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Frenkel's legacy: what is keeping us?

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1. Dr. H. S. Frenkel
   - his life, his work and his legacy -
2. Headlines of the joint FAO/OIE Global FMD Control Strategy
3. The role of research
   - learning from Frenkel's example -

Herman Salomon Frenkel (1891–1968)

1930: Appointed Director of the State Veterinary Research Institute (SVRI) with sole task: ***"Find the cause and develop methods to control FMD"***

1930-1941: Crisis period: Improvised facilities in Rotterdam. Research focus immediately on virus propagation methods in vitro: fetal skin of guinea pigs, cattle, pig and sheep in buffer with serum and under aeration. Problems with bacterial contamination!

1941: SVRI moved to new facility in Amsterdam: isolation provided by location on marine establishment and surrounding city. Problem: animal facilities not included – slaughterhouses used for animal experiments

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1940-1945: Dr. H.S. Frenkel was forced to resign as director of the SVRI and arrested by Nazi occupation

SVRI, led by deputy Dr. Van Waveren, produced Waldmann/Köbe vaccine based on virus harvested from infected cattle in slaughterhouses

1946: Dr. H.S. Frenkel returned to Amsterdam after surviving Theresienstadt concentration camp and recovery period in Switzerland. Research again focused on in vitro production of FMD virus

1947 and 1949: Publications in OIE bulletin and Nature about FMD virus culture in surviving cattle tongue epithelium explants

- In **1950** the majority of FMD antigen was produced in vitro:
  - Superficial layer of cattle tongue removed
  - Epithelial layer separated from underlying layer
  - Cultivation in medium with antibiotics for 24 hours at 37 degrees Centigrade under aeration with O2/CO2 mixture
  - Crushing, centrifugation, filtration
  - Adsorption onto aluminum hydroxide and inactivation with formaldehyde
- Epithelial production was mechanized and virus production scaled up to 40 liter vessels
- One tongue provided antigen for approximately 120 vaccine doses, each with 10 PD50
- In **1965** a maximum of 130.000 tongues was used

Machinery in the 50-ties:

-Brushing the tongues and harvesting tongue epithelium

-Water bath for virus culture

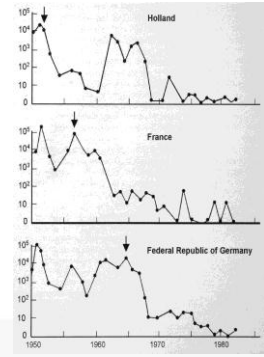
-Autoclaves for formaldehyde inactivation after virus adsorption onto aluminum hydroxide

-Storage of ready-to-use vaccine

Visit of Charles Merieux and C. Mackowiak to SVRI in Amsterdam in June 1958

Institut Merieux was the first to produce the "Frenkel vaccine" commercially

Method was deliberately not protected by patents



Number of FMD cases in Western Europe

Arrows indicate start of large scale vaccination campaigns

What are the lessons from these early experiences?

1. FMD can be controlled with classical vaccines, in combination with veterinary police measures...
2. If vaccine is used in a systematic manner...
3. By only vaccinating cattle...
4. Even in countries with a high density of cattle and other susceptible species...
5. But this can only be done in a concerted effort within the region...
6. And the FMD vaccine production facility should be biosecure...

Since Frenkel's time:

- FMD virus growth in BHK-21 cell cultures (Mowat, Chapman and Capstick, 1962) and in suspension cultures (Telling and Elsworth, 1965), allowing large scale production of cells, virus and vaccine
- Better virus and antigen quantification methods
- Improved inactivation methods with first order inactivants (AEI - Brown and Crick, 1959; (BEI) – Bahnemann, 1975)
- Improved adjuvants – saponin, oil and double oil emulsions, providing longer lasting immunity and making vaccination of pigs effective
- Better and faster diagnostic methods

•Better understanding of FMD immunology
•Better understanding of FMD epidemiology & risk factors
•Development of molecular-epidemiological methods (sequencing)
•Better understanding of biosecurity and bio-secure labs

and indeed...

•FMD has been controlled or largely controlled in several regions of the world where it occurred endemically (Western Europe, South America, parts of Southern and North Africa and South East Asia)

but still...

❑FMD is present in many parts of the world
❑FMD continues to present a threat for FMD-free countries
❑FMD blocks trade in animals and animal products
❑FMD hampers animal husbandry development In developing countries, lowers production efficiency and
❑FMD adds to food insecurity and to poverty at the household level

and we are not talking peanuts….

