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Biomarker development for stress-response and pork meat quality

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Introduction

- Meat quality is influenced by pre-slaughter stress
- Exercise is a stressful event for an animal not used to physical exercise

- Resting restores the pre-stress conditions
- How can we know that pre-stress conditions are reached?: **Biomarkers**

Biomarkers: Why and How

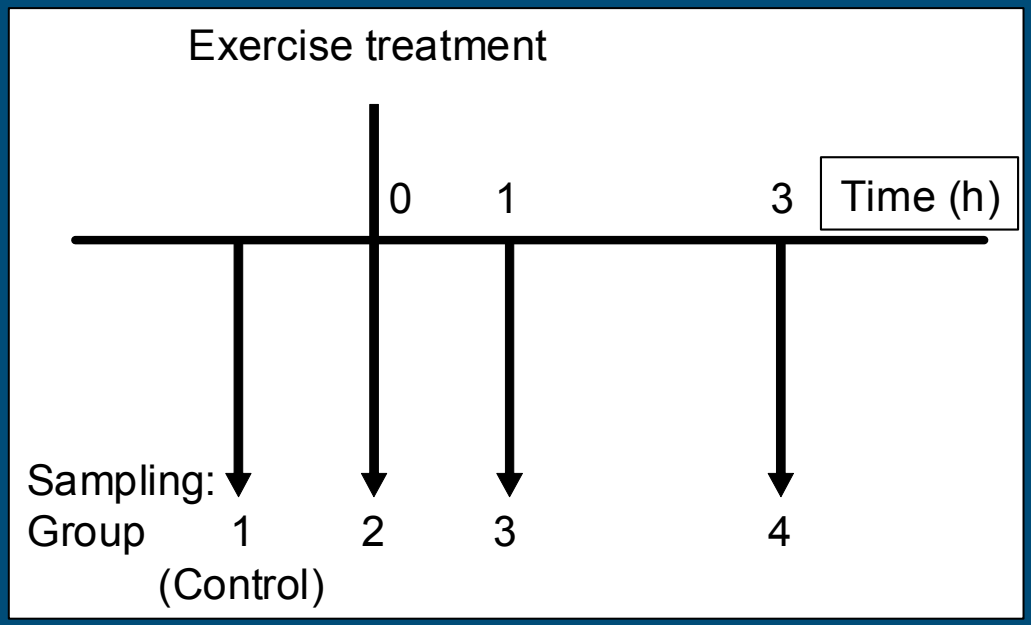
- To **Monitor** and **Predict** Biological processes
- **Difficult** or **Expensive** to measure Biological processes
- **Easy** and **Cheap** measurable molecules

- Can be used to **direct** industrial processes

Aim of the study

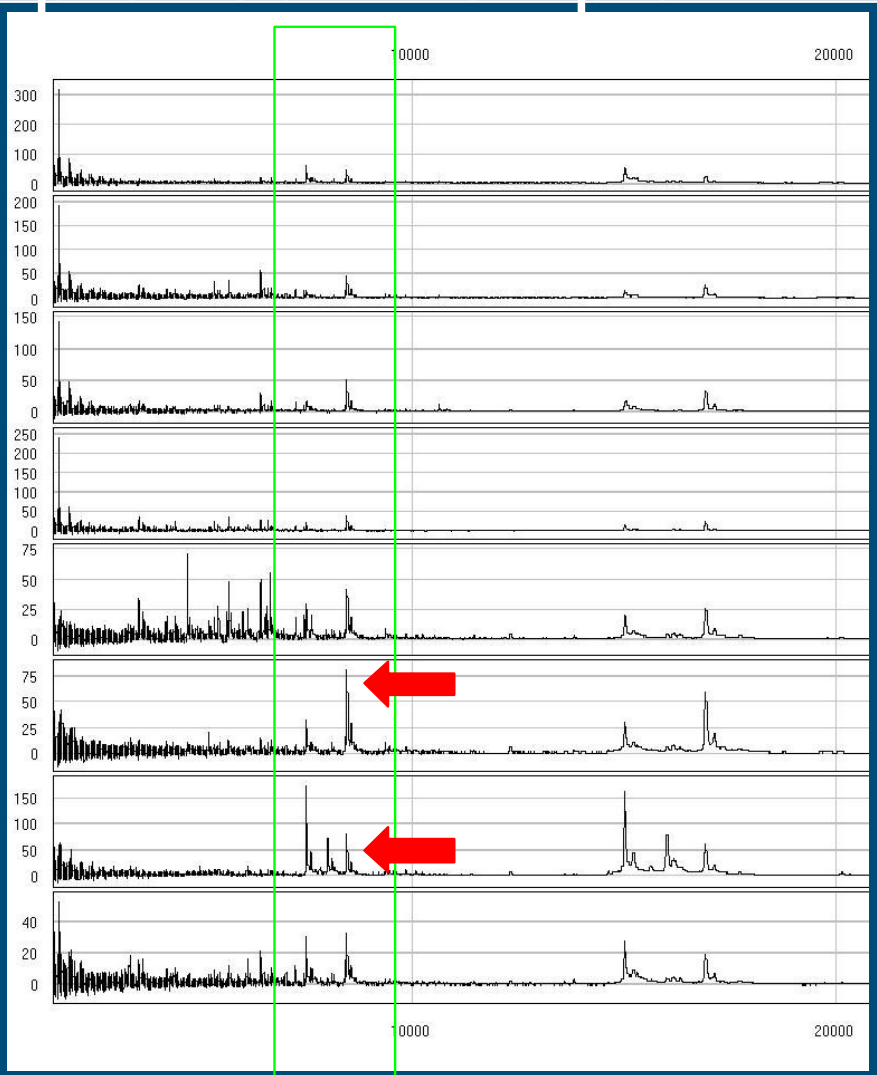
- **Develop biomarkers** that monitor and predict:
  - The effects of stress and resting time
  - The biochemical / meat quality parameters
  - The optimal moment of slaughtering
- The Proteome is a major constituent of meat, thus:
  - changes will affect meat quality
  - Changes may be related to the reaction to stress and resting

