



West Pomeranian
University of Technology
in Szczecin



BYDGOSZCZ UNIVERSITY
OF SCIENCE AND TECHNOLOGY



NICOLAUS COPERNICUS
UNIVERSITY
IN TORUŃ

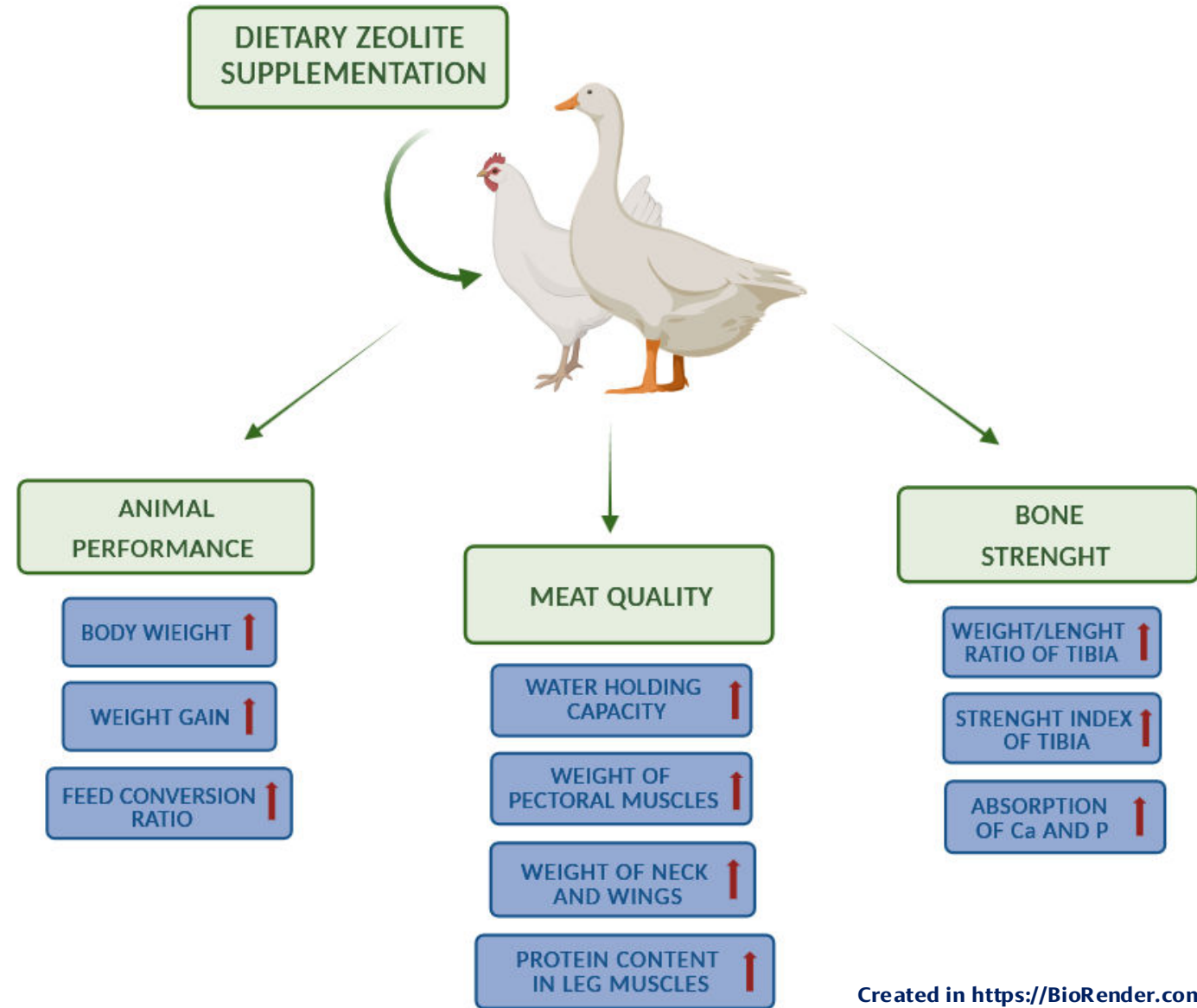
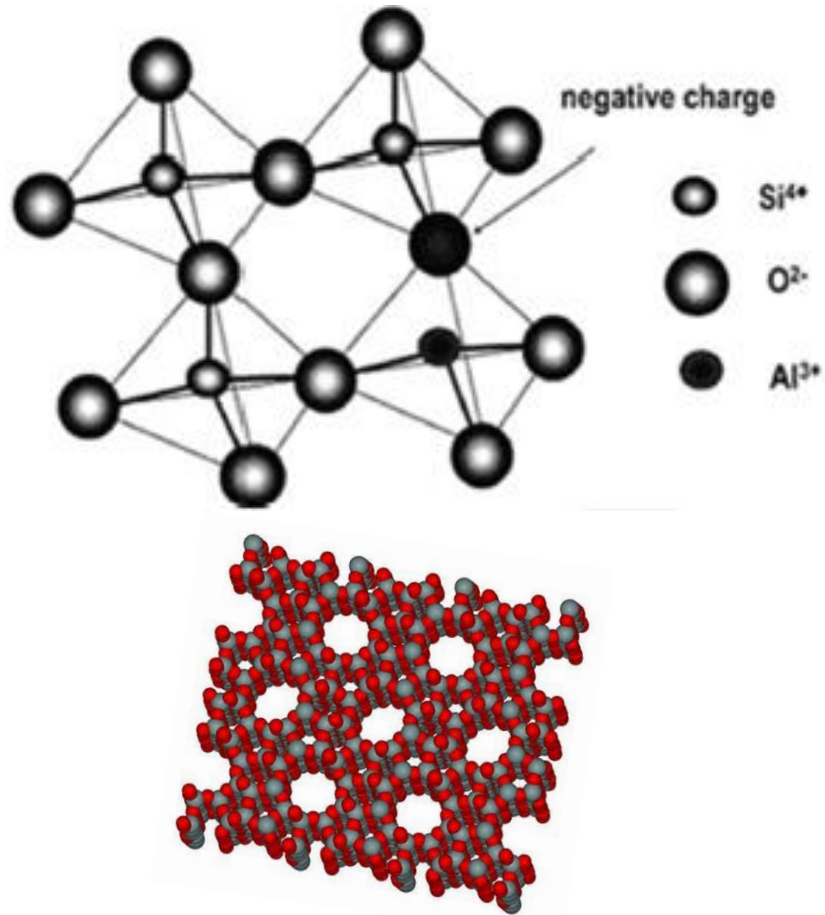


