Achievements of the epidemiological network for monitoring the dynamics of Foot and Mouth disease in the GLTFCA (CORUS Project, 2008-2011)

Jori, F., Heath, L., Etter, E., Caron, A., Massicame,Z. De Garine-Wichatitsky and P. Thompson

11th AHEAD-GLTFCA Working Group Meeting
2nd to 4th March, 2011, Mopani Camp, Kruger National Park

CORUS
Coopération pour la recherche universitaire et scientifique

Development of an epidemiological network for monitoring the dynamics of Foot and Mouth Disease within the GLTFCA

Justification of CORUS FMD Project

- High level of risk in the GLTFCA.
- Important gaps of information on FMD dynamics
- Several ongoing projects in the region

⇨ Need to create a regional network of partners working on FMD in this particular area

Specific objectives of the CORUS FMD Project

1. contribute to development of epidemiological tools to understand disease dynamics of FMD and evaluate its control methods
2. provide training opportunities and scientific support to facilitate capacity building
3. create a network to facilitate exchange of information about FMD surveillance, epidemiology and control within the 3 countries encompassing the GLTFCA

Consortium

Southern Africa, coordinated by UP, Faculty of Veterinary Science, University of Pretoria

- Prof. Nick Kriek (2007-2009)
- Prof. Peter Thompson
- W. Vosloo (Dept. Veterinary Tropical Diseases/ARC-OVI)

- University of Zimbabwe (Faculty of Veterinary Science)
  - Prof. D. Pfukenyi
- Instituto de Investigação Agraria de Moçambique (IIAM), Ministry of Agriculture
  - Dra Rosa Costa
  - Dr. Zacarias Massicame (MSc Student)

Europe, coordinated by CIRAD from South Africa

- CIRAD : F. Jori (RSA), A. Caron (Zimbabwe), E. Etter (Zimbabwe)
- Faculty of Veterinary Science, Utrecht (D. Klinkenberg)

Research areas

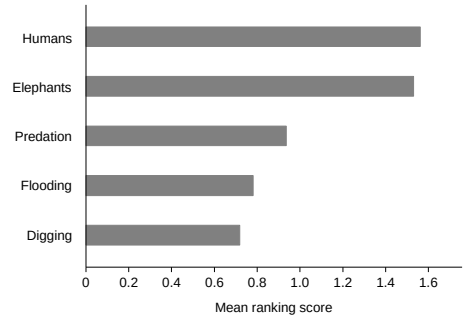
- Efficiency of FMD control strategies
  - Veterinary cordon fence permeability (RSA)
  - Vaccination efficiency (Zimbabwe, Mozambique)
  - Modelling risk of FMD transmission
  - Monitoring transboundary animal mouvement

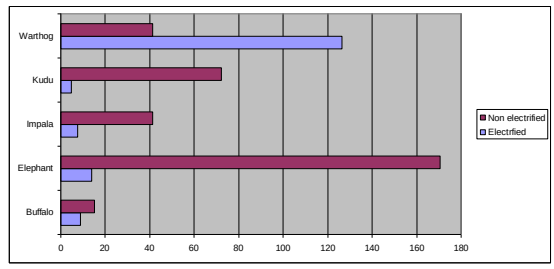
Fence permeability in KNP

- Study included 357 km of KNP fence
- Three sections
- 32 fence maintenance teams of 1-3 people each (epidemiological unit)
- 54 fence workers
- Semi-structured, interview-based questionnaire

Main conclusions

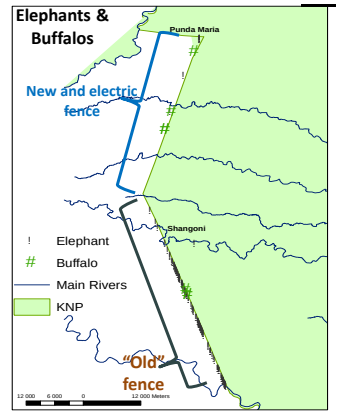
- Good idea of main causes of fence damage
- Lack of electrification was a strong predictor of elephant observation outside the KNP
- Elephant observation was a predictor for observations of other species outside the KNP
- Kudu, impala and buffalo may use elephant breaks to escape
- Questionnaire is useful tool for evaluating fence integrity and identifying risk factors and porous areas





Other methods tested

- Fence Incident Surveillance System (FIRM) using a more sophisticated quantitative and spatially explicit approach.



