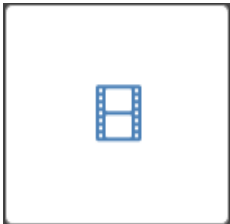


An update on Camel Prion Disease (CPD)



18th Annual Meeting of the TSE EURL

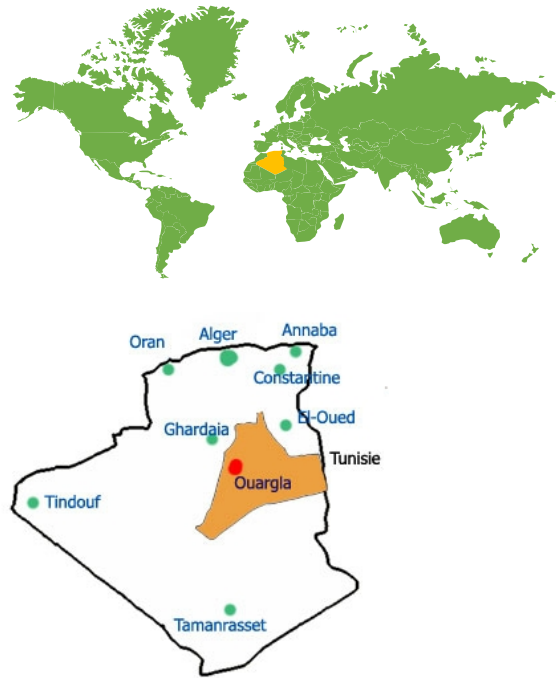
Torino, Italy

12th-13th September, 2019

Dr. Gabriele Vaccari

Where Camel Prion Disease was discovered

Since 2015 neurologic symptoms have been observed in adult dromedaries at antemortem examination in the abattoir of Ouargla, Algeria



- ✓weight loss
- ✓behavioral abnormalities
- ✓tremors
- ✓aggressiveness
- ✓hyperactivity
- ✓typical down and upward movements of the head
- ✓hesitant and uncertain gait
- ✓ataxia of the hind limbs
- ✓occasional falls and difficulty getting up

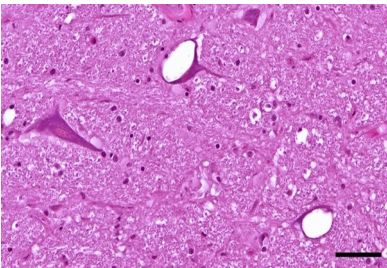


Dr. B. Babelhadj

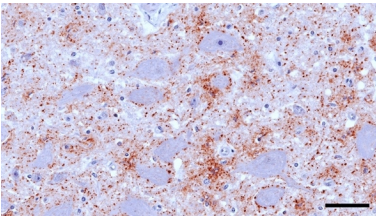
Diagnostic investigations camel prion disease (CPD)



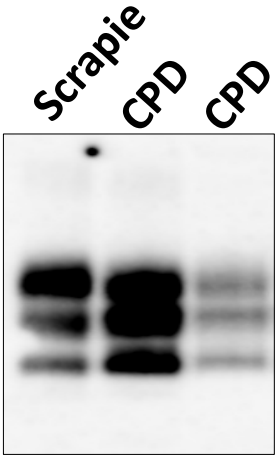
M.A. Di Bari L. Pirisinu S.B.S. Gaouar B. Babelhadj



Histopatological examination revealed the typical spongiform changes



Immunohistochemical examination revealed evident PrP^{Sc} deposition



12B2

Western blot analysis revealed PrP^{Sc} with a PrP^{res} classical electrophoretic profile

ID	Clinical symptoms	Sex	Age	changes	PrP ^{Sc} Deposition	PrP ^{res}
# 3	Yes	F	10	Yes	Yes	
# 4	Yes	F	11	Yes	Yes	Yes
# 8	Yes	F	13	Yes	Yes	Yes
# 5	No	F	14	No	No	

