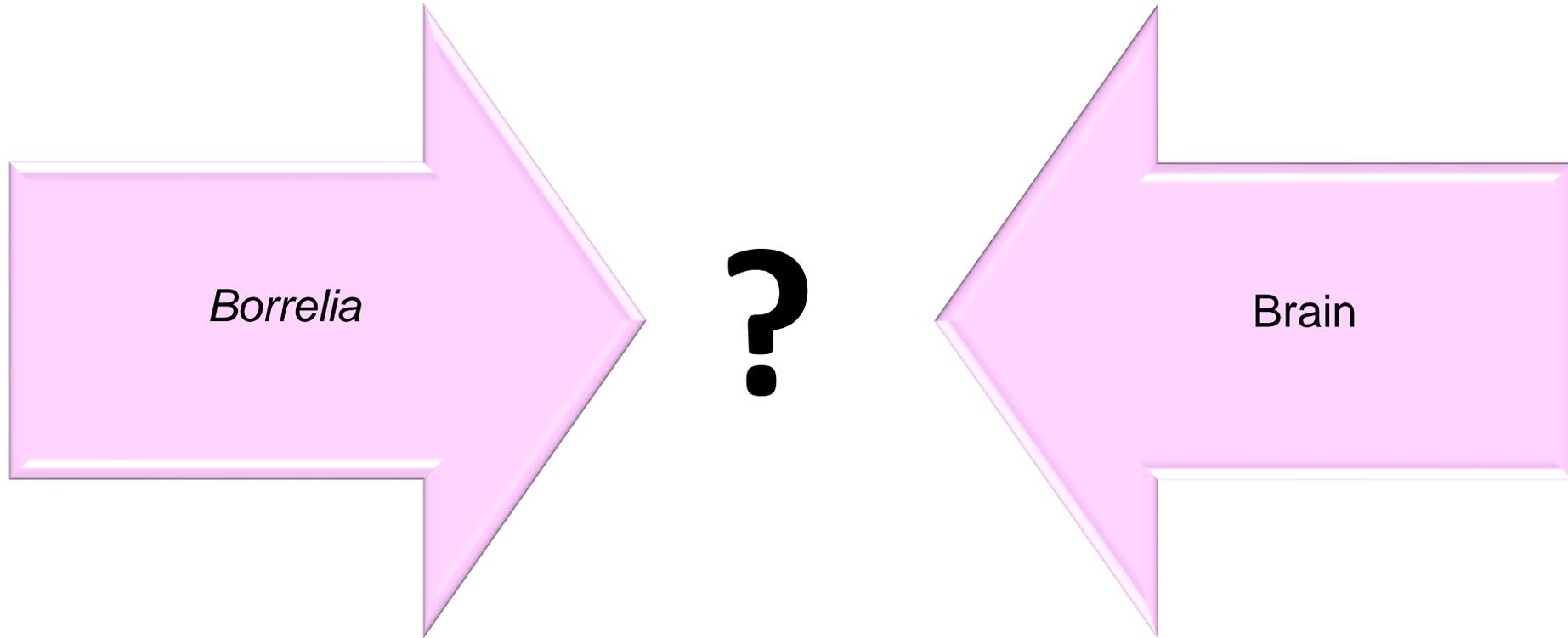


Direct detection of *Borrelia* bacteria in autopsy and necropsy brains

Amir Modirihamedan
Vett Lloyd



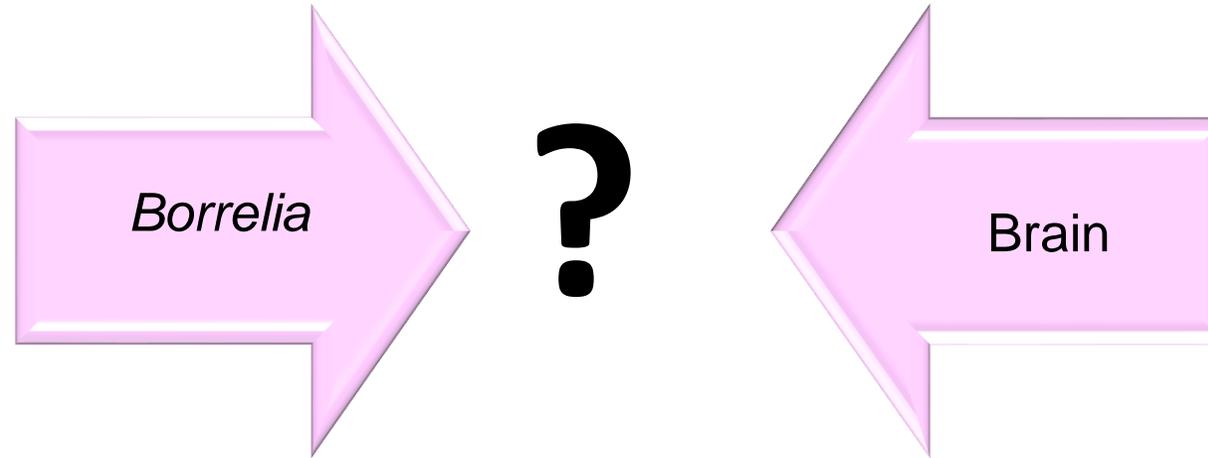
Research Question



Indirect effect of infection

Direct neuropathological effect of infection

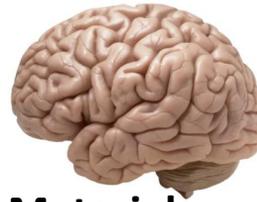
Research Approach



Question

Can *Borrelia* cause Alzheimers?

Does *Borrelia* always/immediately cause Alzheimers?



Material

Brains from **Alzheimers patients** with Lyme disease

Brains from **Lyme disease** patients



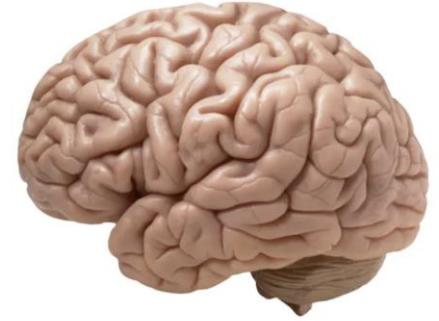
Test

Borrelia present in plaques
Mechanism for plaque nucleation

Are plaques (with or without *Borrelia*) present?