3rd EAAP Regional Meeting 2025
“Animal Production in the Changing World”

Sex-specific proteomic responses in the cecal mucosa of Cherry Valey ducks to dietary zeolite supplementation

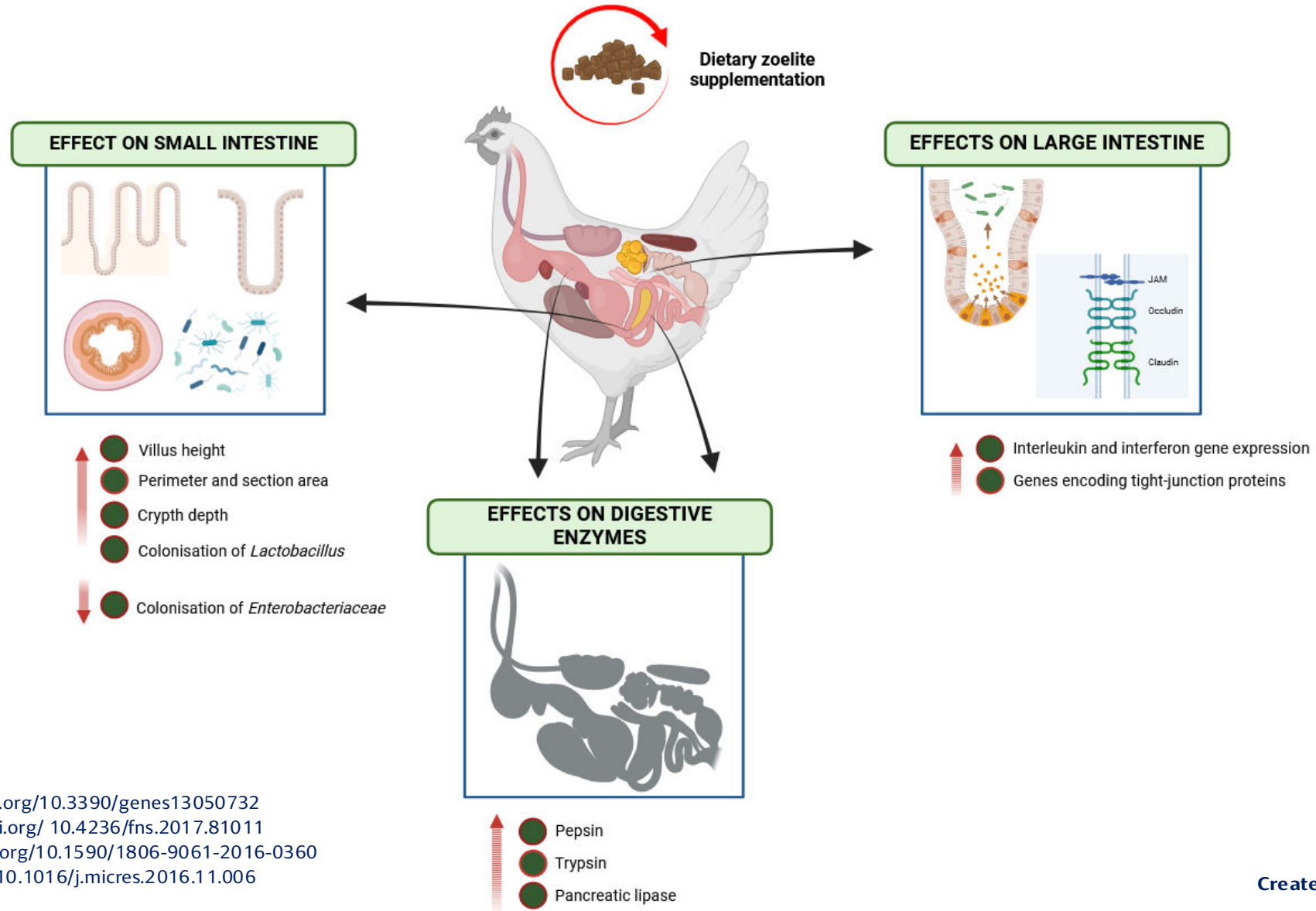
Agnieszka Herosimczyk, Małgorzata Ożgo, Adam Lepczyński,
Marta Marynowska, Marcin Barszcz, Mirosław Banaszak,
Jakub Biesek, Aleksandra Dunisławska, Paweł Pomastowski