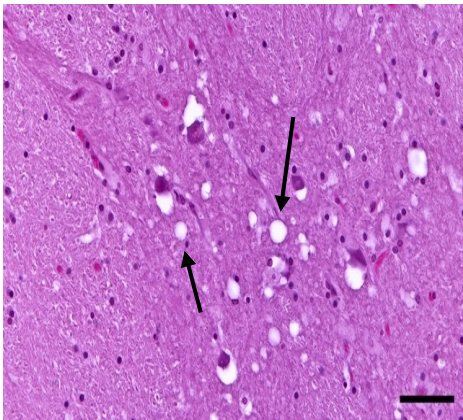
We confirmed diagnosis by detecting pathognomonic neurodegeneration and disease-specific PrP^{Sc} in brain tissues from dromedary camels and designate it as camel prion disease (CPD)

Histopathological, immunohistochemical examinations and PET-blot analysis

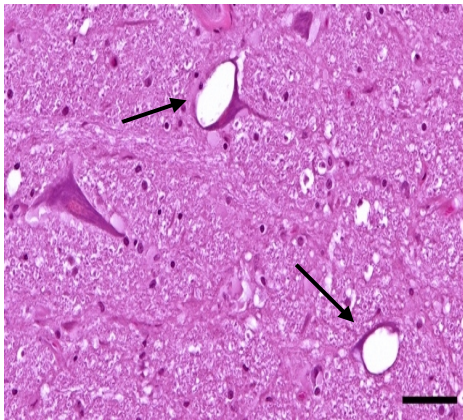


M.A. Di Bari G. Riccardi

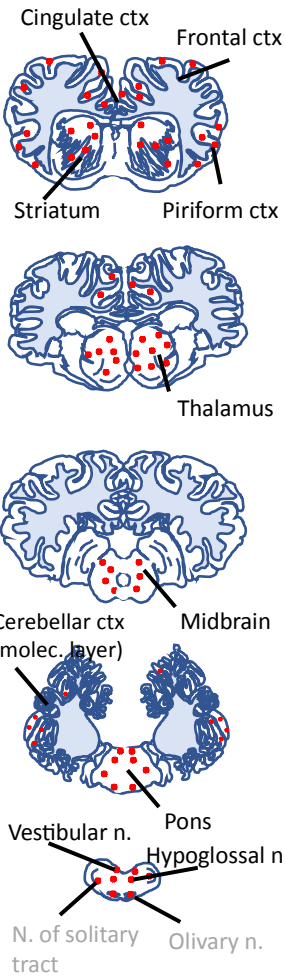
Spongiform change