❑FMD damage worldwide is estimated at 5 billion US dollars per year and outbreaks in FMD-free countries have devastating effects – and cost 1 billion on average per year over the last 20 years (Rushton et al, Bangkok 2012)

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If all basic tools for FMD control are available: what is keeping us?

At the country level:

- ❑A perceived lack of incentives and thus lack of political will
- ❑Inadequate veterinary infrastructure (organization, staffing, expertise, laboratory support, legislation)
- ❑Lack of funds and no or limited external support

At the individual level:

- ❑Only specific categories may see the advantages (dairy farmers)

At both levels:

Vaccines are expensive, not readily available, not always up to standard, not always matching the prevailing field strains and need to be handled with care (cold chain)

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The joint FAO/OIE **Global FMD Control Strategy**

Notions and principles

❖**Component 1: FMD Control**

Basis: FMD control is not an utopia: we can do much better with existing means and methods –

- ○FMD-endemic countries should be better aware of the damage caused by FMD and the opportunities lost *[clear need for more socio-economic studies]*
- ○Only regional approaches will be successful as history has shown (Western Europe, South America, SE Asia)
- ○Regional approaches should take into account regional differences (for instance wildlife issue in Southern Africa)

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- ○Focus should be on FMD-endemic countries using a progressive, risk-based approach, mainly based on the FMD Progressive Control Pathway
- ○FMD-free (usually industrialized) countries should support the Global FMD Control Strategy, not just based on solidarity, but also on well-understood own interest (control at source)

❖**Component 2:** Progressive FMD control in developing countries will go hand in hand with improvement of Veterinary Services (VS)

❖**Component 3:** Improvement of VS will result in better possibilities to control other major diseases of livestock

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The 4 pillars of the FMD Control Strategy

1) *Combination and integration of the tools and instruments of FAO and OIE:*

- ▪The **Progressive Control Pathway (PCP),** embedded in a regional approach with roadmaps jointly produced by the countries
- ▪**Performance of Veterinary Services Pathway (PVS)**, with FMD-related critical competencies worked out per PCP stage

and by using the

- ▪**GF-TADs platform** for governance (with a possibility of acceptance of a PCP stage claimed by countries)
- ▪**OIE Terrestrial Animal Health Code** to provide incentives
  - endorsement of a national FMD control program
  - recognition of FMD-free status (with or without vaccination)

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2) *Strengthening the vital disease control support functions:*

- ▪**Laboratories** (with a proposed structure of national and regional labs, a coordinating global lab and linked by networks; with some additional staff and support)
- ▪ **Epidemiology** (similar structure proposed with national focal points, collaborative centers, coordinating center and networks; some additional staff and support)
- ▪ **Vaccines** (improvement of availability; vaccine test centers for quality assurance and vaccine matching; improved vaccination planning and post -vaccination surveillance)

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3) *Strengthening the "advanced-stage support functions":*

- ▪**Public/private partnerships**
- ▪**Biosecurity**
- ▪**Identification of farms and animals**
- ▪**Emergency responses**

4) *Continuation of research*

The FMD control Strategy advocates for **continued research**, in particular in the fields of diagnostics, strain characterization, vaccine development, vaccine quality control and epidemiology

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Aims

➢The FMD Control Strategy aims at **synchronous worldwide progress** and spells out **global targets** on a 15-year horizon, divided into 5-year periods for evaluation and management, **both for Component 1 (FMD) and Component 2 (Veterinary Services)**

➢**Component 3** of the Strategy (improvement of other disease control efforts and finding sensible combinations) **has to be worked out for each (sub) region,** whereby an important role is foreseen for the regional technical and economical organizations and the Regional GF-TADs Steering Committees

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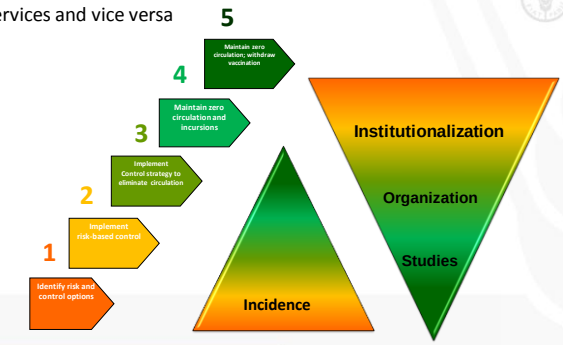
Conceptually: moving up means capacity building of Veterinary Services and vice versa