Experimental design



- 4 groups of 10 sows each
- Moment 0: 30 min running on a treadmill
- Rest: 0, 1, 3 h before slaughter
- Sample LD and BF at slaughter
- Measure biochemical / meat quality traits
- Proteomics abundance profiles
  - Per muscle, all animals
  - Grouping per treatment group
- Analyze with group and biochemical / meat quality data

Proteomics profiles: Example



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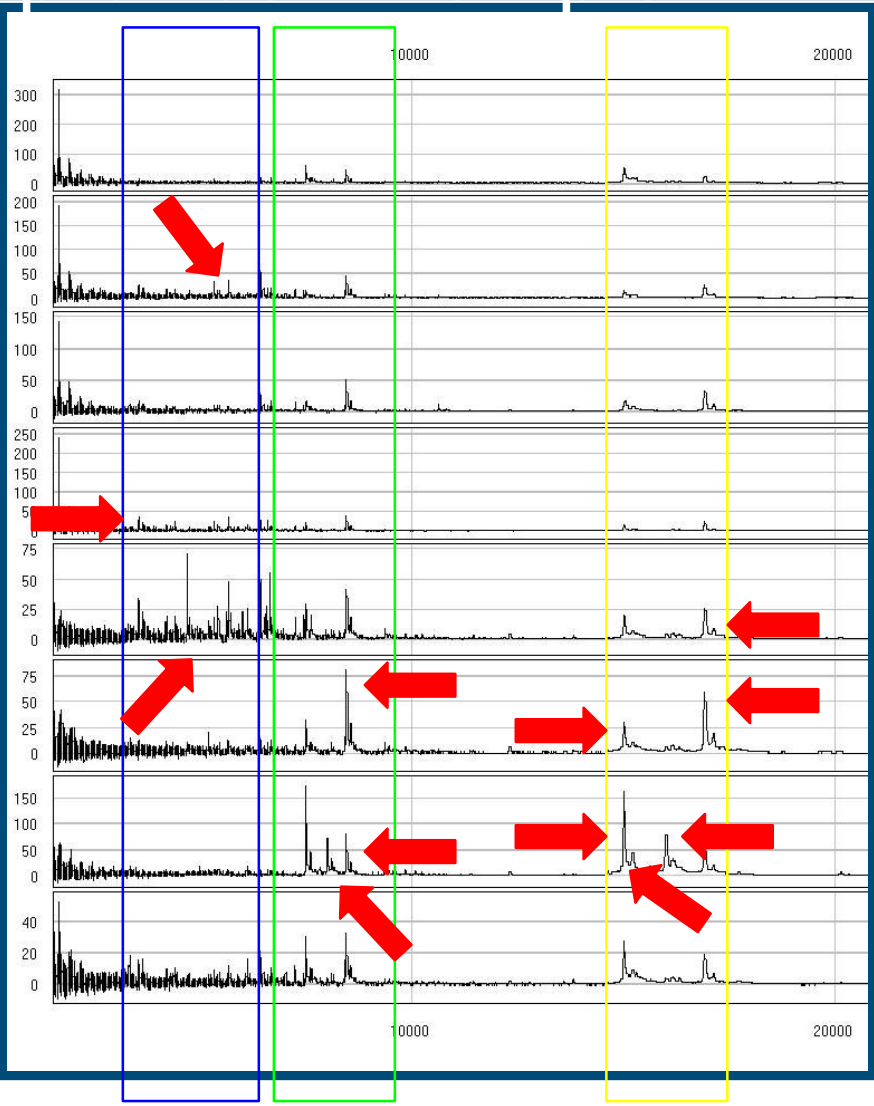
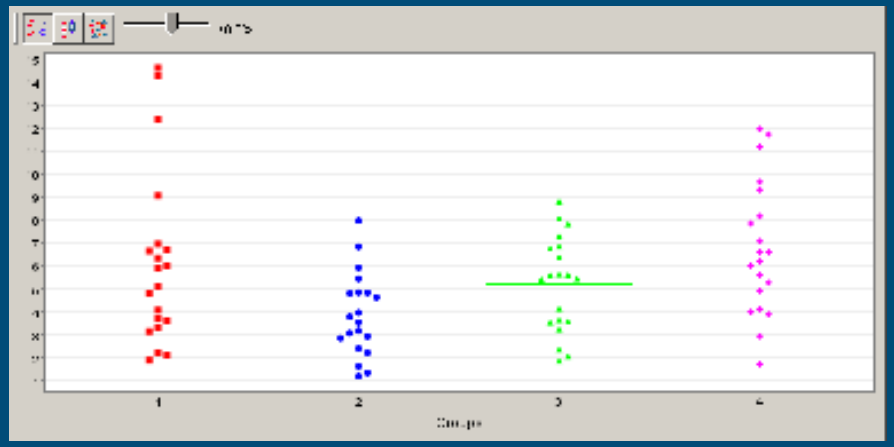
Proteomics profiles: Example