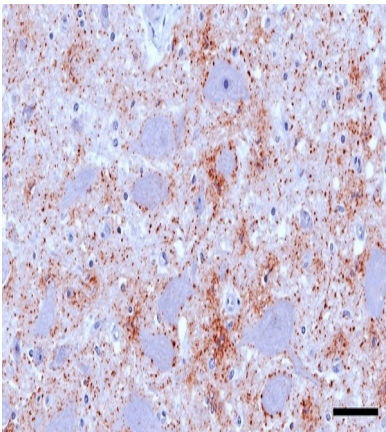
Thalamus



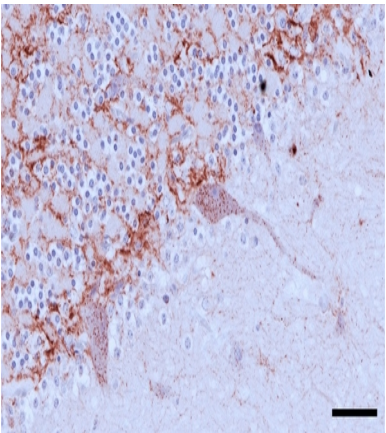
Pons



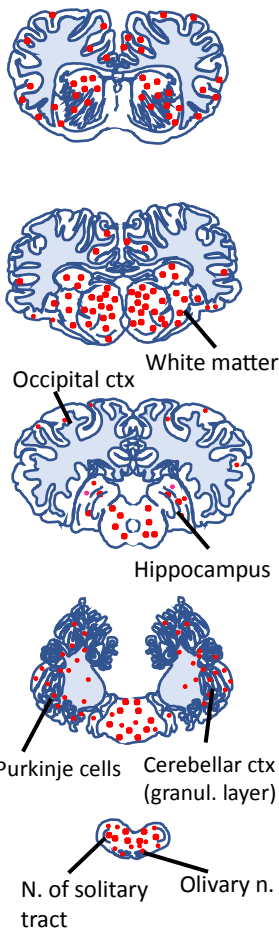
PrP^{Sc} distribution



Nucleus of the solitary tract



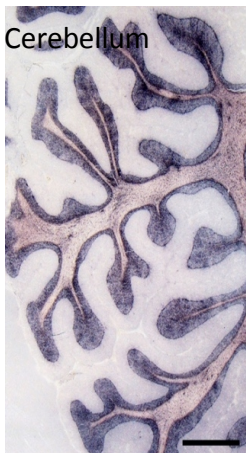
Cerebellum



Paraffin-embedded blot



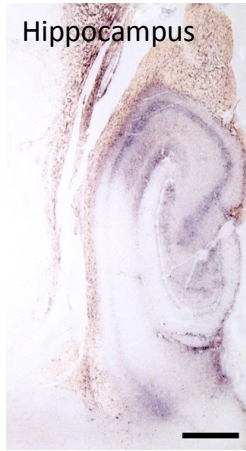
Prefrontal cortex



Cerebellum



Pons



Hippocampus

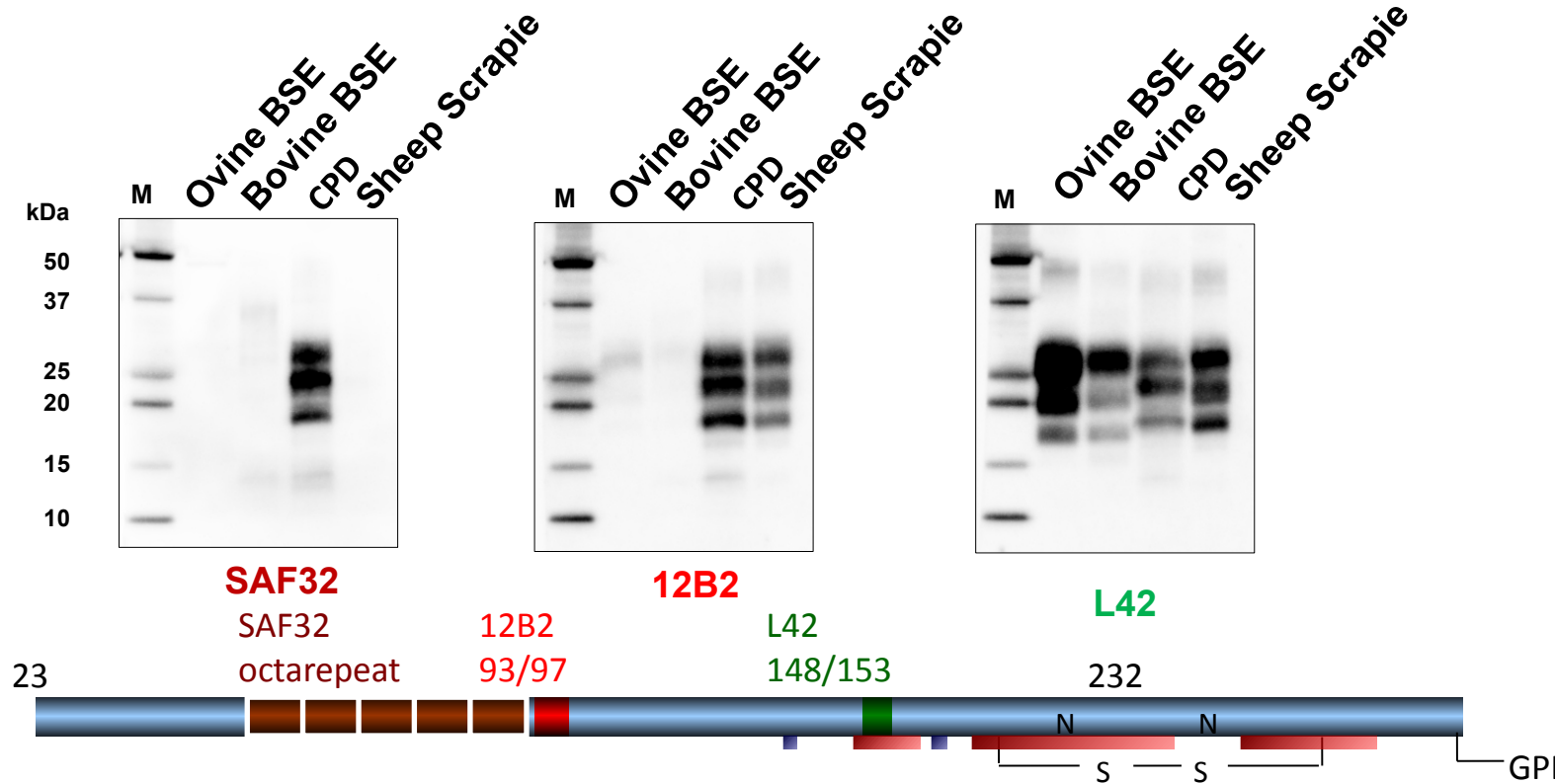
Is CPD similar to other animal prions?