Methods

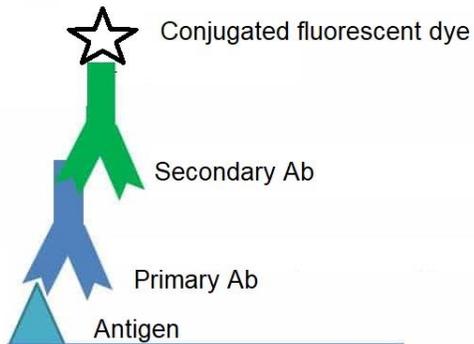
- 5 brain donations to the Mount Allison Lyme disease biobank
- Biobank (BB) BB3, BB4, BB8, BB15 and BB16
- All donors were suspected or known to have Lyme disease
- Male and female
- Ages 19-72



	BB3	BB4	BB8	BB15	BB16
Age	68	71	19	34	72
Sex	male	male	female	female	male

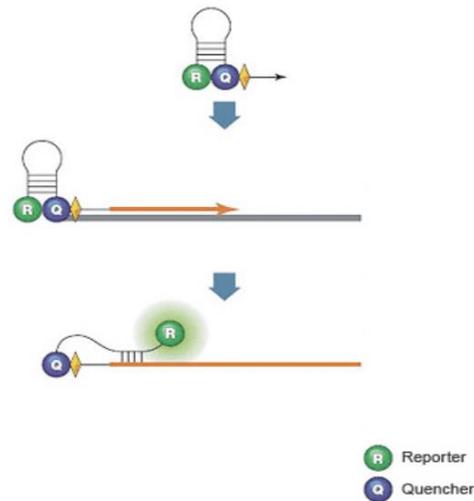
Methods

Immunohistochemistry (IHC)



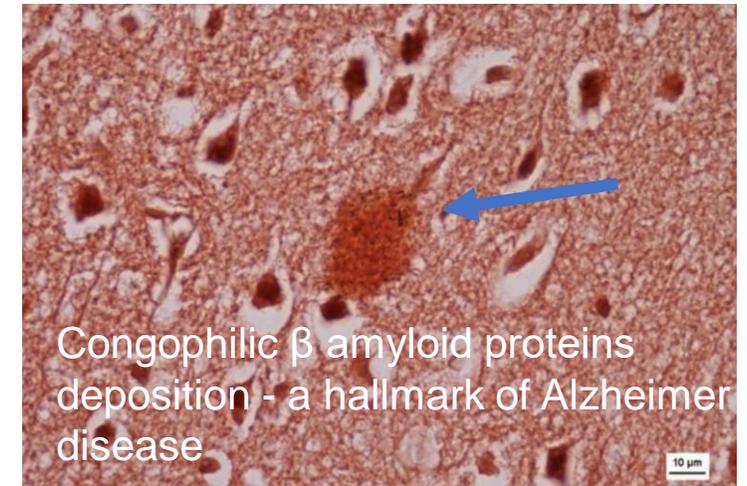
Borrelia protein present?

Fluorescent In Situ Hybridization (FISH) with hairpin probe



Borrelia DNA present?

Histological staining Congo red

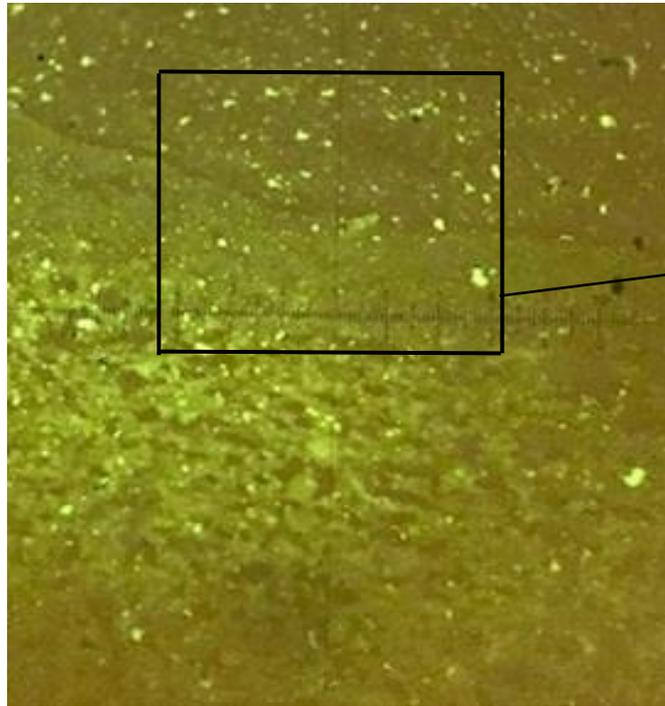


Are plaques present?

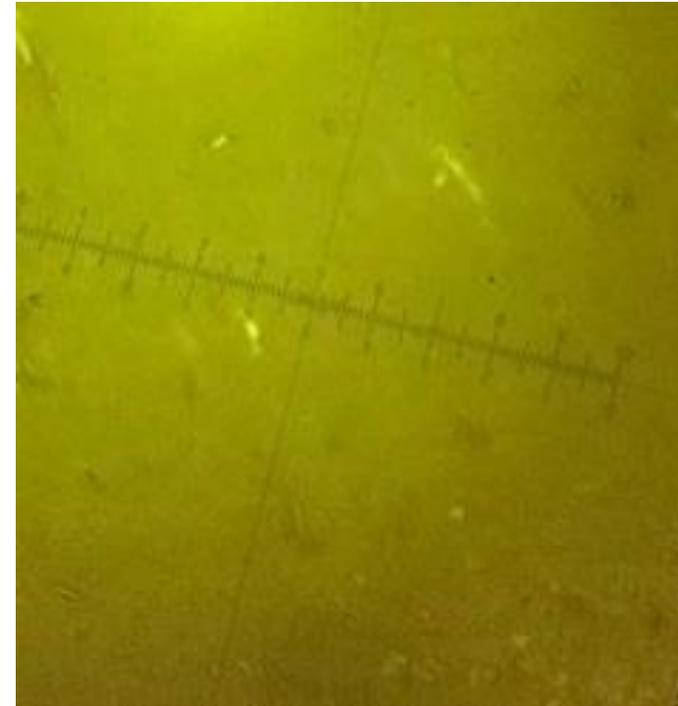
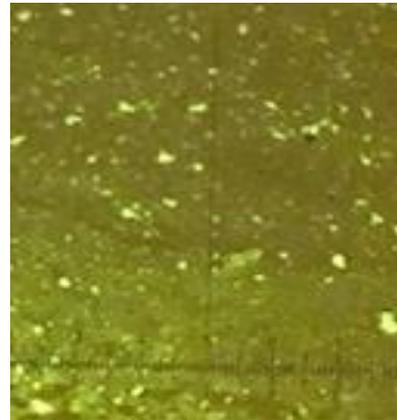
Age-Related Changes in the Central Nervous System in Selected Domestic Mammals and Primates
DOI: 10.5604/17322693.1044490