BACKGROUND



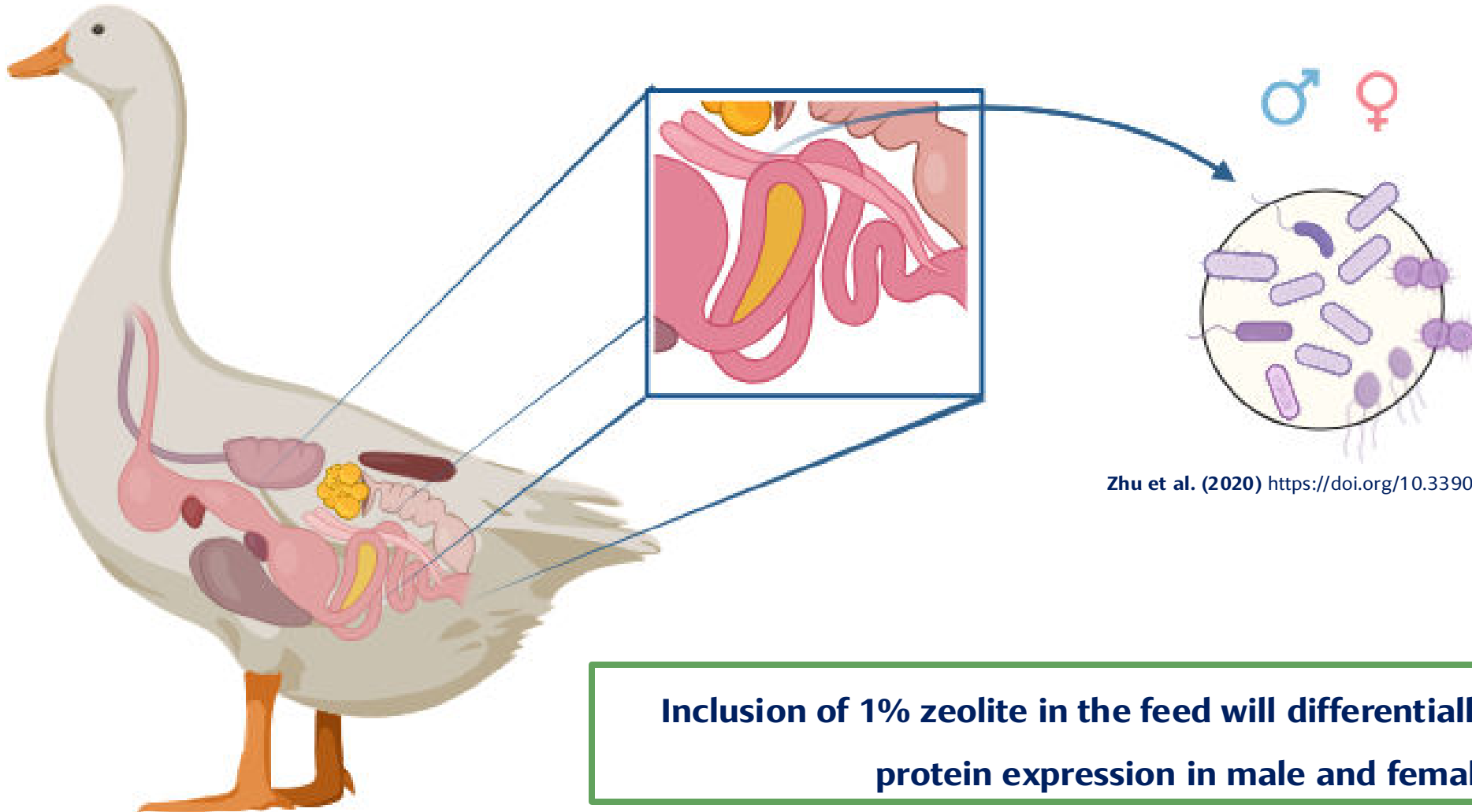
Golomeova and Zendelska (2016) <http://dx.doi.org/10.5772/62347>
Banaszak et al. (2021) <https://doi.org/10.1111/asj.13649>
Banaszak et al. (2022) <https://doi.org/10.1007/s11259-021-09827-x>
Biesek et al. (2021) <https://doi.org/10.3390/ani11041015>

BACKGROUND



Dunińska et al. (2022) <https://doi.org/10.3390/genes13050732>
Le Gall-David et al. (2017) <https://doi.org/10.4236/fns.2017.81011>
Wawrzyniak et al. (2017) <https://doi.org/10.1590/1806-9061-2016-0360>
Prasai et al. (2017) <http://dx.doi.org/10.1016/j.micres.2016.11.006>

HYPOTHESIS



Inclusion of 1% zeolite in the feed will differentially affect cecal mucosa protein expression in male and female ducks.

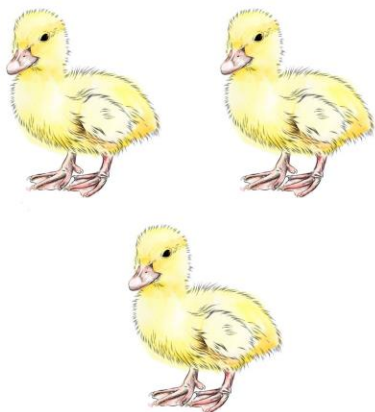
MATERIAL AND METHODS

ANIMALS AND DIETS

The consent for research was obtained from the Institutional Animal Care and Use Committee of the Bydgoszcz University of Science and Technology (Local Ethical Committee, No. 2/2022).