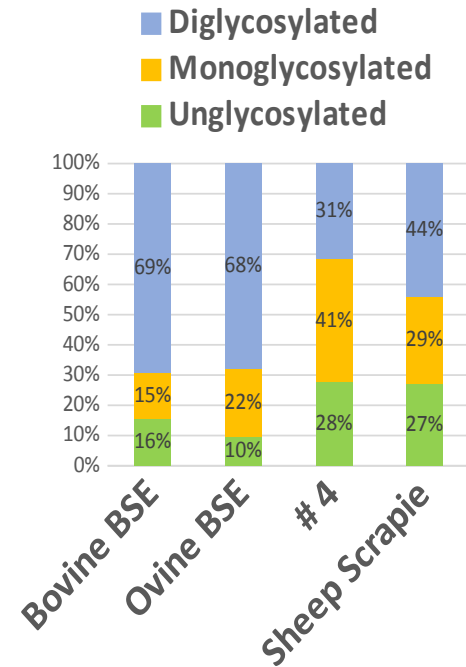
L. Pirisinu



S. Marcon



Glycotype



Molecular investigations show differences between CPD and BSE or scrapie

Bioassays in a panel of rodent models are ongoing for a thorough prion strain characterization of CPD

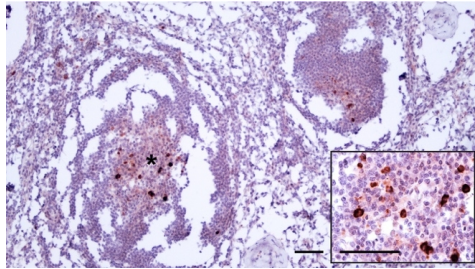
Immunohistochemical examination of lymphoid tissues



M.A. Di Bari

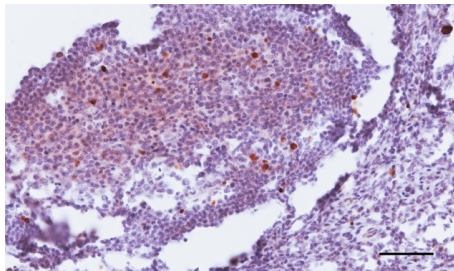


G. Riccardi



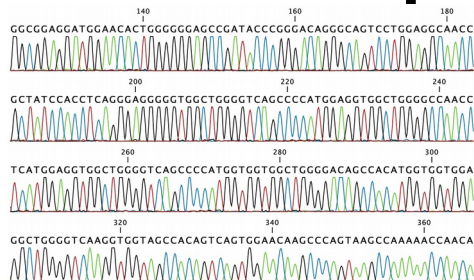
Cervical, prescapular, and lumbar aortic lymph nodes were collected from one symptomatic animal.

Immunocytochemistry revealed PrP^{Sc}-positive signal in all lymph nodes. PrP^{Sc} deposits involved >80% of primary and secondary follicles.