Results

IHC



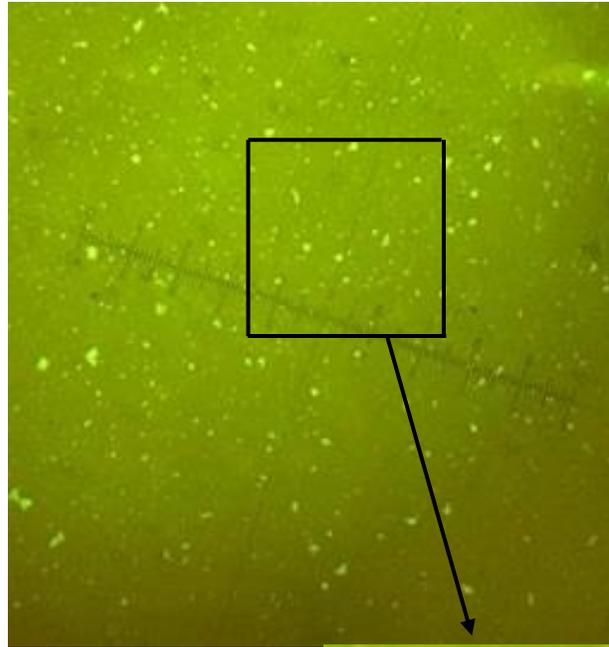
Positive
Control



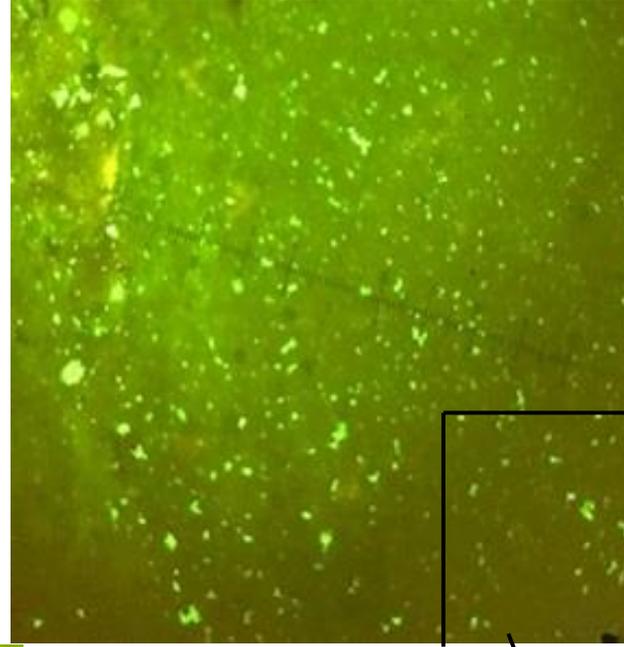
Negative
Control

Results

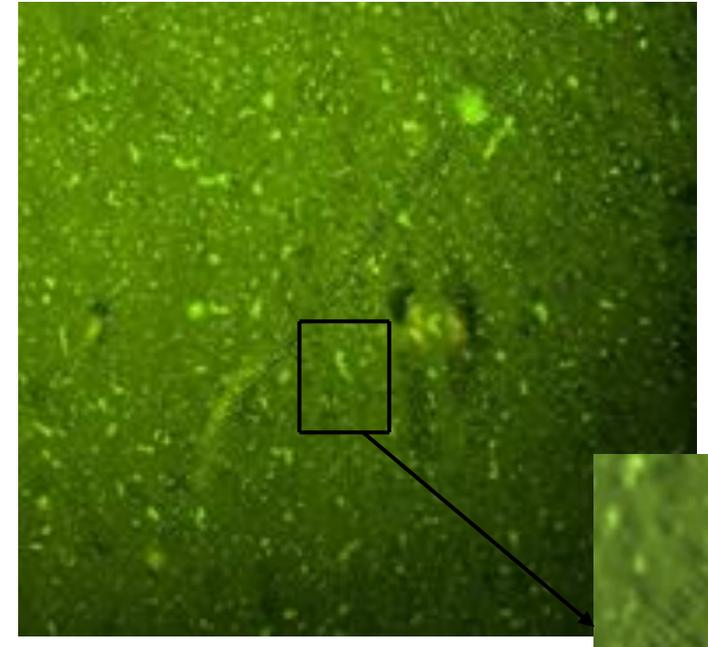
IHC



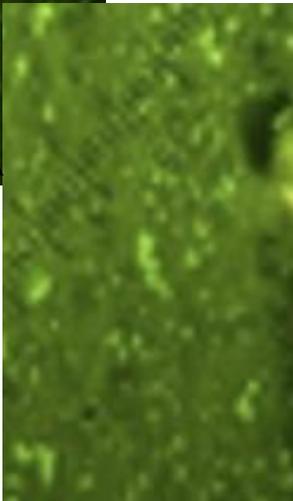
BB3



BB4



BB8

