BIOMARKERS REVEALING ABUSE OF STEROID HORMONES IN FOOD ANIMALS

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Problem: detection of anabolic residues

- spectrum of agents increases
- use of masking agents
- **exogenous versus endogenous**
- cocktails
- dermal applications
- metabolism
- relative low concentrations
- large product volumes
- ...

New Technologies to Screen Multiple Chemical Contaminants in Foods
• approx. 10% of European cattle is illegally treated with anabolics \( (\text{estimate of authorities!}) \)

• # found non-compliant at official inspection:
  \[ \rightarrow \text{average } 0.3\%! \]

\[ \therefore \text{ Gap between reality and findings} \]
Potential Solutions

New ways of dealing with residues, which can enter the food chain, are required.

Equally importantly:
new ways of thinking about how to deliver improved monitoring are required as well.

THE PROBLEMS THAT EXIST IN THE WORLD TODAY CANNOT BE SOLVED BY THE LEVEL OF THINKING THAT CREATED THEM.
An EC funded Integrated research project on chemical contaminant monitoring

Duration: 5 years

Partners: 32

Budget € 15M (9.7M EURO from European Commission)

Project formally began 1st January 2005

Believed to be the largest project of its kind in the world...

www.biocop.org
The fundamental objective of BioCop is to utilise emerging bioscience technologies to create a powerful new approach to detect & control chemical contaminants in foods.
Scope of the technologies

- Transcriptomics
- Proteomics
- Microarrays
- Molecular immunology
- Bioinformatics
- Mass-spectrometry
- Bioprepology
- Biosensor technology

The world’s finest collection of -ologies & -omics........
The diagram illustrates a cell with its components: the nucleus, cytoplasm, receptor, and effector 1. Effector 1 is labeled as an analyte. The receptor is connected to various responses, indicating how it interacts with the cell environment.
Multi-Endpoint

Cell

Receptor

Nucleus

Cytoplasm

effector 2 = analyte

Responses

BioCop

New Technologies to Screen Multiple Chemical Contaminants in Foods
Cytoplasm

Nucleus

Receptor

Responses

effector 3 = analyte

glycome
lipidome
metabonome
proteome
transcriptome

....
Dynamic equilibrium: animal as multi-endpoint system!

Plant protein → Animal protein

GROWTH & MAINTENANCE & REPRODUCTION

ENERGY

cf. use of biomarkers in oncology, clinical chemistry and pathology
Affinity assays

2DGE / DIGE
→ image analysis
→ spot picking
→ tryptic digest
→ MS analysis
BIOMARKER DETERMINATION:
2DGE of Cattle Plasma

New Technologies to Screen Multiple Chemical Contaminants in Foods
inhibin in bull calves

Inhibin (ng/ml)

- Control bull calves
- Treated bull calves

Days relative to first treatment

E2/NT
DEX
osteocalcin in calves

-control female - treated female - control male - treated male

dex

time relative to first treatment (day)
leptin in bull calves

-10 0 10 20 30 40

0 25 50 75 100

ng/ml

Day

E2/NT  E2/NT  E2/NT  DEX

-10 0 10 20 30 40

Control male

Treated male
What is a biosensor?
An instrument which combines a biological recognition mechanism in intimate contact with a sensing device and translates this into an electronic signal.
- SPR biosensor
- Measures up to 16 biomarker concentrations simultaneously
- Throughput: 64 biomarker concentrations/hour
- Low ng/mL sensitivity
- Automated data quality control
- Automated data evaluation
FROM CONCEPT TO APPLICATION:

- Mismatch of biomarker – residue profiles
- Population diagnostics
- Validation
- Introduction in inspection labs
CONCLUSIONS

• The EC is aware of the ‘cat and mouse game’ between inspection and farmers/vets and is searching for and invests in alternative detection systems

• Effect measurements in the animal: new concept of filtering suspected samples

• HTS screening of biomarker profiles in animal materials (plasma) at the farm, in-/on-/at slaughter-line will assist conventional analysis and improve monitoring systems

For more detailed information and news about project events: Please visit our website at www.Biocop.org