1

The experiment involved 12 drakes and 12 ducks Pekin Cherry Valley SM3 Medium ducklings from Tulce, Greater Poland Voivodeship, Poland



2

Birds were divided into four equal groups (n=6):



control males (CM)



control females (CM)



experimental males (ZM)



experimental females (ZF)

3

1–28 day birds were fed with a commercial starter diet

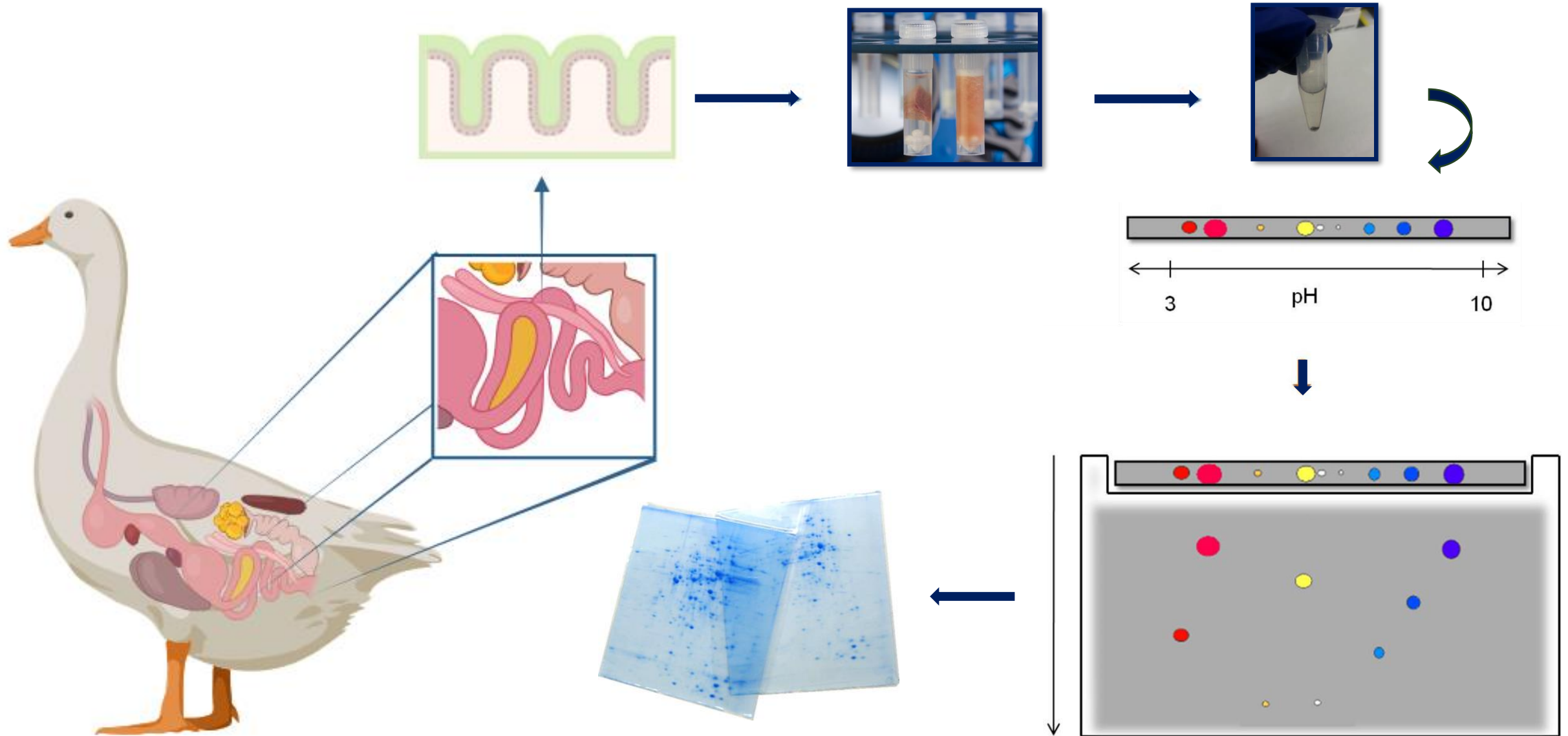
Component	Content
Ingredients	Maize, wheat, soybean extraction meal, wheat bran, sunflower extraction meal, hulled sunflower seeds, barley, rapeseed extraction meal, wheat gluten feed, calcium carbonate, animal fat, monocalcium phosphate, vegetable oil and fat (raw sunflower), sodium chloride, sodium sulfate
Crude Protein	19.5%
Ether Extract (Fat)	3.9%
Crude Fiber	4.2%
Lysine	0.93%
Methionine	0.42%
Threonine	0.72%
Calcium	0.85%
Phosphorus	0.69%
Sodium	0.17%
Vitamin A	10,000 IU
Vitamin D3	3,000 IU
Vitamin E	25 IU

4

29–42 day birds were fed with a grower diet

Component	Content
Ingredients	Maize, wheat, wheat bran, soybean extraction meal, sunflower extraction meal (from dehulled sunflower seeds), triticale, rapeseed extraction meal, animal fat, calcium carbonate, monocalcium phosphate, sodium chloride, calcium bicarbonate
Crude Protein	17.1%
Ether Extract (Fat)	3.7%
Crude Fiber	4.5%
Lysine	0.87%
Methionine	0.37%
Threonine	0.61%
Calcium	0.81%
Phosphorus	0.66%
Sodium	0.16%
Vitamin A	10,000 IU
Vitamin D3	3,000 IU
Vitamin E	25 IU