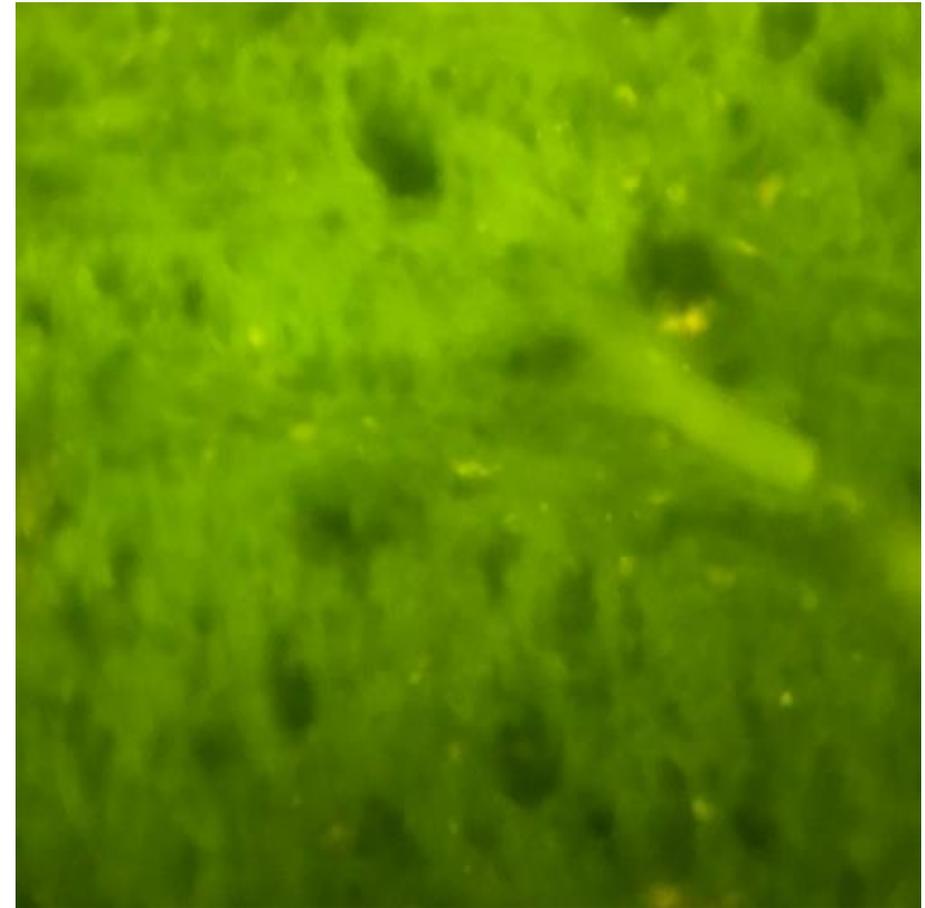


Results

FISH with hairpin probe



Positive Control



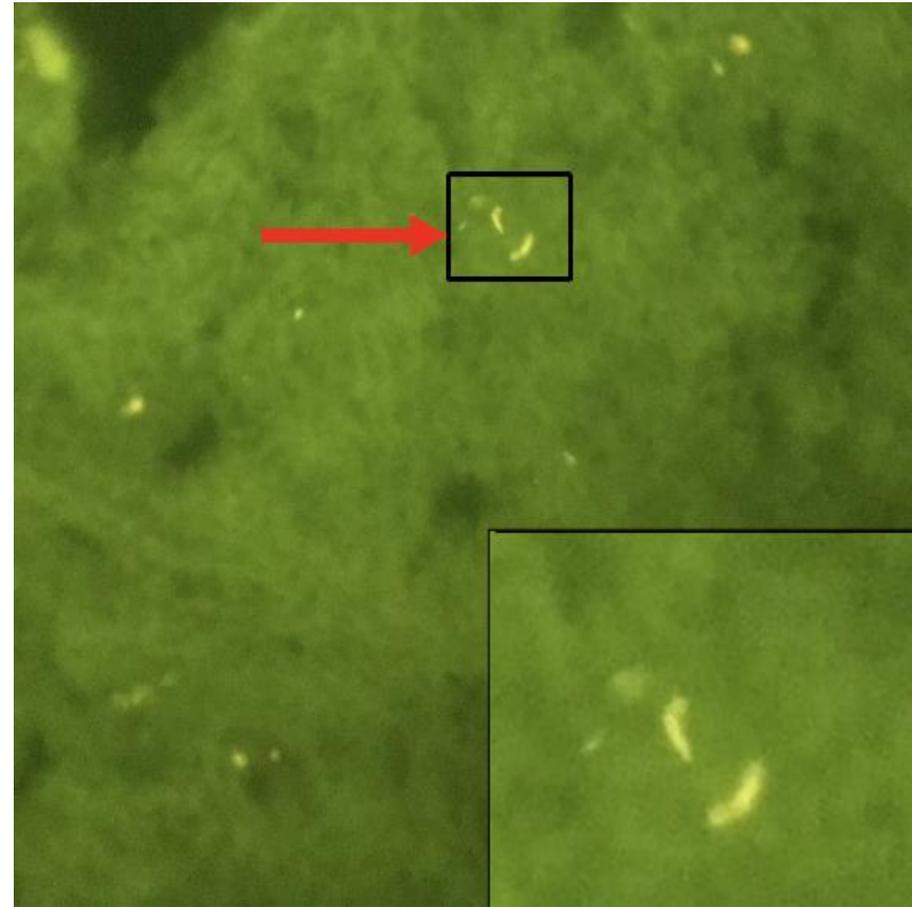
Negative Control

Results

FISH with hairpin probe



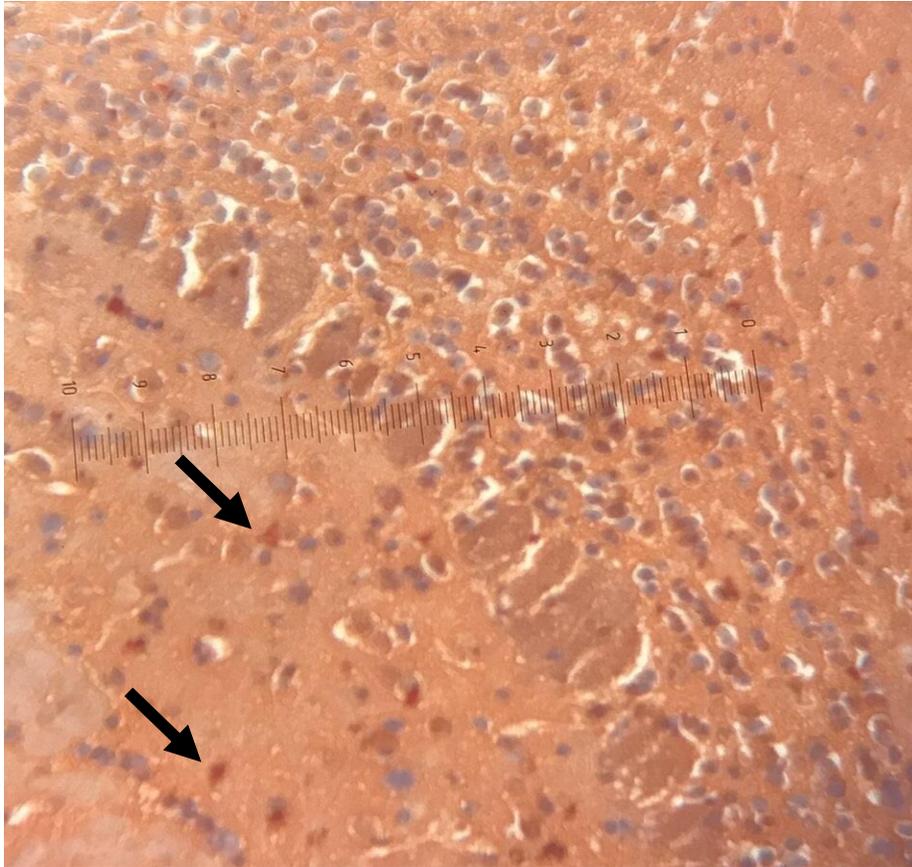
BB15



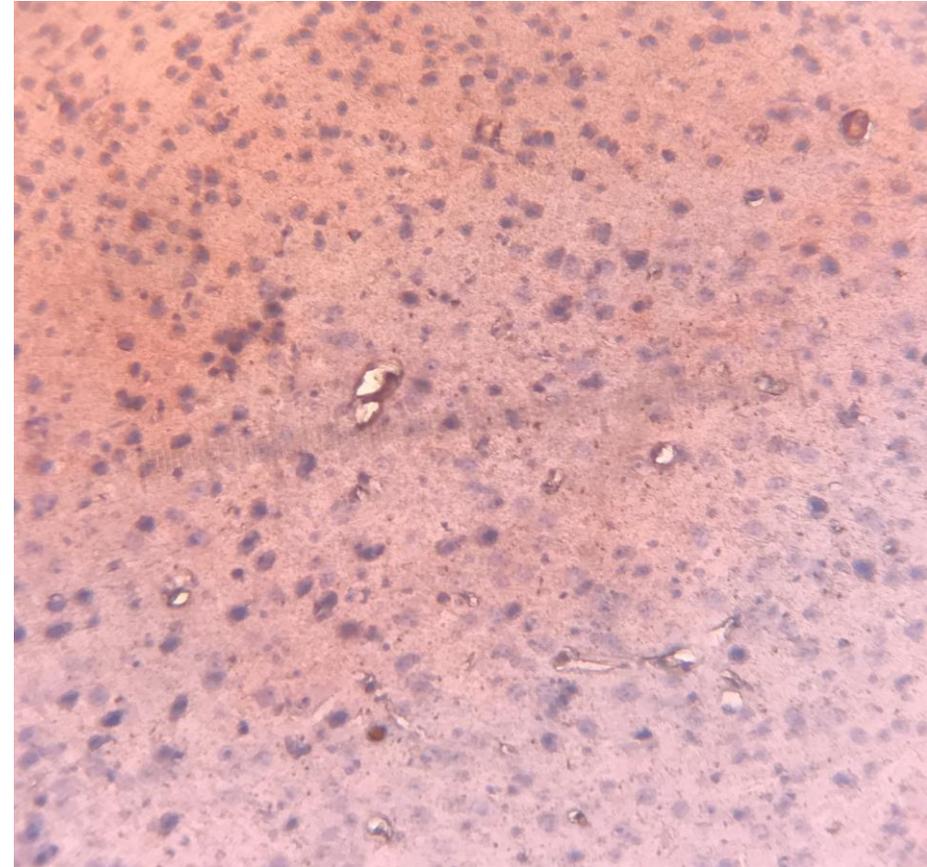
