

Infectious Disease in Caribou: The Blood-on-Filter-Paper Screening Tool

Pat Curry¹, Susan Kutz¹, Carl Ribble¹, Wendy Hutchins², Brett Elkin³, Mitch Campbell⁴, Dale Godson⁵, John Robinson⁶, Klaus Nielsen⁷, Robbin Lindsay⁸

Faculties of ¹Veterinary Medicine and ²Medicine, U of Calgary, Calgary, AB, Canada; ³Environment and Natural Resources, Government of the NWT, Canada; ⁴Dept of Environment, Kivalliq Region, NU, Canada; ⁵Prairie Diagnostic Services, U of Saskatchewan, Saskatoon, SK, Canada; ⁶Government of BC Animal Health Centre, Abbotsford, BC, Canada; ⁷Ottawa Laboratories, Canadian Food Inspection Agency, Nepean, ON, Canada; ⁸Public Health Agency of Canada, Winnipeg, MB, Canada



RESULTS

Climate change is expected to alter disease patterns and spur pathogen emergence. Some barrenground caribou (*Rangifer tarandus* ssp.) herds are currently in serious (more than 80%) decline.¹ Infectious agents may be involved, but wildlife disease surveillance in the Arctic is a major challenge.

Filter-paper blood testing is a potentially powerful tool that has been used in human medicine for decades,² yet lacks validation in wildlife work.

AIM

To develop a practical, versatile diagnostic tool for widespread monitoring of disease exposure in caribou by laypeople, including hunters, biologists and others.

Step 1 • **Evaluate the efficacy of dried blood on filter paper (FP)** for detecting pathogen exposure in *Rangifer*.

METHODS

• **Paired FP and serum** samples were collected from **3 groups** of caribou and reindeer (*R. tarandus* ssp.), and then tested in duplicate at diagnostic labs using different serological assays.

• All groups had known antibodies (seropositivity) to one or more of **8 pathogens** relevant to caribou in the context of climate change (see list below). Knowledge of seropositivity was based on serum testing or testing after vaccinating for agents¹.



"Nobuto" filter paper strips before and after sampling.

Pathogens:

- **Brucella sp.**
- **West Nile virus**
- **Neospora caninum**
- **Bovine respiratory syncytial virus^{††}**
- **Parainfluenza-3 virus^{††}**
- **Bovine herpesvirus-1^{††}**
- **Bovine viral diarrhoea I^{††}**
- **Bovine viral diarrhoea II^{††}**

Sample Groups:



Ranched Reindeer



Wild Caribou



Vaccinated Reindeer

Data have been generated for all 8 pathogens and the results are very promising. cELISA findings for 3 agents are shown below.

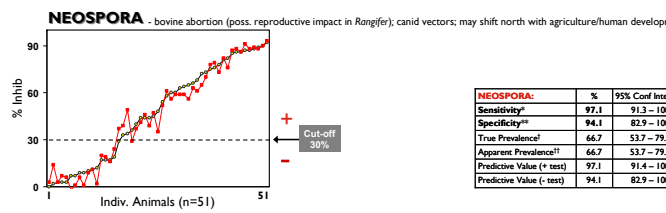
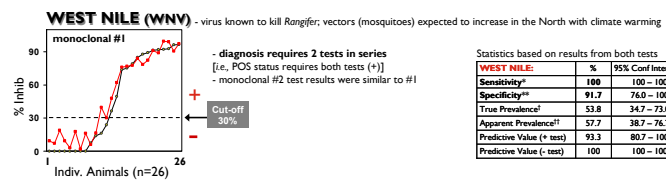
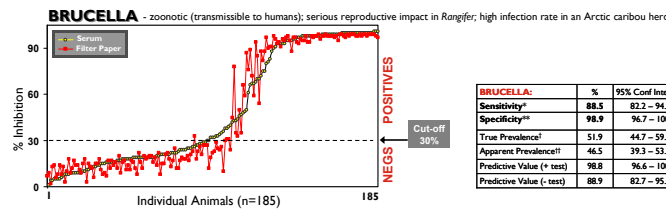
• **Competitive enzyme-linked immunoassay (cELISA)** Principle: Specific **antibody (Ab)** is made in response to each disease (pathogen).

- a set of **colour-tagged Abs** (specific for the pathogen tested) is added to the sample (serum or FP) in a small plastic well containing pathogen ("antigen") - if the animal has been exposed to the pathogen, its **natural Abs will have no colour tag** - the natural and colour-tagged Abs compete to bind antigen
- after a period of binding, any unbound Abs are rinsed away - chemicals are added causing colour-tagged antibodies to appear
- colour density is measured (% Inhibition is calculated) **High % Inhibition (pale colour) = POSITIVE** (exposed or infected)



cELISA wells: Pale = POSITIVE

I. Filter Paper vs Serum (the 'gold standard')



* % true POSs with FP ** % true NEGs with FP

† prevalence - serum

†† prevalence - FP

II. FP Sample Variability

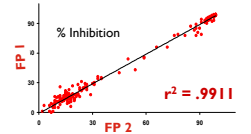
(FP vs FP from same individual)

Other Agents:

WNV: r^2 (test 1) = .9168
 r^2 (test 2) = .9777

NEOSPORA: r^2 = .9767

Example: BRUCELLA (cELISA)



CONCLUSIONS

- Blood-on-filter paper is an excellent tool (comparable to serum) for screening of pathogen exposure in *Rangifer*. FP and serum results are almost identical for cELISA detection of antibodies to each of *Brucella* sp., West Nile virus, and *N. caninum*. The same holds true for other serological tests performed to date: virus neutralization (Bovine viral diarrhoea virus) and indirect ELISA (3 other bovine viruses[†], *Brucella* sp.).
- Serological test results with different FPs from the same animal are reliable.

Plans: Test effects of FP "treatments" that mimic the field (freezing, long storage). Validate FP for detecting progesterone/pregnancy.

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References:

1. Nagy JA, Johnson D. 2006. ENR, Gov't NWT. MS 171; 2. Mei et al. 2001. J Nutr May;131(5):1631S-6S.