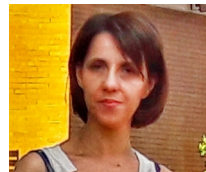


Such results concur to delineate a widespread involvement of peripheral tissues and to suggest the infectious nature of CPD

PRNP sequencing analysis



PRNP sequencing carried out in two animals for which frozen tissue was available, showed homozygosity for the wild type allele



B. Chiappini

Epidemiological investigations

Retrospective analysis of clinical suspects of prion diseases



B. Babelhadj

	2015		2016	
Month	N. of animals presented at the abattoir	N. of clinical suspects	N. of animals presented at the abattoir	N. of clinical suspects
January	63	/	67	3
February	70	2	83	4
March	86	1	73	3
April	79	2	85	3
May	97	3	93	4
June	81	1	117	5
July	92	2	135	6
August	121	4	145	7
September	31	1	44	5
October	42	1	110	4
November	89	2	164	4
December	86	1	206	3
Total	937	20	1322	51

- Retrospective analysis at abattoir, indicated a 3.1% prevalence of animals with neurologic signs suggestive of the disease.
- That figure appears to be reliable given that clinical suspicion was confirmed in all the 3 animals sampled
- The prevalence calculated on aged animals would be conceivably higher

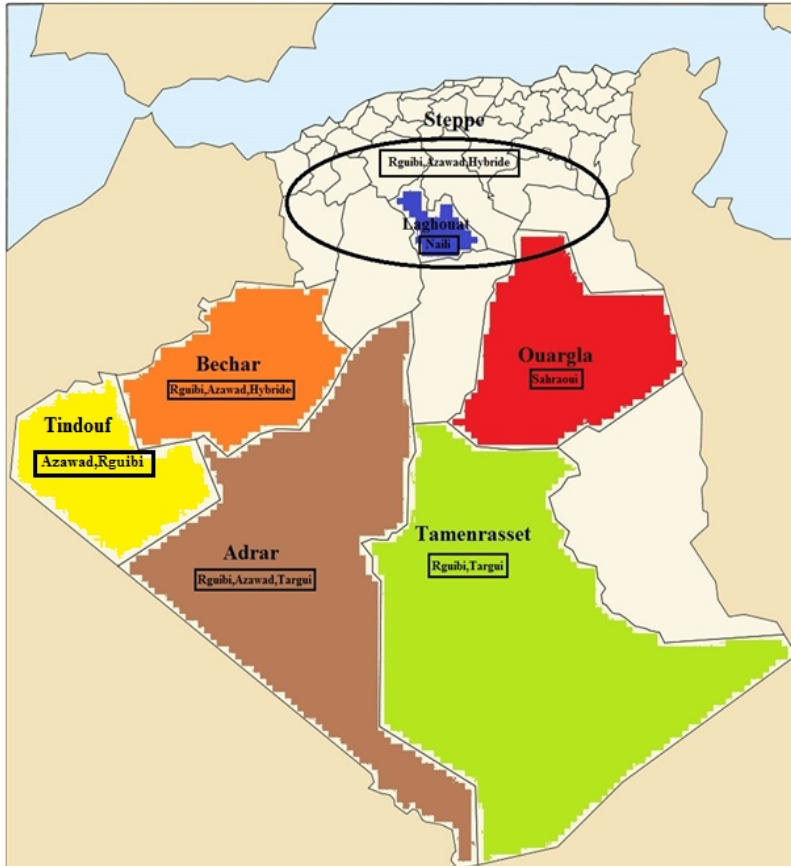
PRNP variability of the in Algerian dromedaries populations