BB16

Results

Congo Red



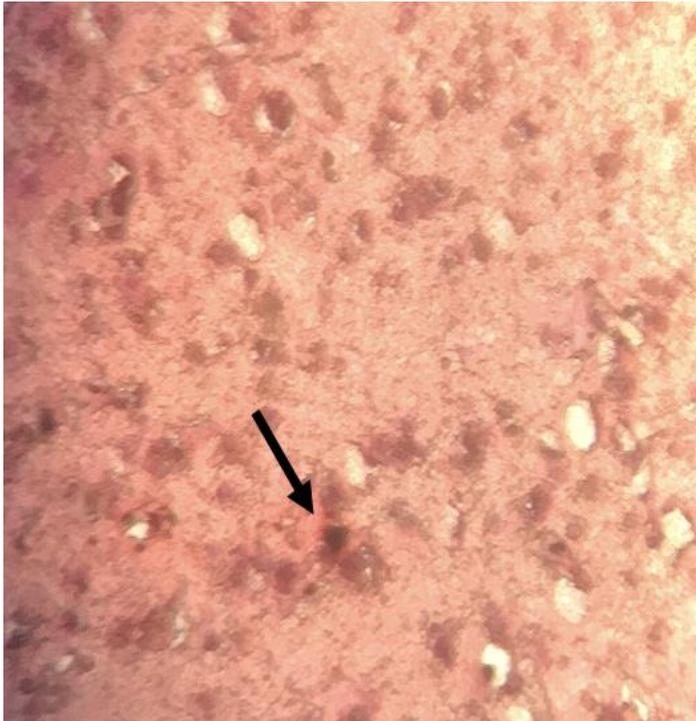
Positive Control



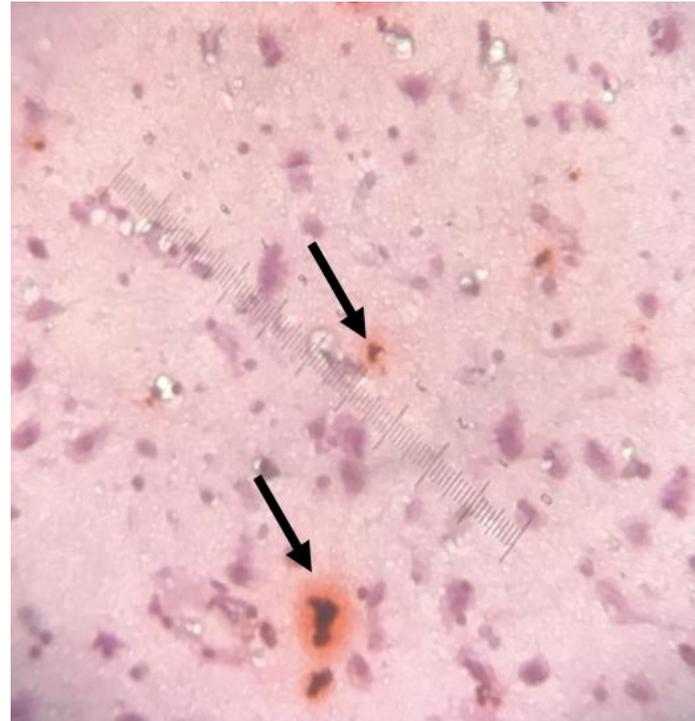
Negative Control

Results

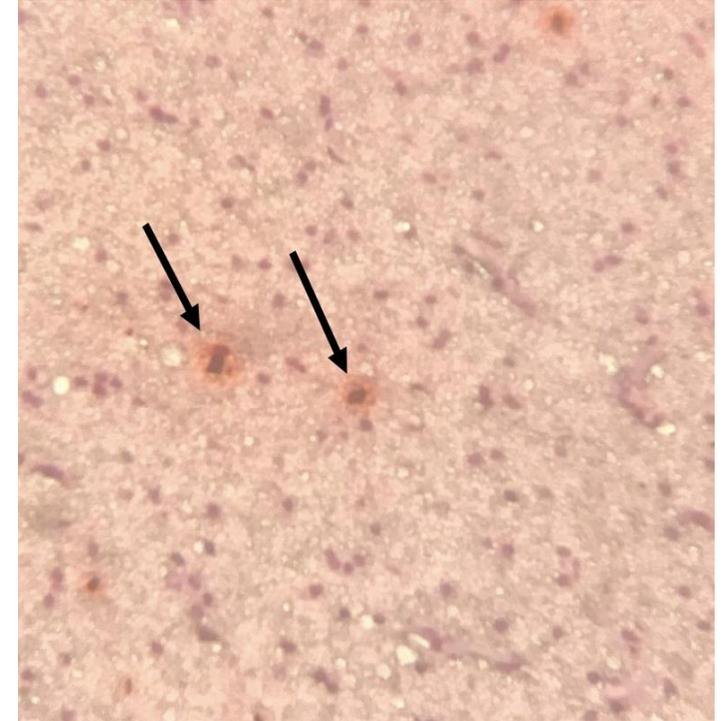
Congo Red



BB3



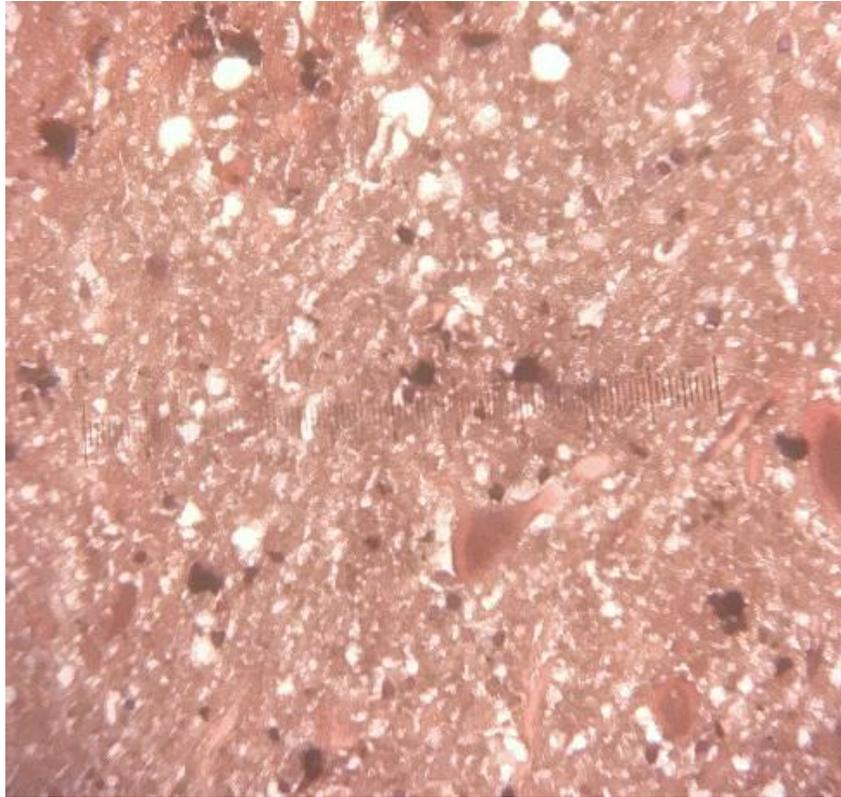
