolates were present.

3. Juliet P. Dukes *et al.*

“Development of microarray for viral characterization”

The first generation of microarray is capable of determining different serotypes of FMDV. The second generation is now on the way.

4. Michelle Remond *et al.*

“Towards the production of FMD virus-like particles in Drsohila Snaider 2 cells”

FMDV was reproduced in Drsohila Snaider 2 cell system for driving a non-infectious material – virus like particles for research purposes.

5. Kozuki Morioka *et al.*

“Comparison of the pathogenicity to suckling mice using O/JPN/2000 derivate of FMDV”

Two types of derivates of FMDV (differing by plaque formation, their biological characteristics and growth in cell cultures) were studied in pathogenesis in mice.

III. Studies on humoral and T-cell mediated immunity of FMDV

1. Annette Barfoed *et al.*

“Identification of immuno-dominant but non-protective FMDV CTL epitope in Balb/C mice”

The mechanism of cell mediated immune response in FMDV vaccine protection was studied and the role of cytotoxic T lymphocyte response was investigated.

2. Tina Friman *et al.*

“Humoral immunity against FMDV - significance of dominant and sub-dominant protective B-cells epitopes”

Two dominant B –cell epitopes of FMDV were modified and the experiments for the better understanding of the mechanisms of FMDV antibody protection were carried out.

3. Seiichi Ohashi

“Examination of control of FMDV excretion in the infected pigs by subcutaneous injection of antiviral agent T-1105 –Na”

The efficacy of T-1105 –Na antiviral agent was evaluated by subcutaneous injection of FMDV infected pigs and measurement of the virus excretion.

IV. Molecular-biological studies on structural and non-structural proteins of FMDV

1. Kaiser Claude *et al.*

“Cloning, expression and use of non-structural protein 3D expressed in insect cells for the surveillance of FMDV”

3D protein was cloned, expressed and used in NSP ELISA for surveillance purposes.

V. Studies on biology and virulence of SVDV

1. Kristen Tjornehoj and Soren Alexandersen

“Virulence of SVDV: Preliminary studies of comparative virulence of Italian SVDV isolates from 1992-1997”

The studies on comparative virulence of SVDV from Italy 1992-1997 showed a reduced virulence but they can elicit clinical signs and lesions. This phenomenon has no explanation until now.

VI. Web Information system of OIE and FAO for FMD and other exotic diseases

1. Jullie Stirling *et al*

“Plus for the exchanging FMD RL information via the World Wide Web”

A network of FAO and OIE for FMD RL has been established for the informatics network trough world web site.

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