I. Kaouadji



K. Meghelli



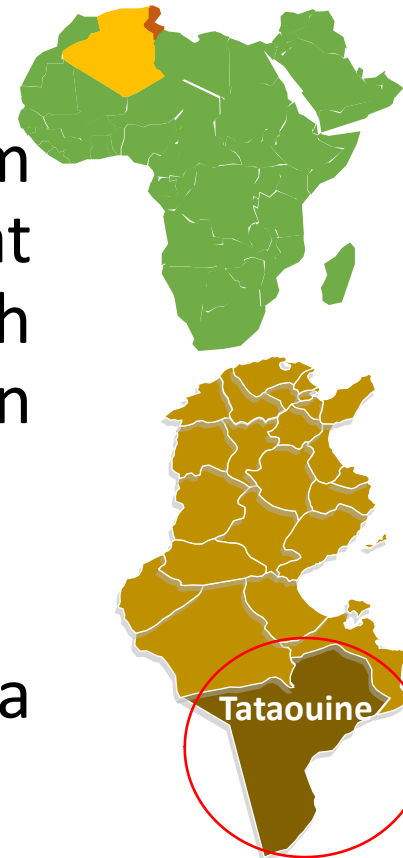
Breed	69 G/ G	69 G/S	134 G/G	134 G/E
Azawad (n=38)	100%	0%	97,4%	2,6%
Hybride (n=13)	100%	0%	92,3%	7,7%
Naili (n=23)	100%	0%	100%	0%
Rguibi (n=56)	100%	0%	92,9%	7,1%
Sahraoui (n=16)	100%	0%	100%	0%
Targui (n=86)	98,8%	1,2%	100%	0%

CPD surveillance in Tunisia



A. Abdelkader

- After the identification of CPD in Algeria, an epidemiological surveillance network was set up in Tunisia to monitor neurological diseases in dromedaries with a syndromic approach
- Brain and one lymph node were sampled in 2018 from a female dromedary with neurological symptoms that was presented at the abattoir of Tataouine in the south of Tunisia, at the veterinary services for authorization to slaughter
- Rabies was excluded
- In 2019 we received the samples from Prof. Amara Abdelkader