Initially tested in the North section of KNP, and now being implemented in the South.

Mozambique and Zimbabwe: Vaccination efficiency trials

- To characterise FMD virus isolates circulating in cattle and wildlife populations in the study areas

- To determine the antibody levels and duration in cattle vaccinated with current vaccines

- To estimate vaccine efficacy by comparing antibody levels in vaccinated and non vaccinated cattle

Mozambique

Massingir district three villages inside Limpopo National Park:

- Bingo,
- Machamba and
- Chimangue

Mabalane district Three villages outside LNP:

- Covela and
- Pfukwe
- Tsocate

3/4/2011

Sero-servey of cattle vaccinated with bivalent FMD vaccine in Mozambique. Zacarias Massicame

Mozambique

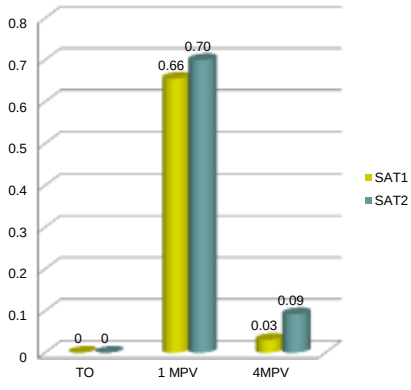
- Bivalent vaccine (SAT1 & SAT2)
- 2 singles doses T0 and T0+6months
- Longitudinal monitoring of animals at T0, T0+4
- 175 animals were vaccinated in both districts
- 42 animals were left as controls

Materials and methods

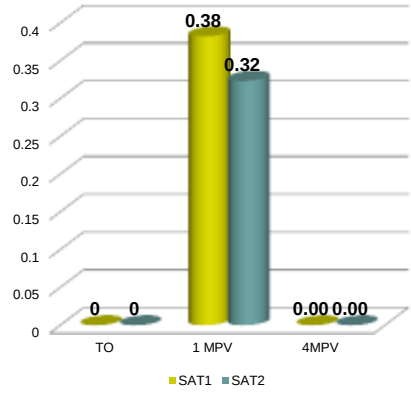
- Young cattle not less than 6 months of age
- Individually identified by labelled ear tags
- Analysis for the presence of antibodies against all 3 SAT strains at ARC-OVI.
  - Total screening with LBP ELISA
  - At specific time points (T3), positive samples, tested for *NSP 3ABC ELISA (CEDI)* to distinguish between vaccinated and infected animals

Proportion of animals seropositive (>=1.6) for SAT 1 and 2 (1 and 4 MPV)