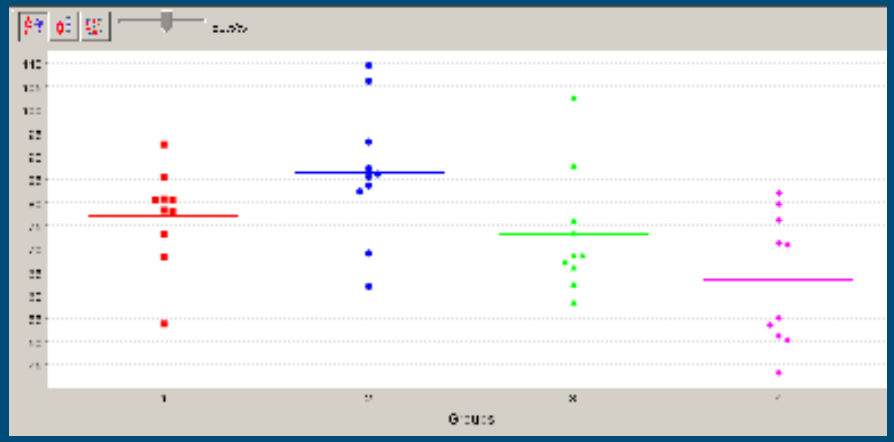
Group related proteomic peak abundance profiles

Stress reversal



- Exercise reduces or increases peak abundance
- Rest reverses stress effect
- Rest can over react

Over react



- Animal differences may point to phenotypic differences for stress resistance

Association number of peaks per trait per muscle

Trait	LD	BF
pH	27	17
Drip loss	8	8
Minolta L	2	2
Minolta b	15	14
CP	18	14
IMP	2	22
ADP	4	24
ATP	3	31
Pro glycogen	22	41
Total Glycogen	26	27

- Energy metabolism traits differ between muscles
  - BF more associations
  - BF also more functional during exercise

Monitoring and predicting both exercise and biochemical / meat quality parameters

Protein	Trait	P-value	P1-2	P2-3	P2-4
1	ATP	0.03921	0.01		
2	ATP	0.03305	0.01		
3	ATP	0.00913	0.02	0.03	0.01
3	Inositol mono phosphate	0.043114	0.02	0.03	0.01
4	ATP	0.029809	0.02	0.06	0.01
4	Pro glycogen	0.035421	0.02	0.07	0.01
5	ATP	0.011559	0.02		
5	creatine phosphate	0.03597	0.02		
6	ADP	0.047418	0.03	0.004	0.003
6	ATP	0.020479	0.03	0.004	0.003
6	Creatine phosphate	0.037661	0.03	0.004	0.003
6	Drip loss	0.03436	0.03	0.004	0.003
6	Inositol mono phosphate	0.011835	0.03	0.004	0.003

Discussion: How can we use these data?

- **Monitor** and **predict:**
  - the effect of exercise on muscle tissue and meat quality
  - the effect of resting after exercise on muscle tissue and meat quality
  - the optimal moment of slaughtering

Conclusion - summary

- We developed **potential biomarkers**
- Biomarkers could **monitor** and **predict** more than one process at a time
- Biomarker development
  - What is needed to develop the biomarker from these data towards commercial use?
    - Identification of peak
    - Fast, cheap test development
    - Validation in other datasets / other commercial environments
    - Proof of concept in industrial environment

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