TWO-DIMENSIONAL ELECTROPHORESIS AND DATA ANALYSIS

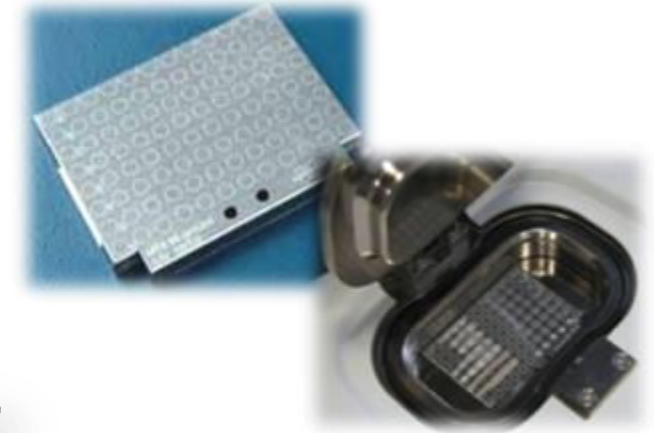
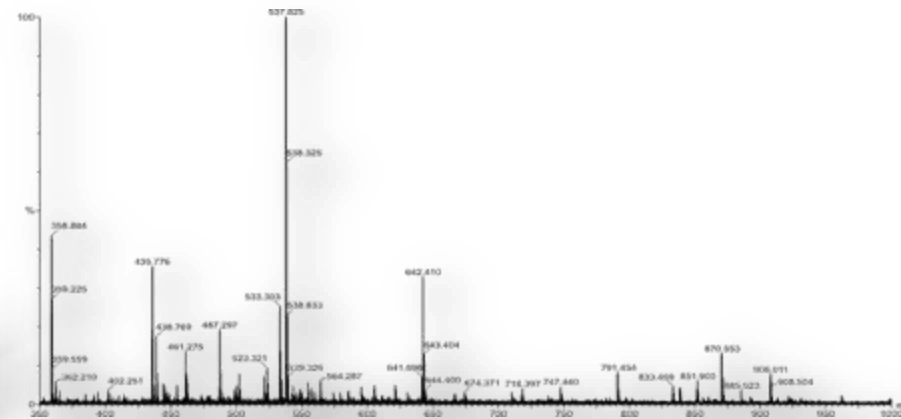
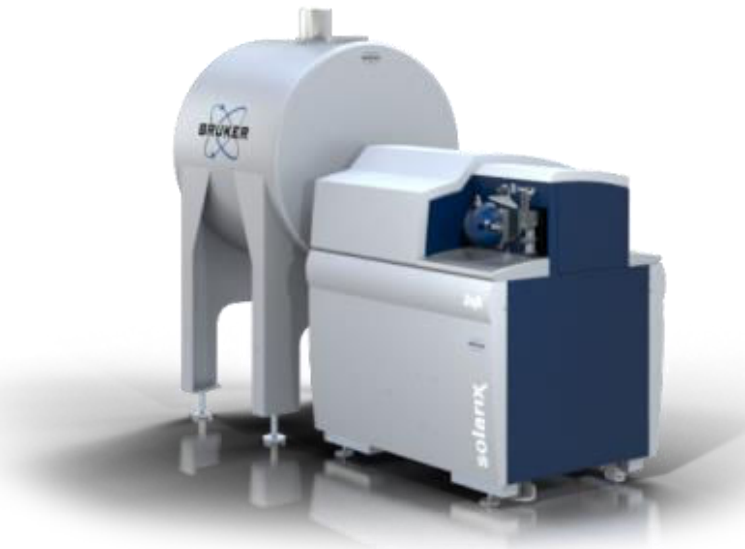


MASS SPECTROMETRY AND DATA ANALYSIS

7T Solarix 2xR MALDI FT-ICR mass spectrometer equipped with dual ESI-MALDI source.

The mass spectra were collected in the positive mode with 1000 laser shots from each spot. Data were acquired with the use of ftControl and analysed with the aid of the Data Analysis software (Bruker Daltonics, Bremen, Germany).

All peptide mass fingerprinting (PMF) data were compared to vertebrate databases (SWISS-PROT; <http://us.expasy.org/uniprot/> and NCBI; <http://www.ncbi.nlm.nih.gov/>) with the aid of MASCOT search engine (<http://www.matrixscience.com/>) in Protein Scape 4.2 software (Bruker Daltonics, Bremen, Germany).