Histopathological, immunohistochemical examinations and PET-blot analysis

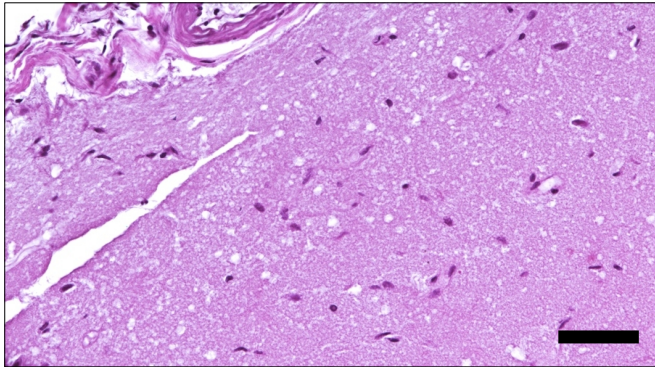


M.A. Di Bari



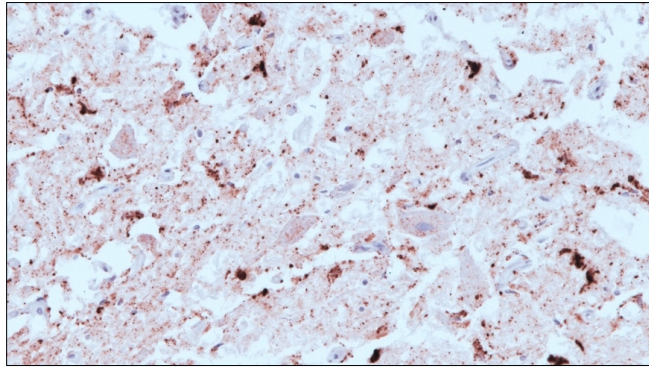
G. Riccardi

Spongiform change

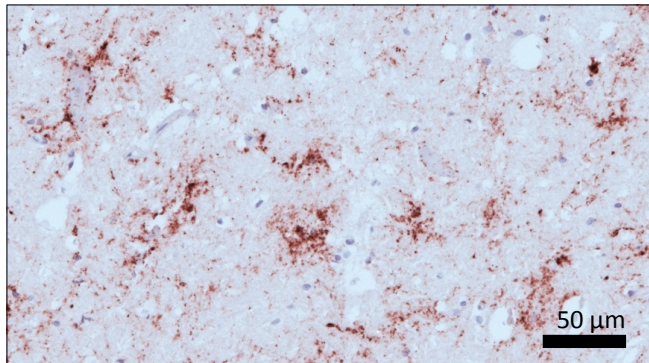


Temporal cortex

PrP^{Sc} distribution

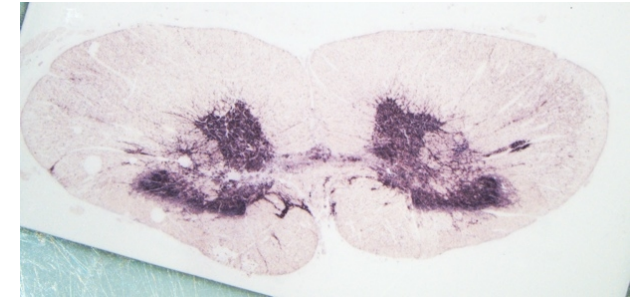


Dorsal nucleus of vagus nerve

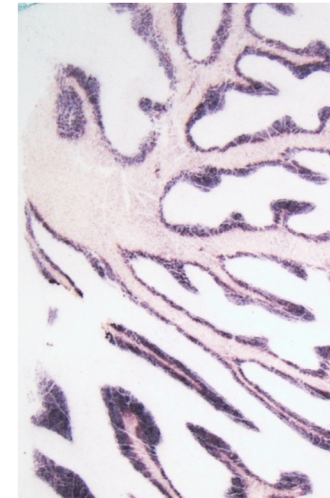


Thalamus

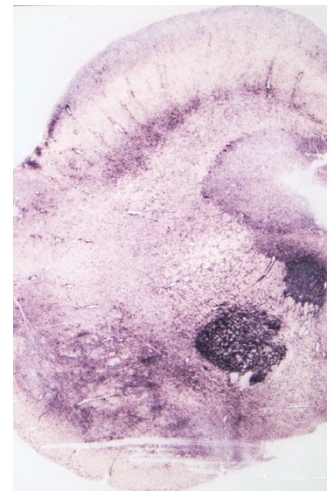
Paraffin-embedded blot



Medulla

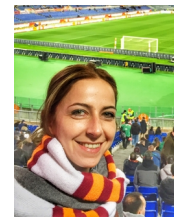


Cerebellum



Pons

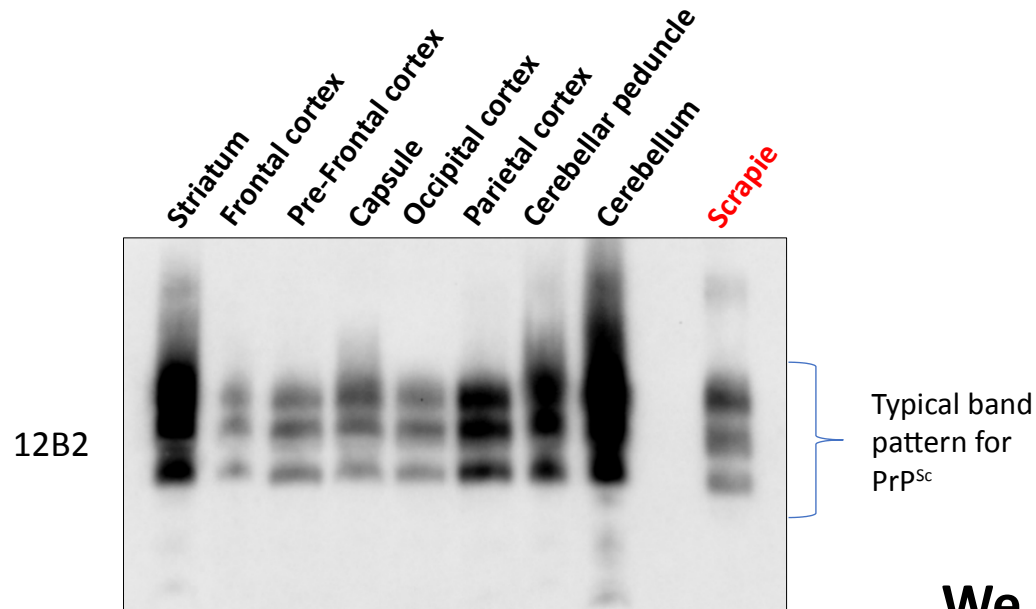
Western Blot for PrP^{Sc} on several brain areas of the dromedary brain sample