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Action plan

Action plan (typical activities) was worked out

- ❑ At country level – for each of the PCP stages and for each of the Strategy components
- ❑ At regional level
- ❑ At global level

The Global FMD Control Strategy and supporting documents are available on the websites

www.FMDconference2012

http://www.oie.int

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Financial implications

in USD as calculated by the World Bank for the first 5 years

- **Cost of national FMD programmes** **68 M**
  (to support 79 initial PCP 0-2 Stage countries)
- **Vaccination cost** **694 M**
  (to support 45 initial PCP 1-3 Stage countries)
- **Regional level** **47 M**
  (reference labs/epidemiology support and networks)
- **Global level** **11 M**
  (coordination, evaluation)

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Is that a lot?

The FMD damage in terms of production losses, trade opportunities, control costs etc is estimated at (Rushton et al, Bangkok 2012):

- ❑5 billion US dollars **per year**
- ❑Outbreaks in FMD-free countries cost 1 billion US dollars on average per year over the last 20 years
- ❑Although difficult to measure in figures, FMD can have severe effects at the household level in terms of food security and income
- ❑Outbreak control methods used in hitherto FMD-free countries are under severe criticism and may be difficult to apply in the future

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FAO/OIE GLOBAL CONFERENCE ON FOOT AND MOUTH DISEASE CONTROL
BANGKOK, THAILAND 27-29 JUNE 2012

Bangkok and post-Bangkok

Bangkok was not a pledging conference, but over 100 countries, regional organizations, development partners and stakeholders supported the launch of the FAO/OIE Global FMD Control Strategy

Roll out of the Global Strategy after Bangkok:

1.Countries where FMD is still endemic will be stimulated to step up their control efforts using the Progressive Control Pathway

2.Countries where FMD has been controlled, as well as development partners, will be requested to increase their support for FMD control at source (usually in developing countries)

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3. Specific attention will be paid to countries in the FMD virus pool regions 3, 4, 5 and 6, the need of which was indicated by the port folio review of the Global Strategy
4. Socio-economic studies will be stimulated to provide further evidence of the damage caused by FMD at the country, sector and household levels
5. In regions where incentives for FMD control appear to be lacking, studies and workshops will be initiated to develop multi-disease approaches tailor-made for the (sub)region
6. Specific support will be requested from development partners to fund the studies and regional and global activities foreseen under the Global Strategy

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Where does science come in?

1. Current and future research should assist in the roll out of the Strategy by providing effective **means, methods and expertise** to support and correctly implement the Progressive Control Pathway and move up the ladder
2. Science should help in **improving the availability and quality of FMD vaccines** as well as in **simplifying vaccine quality control procedures**
3. Science should help in **solving problems and answering questions** that inevitably arise in large-scale disease control efforts
4. Science should help to **lower the cost of FMD preventive and control actions**

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- **An enormous boost for the Global FMD Control Strategy would be the availability of a new generation of FMD vaccines** that have the desired characteristics: safe, effective, long term immunity, broad spectrum of field strains covered, less temperature-dependent and cheaper

- Such a breakthrough may even be needed to convince skeptics that progress with FMD control indeed is no utopia and to mobilize forces on a global scale **(Plan B -** if we fail to convey our message that we can do much better with existing means and methods)

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Dr. H. S. Frenkel's example should inspire both the scientific and the regulatory community:

- **With focus and dedication**
  and despite
  - 10 years of frustration during the economic crisis and
  - 5 terrifying years during World War II
- **He managed to move in just 5 years from the first experiments with FMD virus cultured on cattle tongue epithelium explants to large scale FMD vaccine use in practice!**

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Thank you for your attention

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GF-TADs joint FAO/OIE FMD Working Group

•J. Domenech (OIE) and P. de Leeuw (FAO) - co-chairs; N. Leboucq and B. Todeschini (OIE); G. Ferrari and S. Metwally (FAO)

• Consultants: A. Donaldson and J. Rushton

• Financial expertise: F. Legall and E. Fukase, World Bank

With indispensable contributions from regional organizations (EuFMD, AU-IBAR, SEACFMD; Panaftosa); country and regional representatives; individual experts; peer review group; OIE - SCAD; GF-TADs Management Committee and GF-TADs Global Steering Committee

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