RESULTS

STATISTICALLY SIGNIFICANT PROTEIN SPOTS

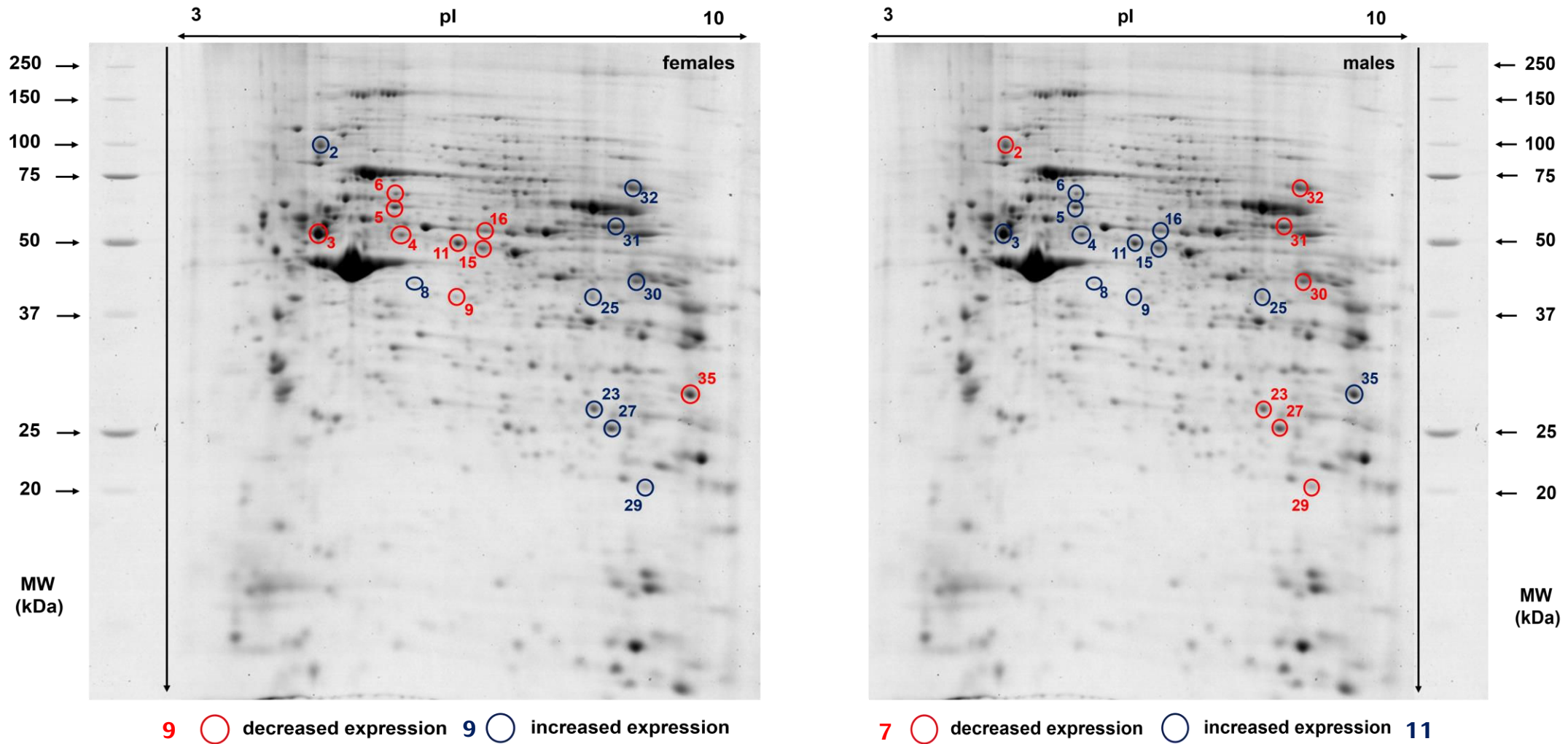