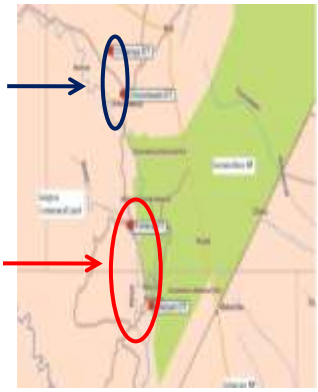
In LNP



Outside LNP

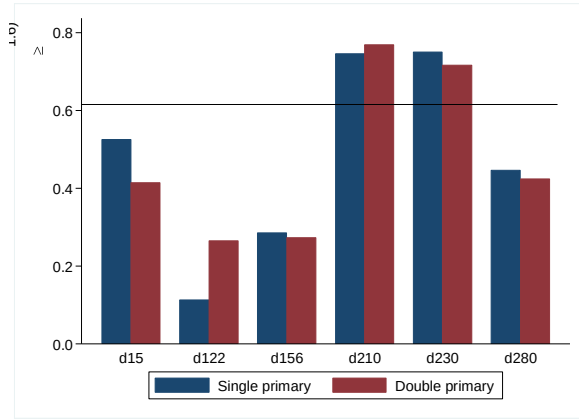


Zimbabwe



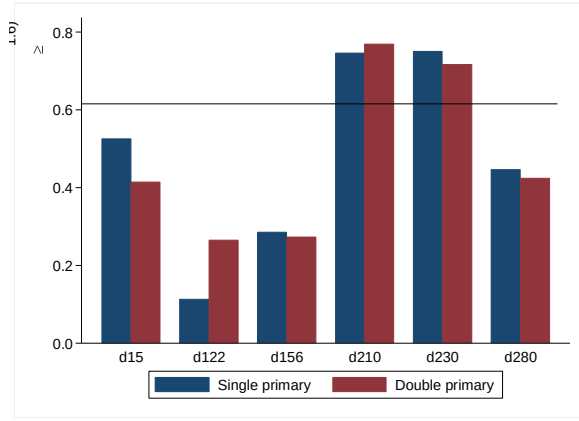
- Trivalent vaccine
- One vaccinated diptank & one control diptank
- Total 240 animals vaccinated and 48 left as controls
- Vaccinated animals received two
  - 2 primary vaccination (15 days)
  - 2nd vaccination at 6 months
- Monitored longitudinally during one year
- Sampled at 2 weeks, and at 4, 5, 7, 8 and 10 months post vaccination (

Conclusions



- Primary vaccination provided a significant antibody reaction close to 50% of the animals
- Antibodies fall quickly below desirable levels in the herd at d122 and d156.
- Non significant improvement after second primary vaccination 1 month later
- Revaccination at six months clearly improved the level of protection in the vaccinated herds
- Protective antibody reaction is not achieved in the majority of vaccinated animals.

Conclusions



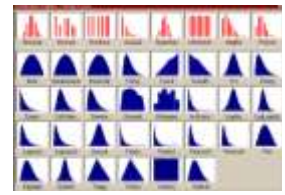
- Primary vaccination provided a significant antibody reaction close to 50% of the animals
- Antibodies fall quickly below desirable levels in the herd at d122 and d156.
- Non significant improvement after second primary vaccination 1 month later
- Revaccination at six months clearly improved the level of protection in the vaccinated herds
- Protective antibody reaction is not achieved in the majority of vaccinated animals.

These results require validation with a homologous antigens at BVI

Conclusions on vaccination trials

- The vaccination protocols implemented in Zimbabwe and Mozambique in our studies are clearly insufficient to protect from FMD challenges since it does not provide sufficient protection (tittres > 1.6) in the large part of the herd.
- Manufacturer currently recommends a 3-course primary dosages & boosters 4-mthly (6 doses per year)
- This is clearly inaccessible due to economic and logistic constraints for many countries in the region.
- Additional research to develop appropriate and realistic vaccination protocols is urgently needed in Southern Africa in other to control FMD at a national and regional level.

Modelling the risk of FMD transmission at the KNP interface



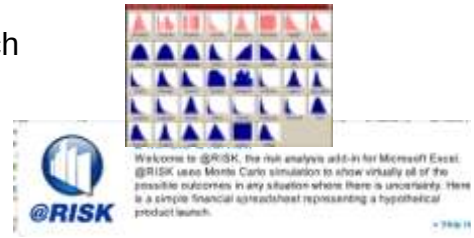
- Objectives
  - to understand and quantify the pathways leading to FMDV transmission between wildlife and cattle
  - to quantify those pathways and parameters having a major contribution to the risk of transmission
  - to give an estimate of the risk of transmission between cattle and wildlife in the interface of KNP.
  - to identify where are the most important information gaps of information regarding this topic

Materials and Methods

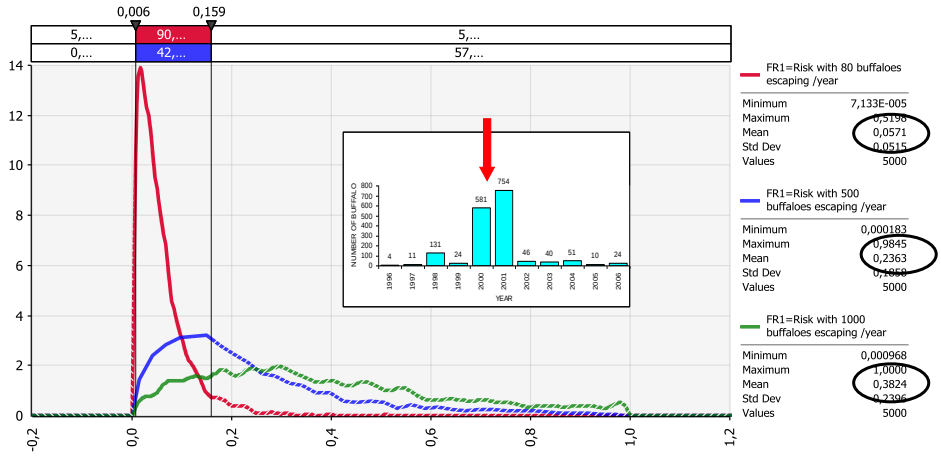
- Risk =annual probability for at least one cattle being infected by FMDV due to contacts with wild buffalo at the KNP interface.
- Two events were considered:
  - Event 1: buffaloes escaping from KNP
  - Event 2: Cattle entering KNP

