Novel sensor technology for progesterone and estradiol detection in milk samples

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BACKGROUND

- **Undetected estrus is the main contributor to poor reproductive efficiency in dairy herds in Alberta.**

- **By monitoring milk estradiol (E2) and progesterone (P4) , it is possible to predict estrus.**

- **Current methods to detect P4 and E2, are either expensive, lack sensitivity, and/or are time consuming.**

APPROACH

- **The biosensors, based on an etalon device, had been developed by sandwiching a polymer micro-particles monolayer between two layers of gold (Au) (Figure 1).**

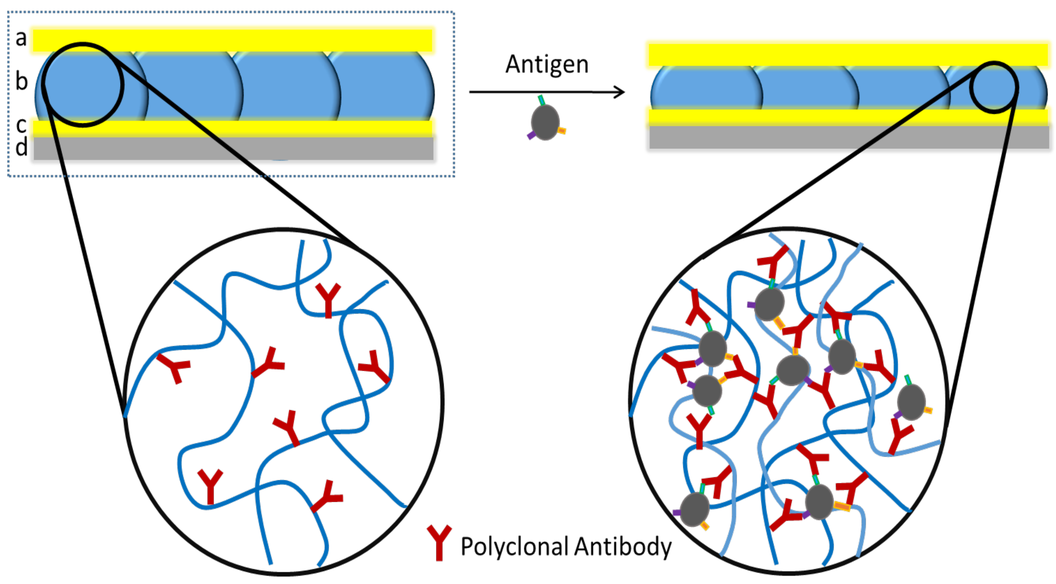

Figure 1. A cartoon depiction the mechanism of antigen detecting using an etalon sensor; (a) and (c) are 15 nm Au layers (with 2 nm Cr as adhesion layer) sandwiching a microgel layer (b) all on a glass substrate (d).

- **Aptamers or antibodies which target P4 and E2 were applied as capture probes for the sensors and optical spectra of etalon devices or color change was monitored.**

FINDINGS

- **The lowest detectable concentration of E2 was 0.86 pg/mL.**

- **The E2 sensor has very low cross-reactivity with P4, and could be reused 5 times without losing sensitivity.**

- **The lowest detectable concentration of P4 was 2.51 pg/mL.**

- **The P4 sensor also showed low cross reactivity with E2.**

Table 1. Detection of E2 and P4 in commercial and farm milk samples

	Milk samples (n=5/each)	Results
E2 detection	Commercial skim milk	0.89±1.25 pg/mL
	Commercial 2% milk	8.41±0.94 pg/mL
	Milk from cows in heat (expected to have high concentrations of E2)	9.10±4.32 pg/mL
	Milk from cows in mid-cycle (expected to have low concentrations of E2)	3.99±1.41 pg/mL
P4 detection	Commercial skim milk	0.59±0.20 ng/mL
	Commercial 2% milk	1.82±0.55 ng/mL
	Milk from cows in heat (expected to have low concentrations of P4)	1.89±0.35 ng/mL
	Milk from pregnant cows (expected to have high concentrations of P4)	8.27±1.00 ng/mL

- **E2 and P4 sensors performed very well in different milk samples**

SUMMARY

- **Cost effective, simple, and easy to use biosensors have been developed to determine P4 and E2 in milk.**

- **These findings make feasible the development of "cow-side" test devices or in-line hormone measurements for reproductive monitoring in dairy cows.**

Research supported in part by *Growing Forward 2*, a federal-provincial-territorial initiative. The authors also gratefully acknowledge financial support from Alberta Agriculture and Forestry, the University of Alberta, the Natural Sciences and Engineering Research Council of Canada (NSERC), the Canada Foundation for Innovation (CFI), the Alberta Advanced Education & Technology Small Equipment Grants Program (AET/SEGP), Grand Challenges Canada and IC-IMPACTS.