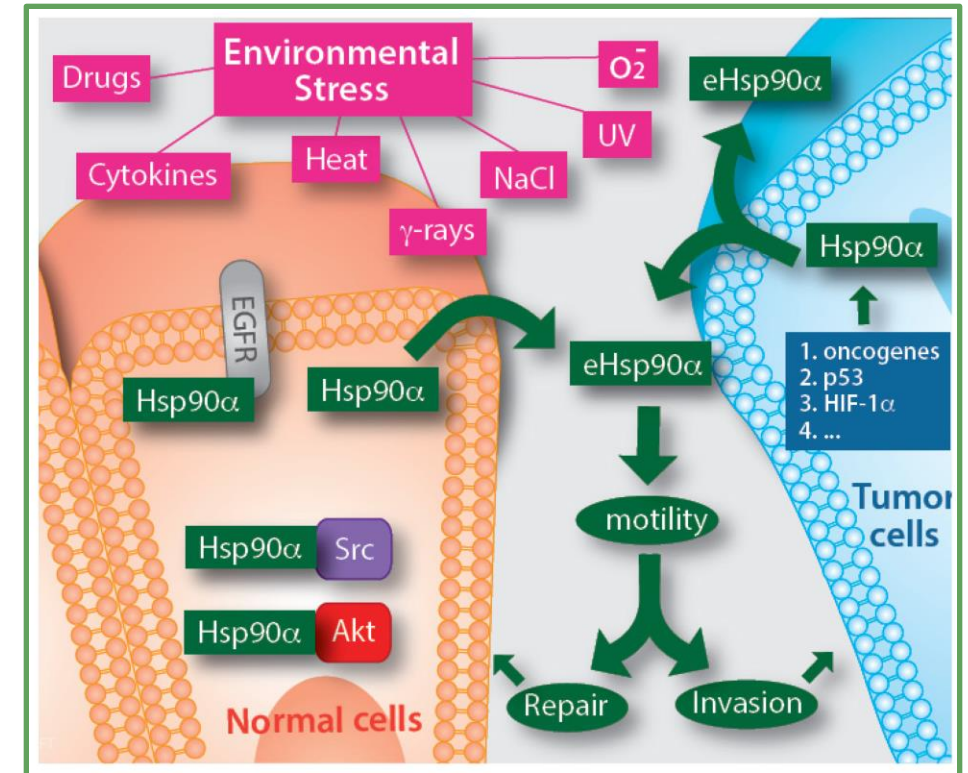
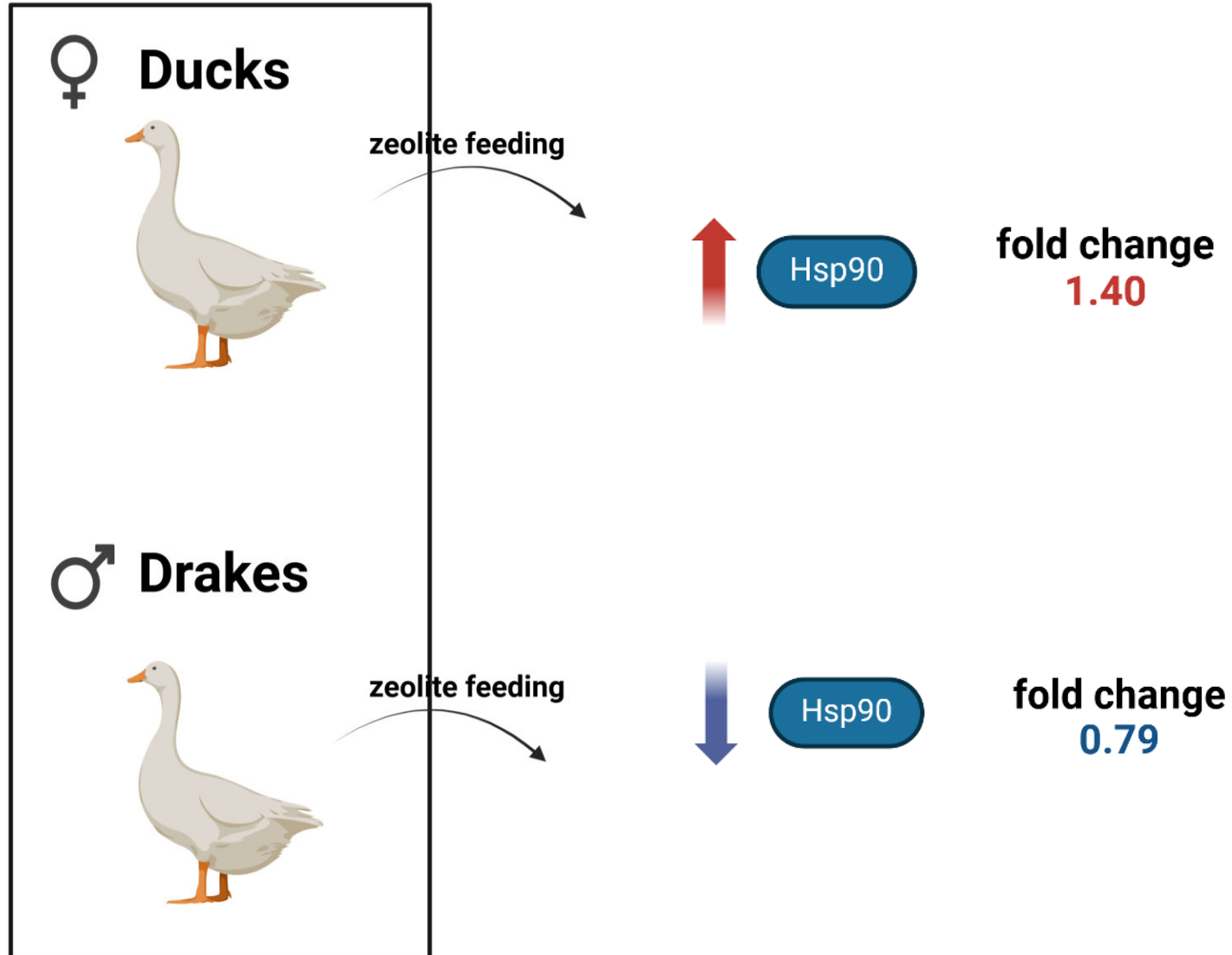