Materials and Methods

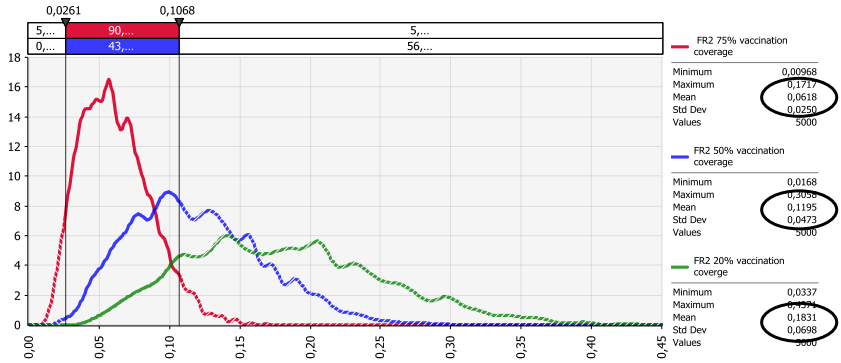
- Quantitative risk assessment was carried using software package @Risk (Palissade Corporation)
- Inputs are probability distributions calculated according to the information available or produced
- They are combined with each other, several thousands of iterations to produce final estimation of risk.



Scenario comparison of risk depending on numbers of escaped buffaloes



Influence of drop in vaccination coverage in risk of transmission



Conclusions

Positive points

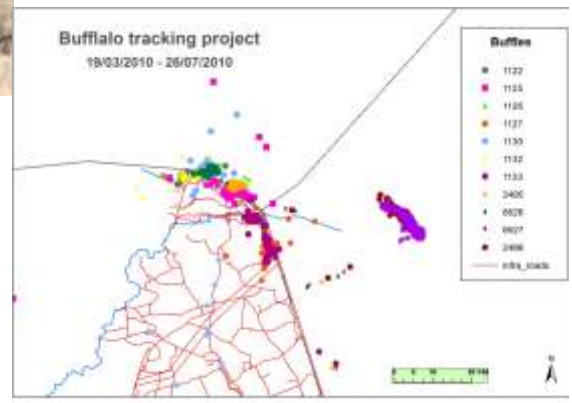
- Development of a tool useful to start modelling transmission at the wildlife/livestock interface
- Provides consistent responses to major FMD control strategies:
  - escapes of buffaloes,
  - vaccination coverage
- Highly flexible, integrative and relatively easy to use/ communicate

Areas of improvement

- Can be improved as new information is produced
  Cf: Vaccination efficiency
- Some inputs still require additional data to reduce uncertainty
  - Contacts wildlife/cattle difficult to assess
  - Number of young animals escaping

Contribution to GLTFCA Buffalo movement

.



Capacity building in the region

- 4 MSc students registered at UP
  - Zacarias Massicame, Moçambique
  - Shikumbuzo Ncube, Zimbabwe
  - Khumbulani Nyathi, Zimbabwe
  - Erika Pretorius, RSA
- Students participation to the different FMD and epidemiology workshops in the Region
  - ISVEE conference in Durban 2009
  - AHEAD meetings
  - CORUS meetings
  - MSc fees at UP

Scientific Production: 4 papers + 2-3 more expected

Jori, F., Vosloo, W., Du Plessis, B., Bengis, R. Brahmbatt, D., Gummow, B. and Thomson, G.R. 2009. A qualitative risk assessment of factors contributing to foot and mouth disease outbreaks on the Western Boundary of Kruger National Park. *Revue Scientifique et Technique*, OIE. 28(3), 917-933.