BB4



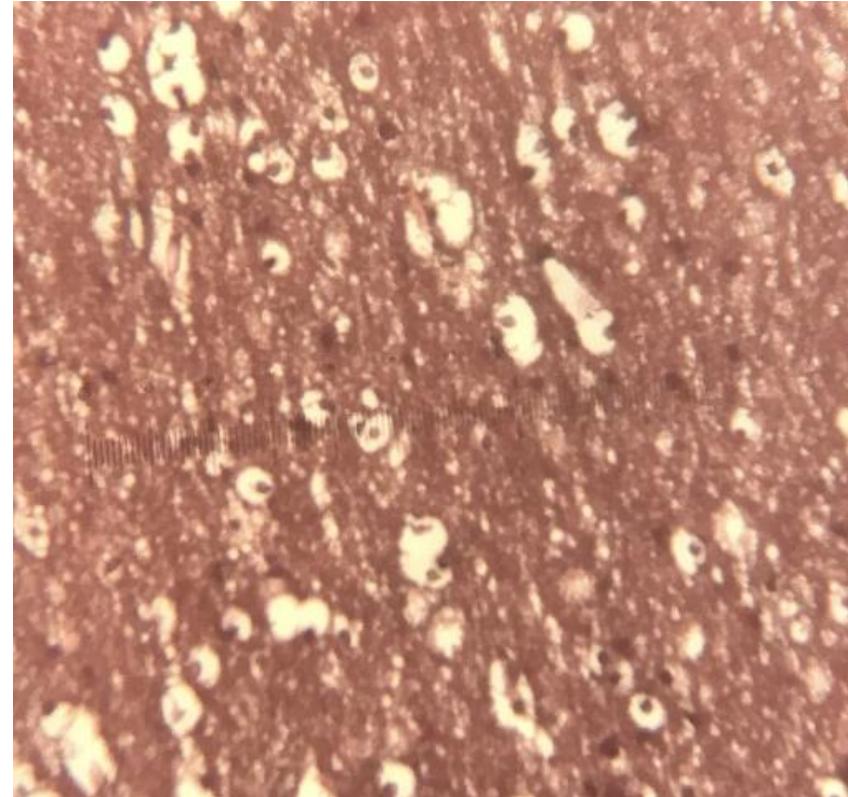
BB16

Results

Congo Red



BB15



BB8

	BB3	BB4	BB8	BB15	BB16
Age	68	71	19	34	72
Sex	male	male	female	female	male

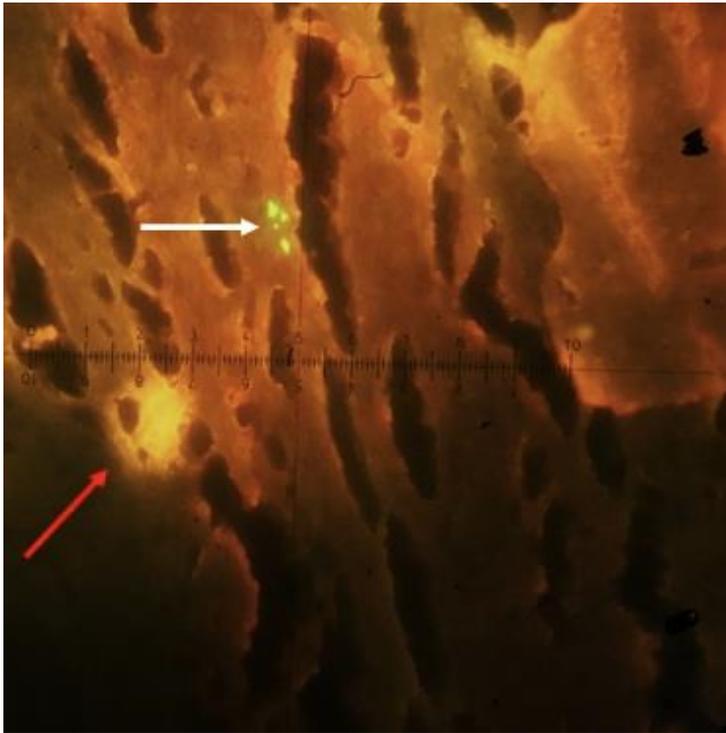
IHC	+	+	+	+	+
FISH	+	+	-	+	+
plaques	+	+	-	-	+