L. Pirisinu



S. Marcon



Western Blot analysis demonstrates the presence of the pathognomonic protease resistant PrP^{Sc} in different brain areas of the dromedary sample

We confirmed the diagnosis of CPD by detecting pathognomonic neurodegeneration and disease-specific PrP^{Sc} in brain tissues

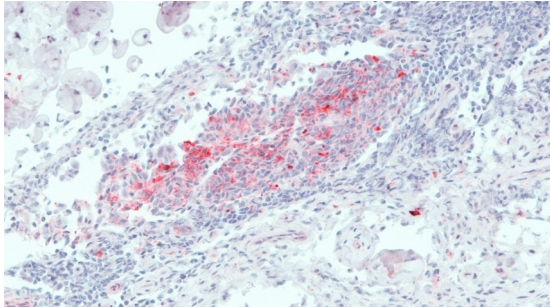
Immunohistochemical examination of lymphoid tissue



M.A. Di Bari

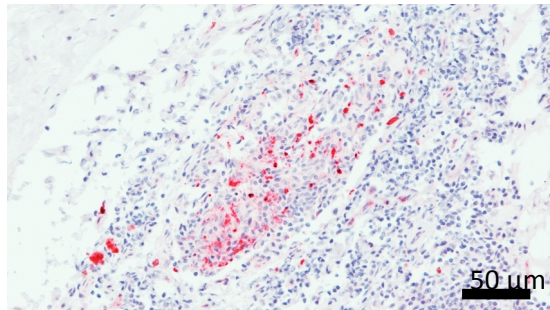


G. Riccardi



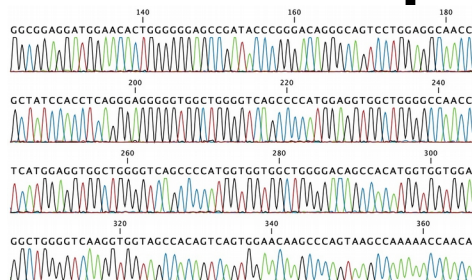
Retrosplenic lymph node was collected from the symptomatic animal

Immunohistochemistry revealed PrP^{Sc}-positivity



PrP^{Sc} deposits involved >80% of primary and secondary follicles suggesting an abundant involvement.

PRNP sequencing analysis



PRNP sequencing analysis showed that the animal was homozygous for the wild type allele described for dromedary



B. Chiappini

Epidemiological investigations



A. Adbelkader

Retrospective analysis evidenced that the animal derived from a herd of 72 animals (1 male and 71 females), Ardhaoui breed

Symptoms included spatial orientation and coordination loss

The index case, a female of 12 years of age born in Tunisia, was the only animal presenting symptoms

The herd was bred extensively, without the use of feeds and the grazing are bordering the Ouargla region

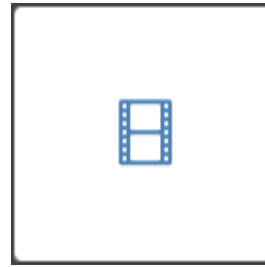
For dromedaries extensively breed, the borders at the East with Libya and West with Algeria are permeable

Tataouine region is the entrance of one of the three route of camel importation in Tunisia, deriving directly from the Algerian desert (Ouargla)



Conclusion

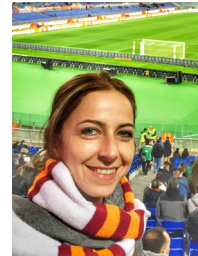
- **We described CPD in two bordering North African countries**
- **Evidences suggest that CPD has an high prevalence in the Ouargla region**
- **It would be important to understand the spread of the disease in Algeria, Tunisia and other Countries were camels are raised**
- **Preliminary results showed that the pathological deposition are very similar in all analysed animals**
- **Lymphoreticular system is involved**
- **Results obtained up to know suggest that CPD is a new, emerging and infectious prion disease of dromedary camels**



B. Babelhadj



M.A. Di Bari



L. Pirisinu



B. Chiappini



I. Kaouadjj



K. Meghelli



G. Riccardi



S. Marcon



U. Agrimi



S.B.S. Gaouar



A. Adbelkader



R. Nonno



G. Vaccari