Brahmbhatt , DP, Fosgate , GT, Dyasson, E. , Budke , C. , Gummow , B. , Jori, F., Ward, MP and Srinivasan, R. 2011. Contacts between domestic livestock and wildlife at the Kruger National Park Interface of the Republic of South Africa. *Preventive Veterinary Medecine,* (provisionally accepted)

Jori, F., Brahmbhatt, D. , Fosgate, G., Thompson PN, Budke, C., Ward, M., Ferguson and B. Gummow. 2011. A questionnaire-based evaluation of the veterinary cordon fence separating wildlife and livestock along the Kruger National Park, South Africa. *Preventive Veterinary Medecine,* (provisionally accepted)

Ferguson, K. Adam, L and Jori, F. An adaptive monitoring programme for studying impacts along the western boundary fence of Kruger National Park, South Africa. In: *Hayward, MW & Sommers, MJ and Kerley, GIH (Eds). Fencing for Conservation. Fencing for Conservation*. Springer (in press).

Congresses (±12 presentations)

- Jori F., Heath L., Vosloo W., Costa R., Thomson G., Thompson P.2010.Serological monitoring of cattle vaccinated with bivalent FMD vaccine at the interface of Limpopo National Park, Mozambique. Foot and Mouth Disease International Symposium, 12-14 April 2010, Melbourne, Australia.
- Jori F., Etter E., Gummow B., Vosloo W.2010.A stochastic probability model to quantify the risk of transmission of foot and mouth disease virus at the wildlife/livestock interface of Kruger national park, South Africa. Foot and Mouth Disease International Symposium, 12-14 April 2010, Melbourne, Australia.
- Caron A., Heath L., Pfukenyi D., De Garine-Wichatitsky M., Thompson P., Jori F. 2010. FMD vaccination trial and viral circulation at the wildlife-livestock interface in the South-East Lowveld (SEL) of Zimbabwe. In : Foot and Mouth Disease International Symposium, 12-14 April 2010, Melbourne, Australia.
- Jori F , Vial L, Etter E , Akakpo J , Perez R , Blanco E and Roger F. Study of the role of the sylvatic cycle of African swine fever in Senegal. 12th Symposium of the International Society for Veterinary Epidemiology and Economics, Durban, South Africa, August 2009.
- Brahmbhatt DP , Fosgate GT , Dyason E , Gummow B , Jori, F , Budke C, Srinivasan R , Ward MP. Contacts between wildlife and livestock at the Kruger National Park Interface of the Republic of South Africa. 12th Symposium of the International Society for Veterinary Epidemiology and Economics, Durban, South Africa, August 2009.
- Jori, F. & P. Thompson. The CORUS FMD Project. An update of year 1. 9th Annual AHEAD meeting,, Namaacha, Mozambique, 4-6 Mars 2009
- Jori, F. The CORUS FMD Project: Development of an epidemiological network for monitoring the dynamics of Foot and Mouth Disease within the GLTFCA 8th AHEAD meeting, 5-7 Mars 2008, Hazyview, South Africa.
- Jori, F, Brahmbhatt D, Bengis R, Du Plessis B, Keet D Dyasson, E. and Gummow B. An evaluation of the fence in the Southern and Western boundaries of Kruger National Park. *8th AHEAD meeting*, 5-7 Mars 2008, Hazyview, South Africa.
- Jori F, Brahmbhatt, D, Kriek N, Vosloo W, and Gummow B. 2007. Development of a quantitative stochastic decision model for assessing the risks of animal diseases occurrence within the Transboundary Conservation Areas. Kruger National Park Science Network Meeting, Skukuza, 16h h-20th April.
- Jori, F., Du Plessis, B., Bengis,R.,Vosloo, W., Thomson, G.R. and Gummow, B. 2007. A qualitative assessment of the risk of foot and mouth disease outbreaks outside the western boundary of Kruger National Park. Proceedings of the 6th meeting of the South African Society of Veterinary Epidemiology and Preventive Medicine, Cape Town, 22nd -25th August 2007
- Brahmbhatt, D., Fosgate, G., Gummow, B., Ward, M. P. , Vosloo, W., Jori, F., Budke, C., Srinivasan, R. and L. Highfield. 2007. Defining the distribution of species susceptible to foot and mouth disease in the Kruger National Park interface of South Africa. Proceedings of the 6th meeting of the South African Society of Veterinary Epidemiology and Preventive Medicine, Cape Town, 22nd -25th August 2007.