Methodology can detect *Borrelia* in neural tissue

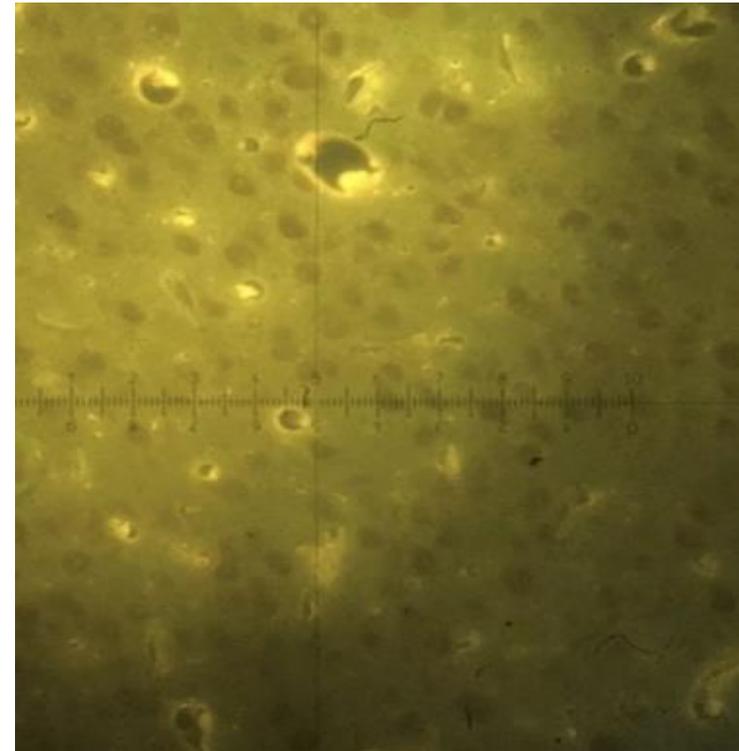
Plaques not invariably present with *Borrelia*

Co-localization of IHC and Congo red

Borrelia protein and beta amyloid protein
close to each other in the Positive Control



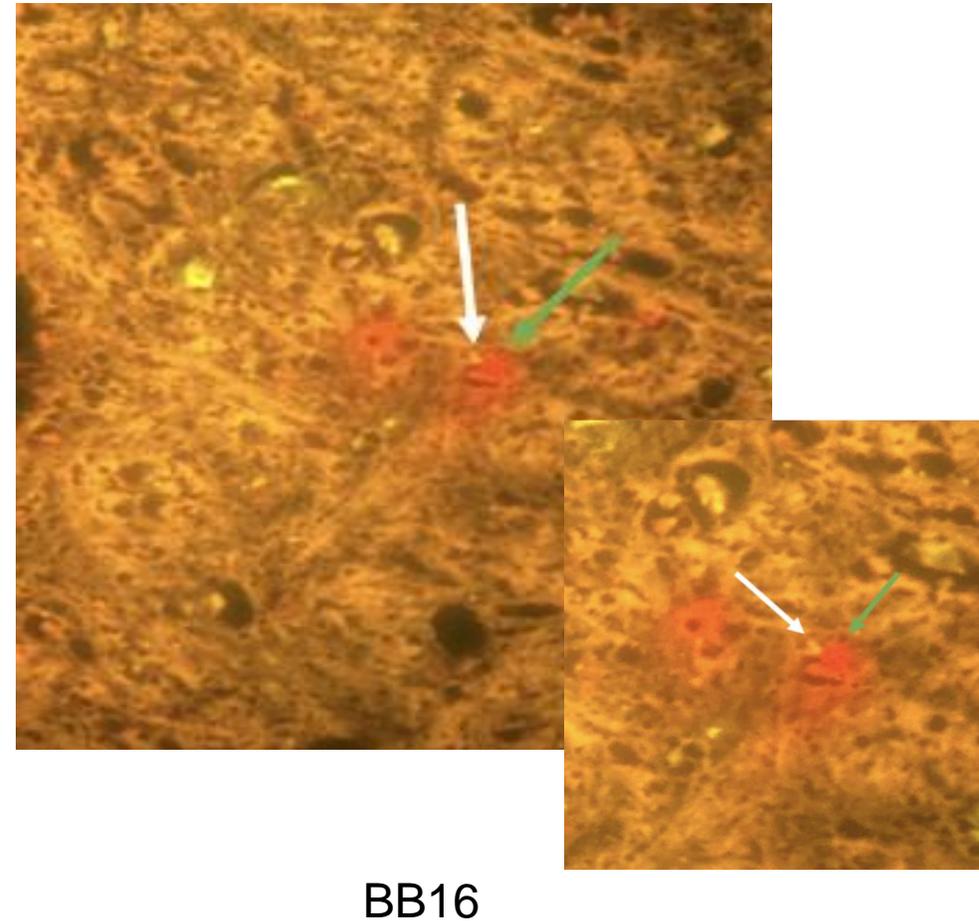
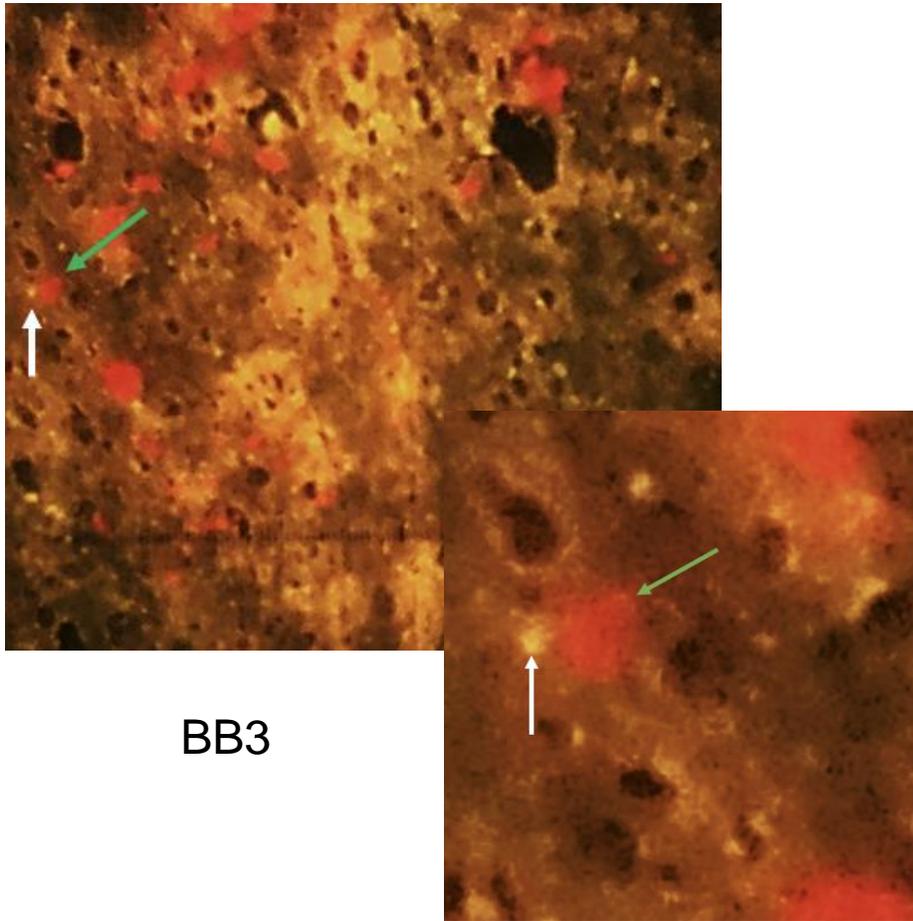
Positive
Control



Negative
Control

Red arrow shows beta amyloid protein deposition
and white arrow shows *Borrelia* antigen

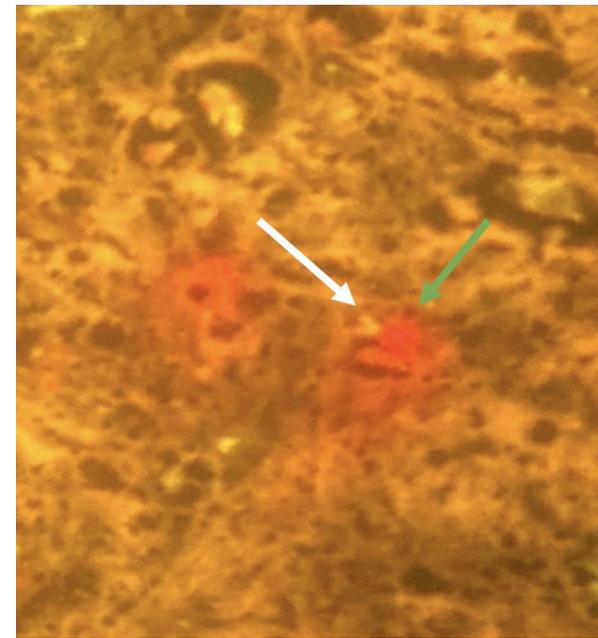
Results



Green arrows show beta amyloid protein deposition and white arrows show *Borrelia* antigen

Summary

- **Co-staining of IHC and Congo red showed *Borrelia* protein and beta amyloid protein close to each other but not necessarily exactly co-located**
- ***Borrelia* proteins are not always found with plaques**
- **Plaques are not always found with *Borrelia***
- Caveat – need to confirm both *Borrelia* and plaque signals



Conclusion – *Borrelia* and plaques – may be a complex association with other factors – time being a major factor

Thank you

Special thanks to:

Tissue donors and
their families

Dr. Alan Macdonald
CanLyme

Lloyd lab