Networking/communication

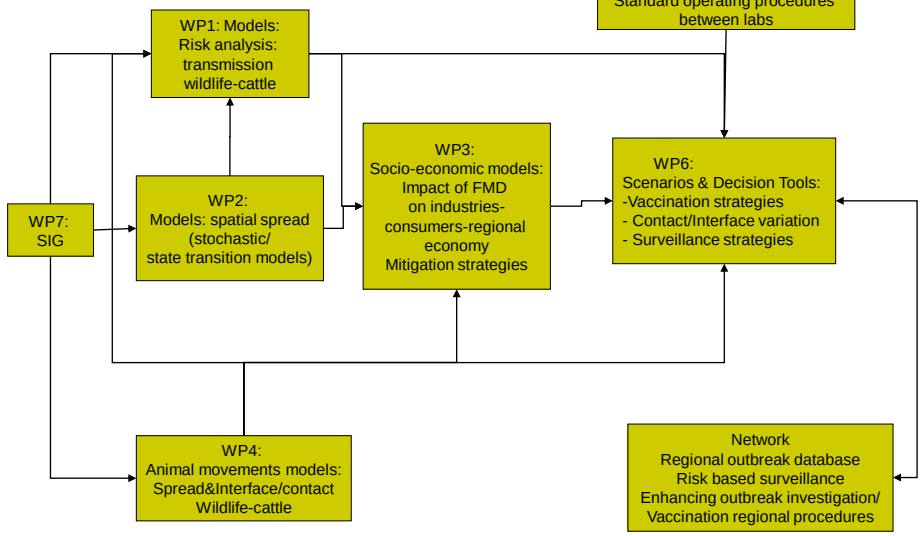
- Semestrial newsletter
- Annual meetings
  - 1st Kick off meeting, Pilanesberg, Feb. 2008
  - 2nd Meeting, Itundla Lodge, Dinokeng, March 2009
  - 3rd Meeting Casa do Sol, Hazyview, 22-23 March 2010

Forthcoming meeting Skukuza, 3rd-6th May 2011

- 6 sessions
  - Immunological prevention and control
  - Assessment of wildlife/cattle contacts
  - FMD modelling tools
  - Alternatives to current control strategies
  - Establishing priorities on FMD research & Way forward on regional FMD network

Save your dates!

FMD Ultimate Cooperation: Key-Issue



Conclusions

- Since the project started at least 12 outbreaks have been reported in the Southern African Region…Current FMD control methods have not been able to prevent those outbreaks and some have taken months to be controlled.

Conclusions

- Since the project started at least 12 outbreaks have been reported in the Southern African Region…Current FMD control methods have not been able to prevent those outbreaks and some have taken months to be controlled.
- Alternative actions for FMD control (cf. CBT) are urgently needed, but may take time…

Conclusions

- Since the project started at least 12 outbreaks have been reported in the Southern African Region…Current FMD control methods have not been able to prevent those outbreaks and some have taken months to be controlled.
- Alternative actions for FMD control (cf. CBT) are urgently needed, but may take time…
- In the meantime, cuurent methods need to be assessed and subsequently improved

Conclusions

- Since the project started at least 12 outbreaks have been reported in the Southern African Region…Current FMD control methods have not been able to prevent those outbreaks and some have taken months to be controlled.
- Alternative actions for FMD control (cf. CBT) are urgently needed, but may take time…
- In the meantime, cuurent methods need to be assessed and subsequently improved
- FMD should be adressed from a regional perspective and not only national

Conclusions

- Provided useful and applicable information for key FMD control issuesin the GLTFCA region targeting key
- Good scientific production
- Some of the outputs of the project can be adapted, updated and applied to different sites of the GLTFCA and in other areas in Southern Africa.
- Further funding is needed to pursue this regional experience beyond 2011 and expand to other GLTFCA facing similar problems.

Acnowledgements

- Ministry of Foreign Affairs / Embassy of France, Pretoria
- FAO ECTAD, Gaborone, Botswana
- TAD Scientific (G. Thomson)
- National Veterinary Services in KNP (R. Bengis, D. Keet)
- SanParks (M. Hofmeyr, P. Buss)
- FIRM Initiative (Ken Ferguson)
- National Veterinary Services, Mpumalanga Province (B. Du Plessis, O. Rikhotso)
- Department of Veterinary Integrative Biosciences, Texas A&M University (Dipa Brahmbatt, Geoffrey Fosgate, Michael Ward)