Figure 1. Representative 2-DE gels showing protein spots with significant changes in response to sex and 1% zeolite supplementation in the cecal mucosa of male and female Cherry Valley ducks. Two-way ANOVA was used to assess the effects of both factors on protein expression.

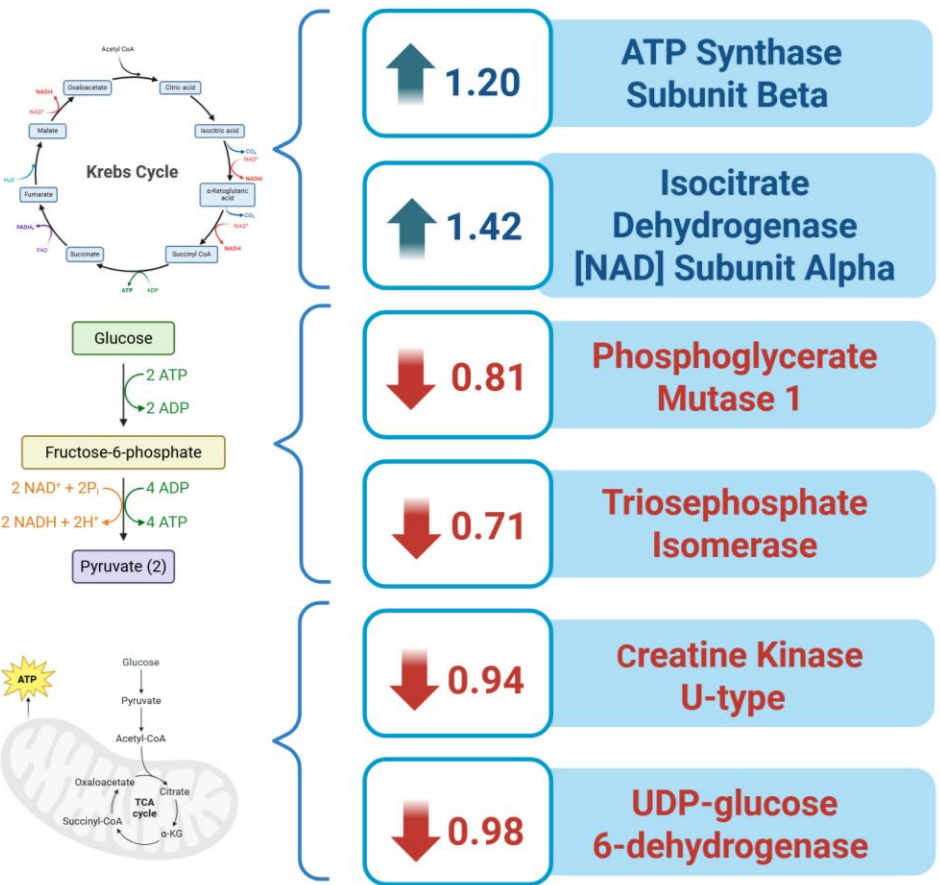
STRESS RESPONSE PROTEIN



Jay et al. (2022) <https://doi.org/10.3390/biom12070911>

METABOLISM-RELATED PROTEINS

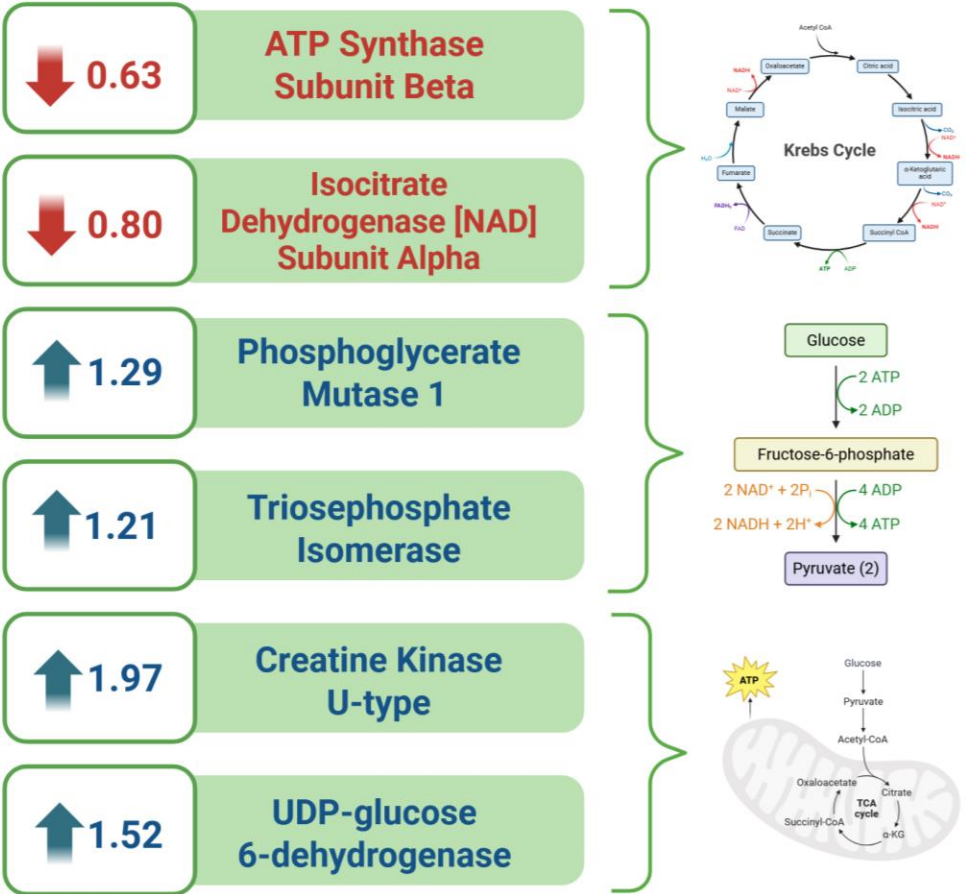
DRAKES



Dietary zoelite supplementation



DUCKS

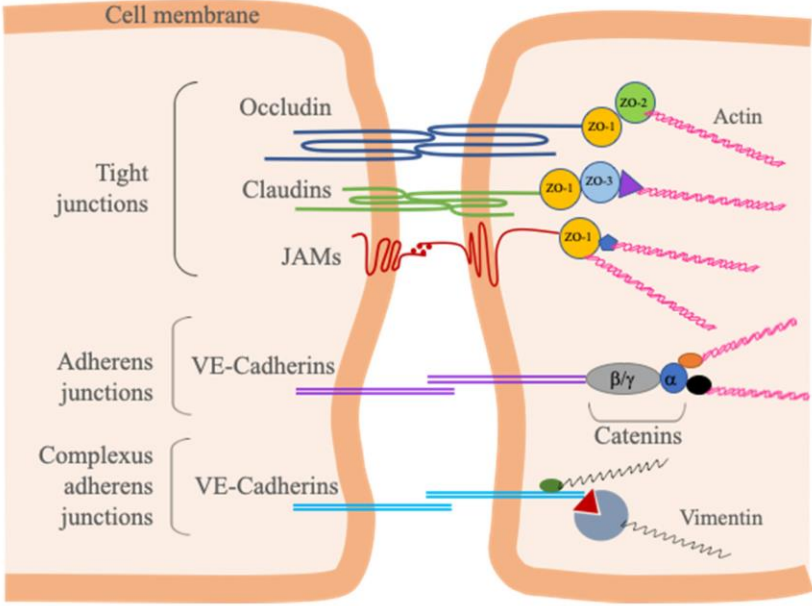
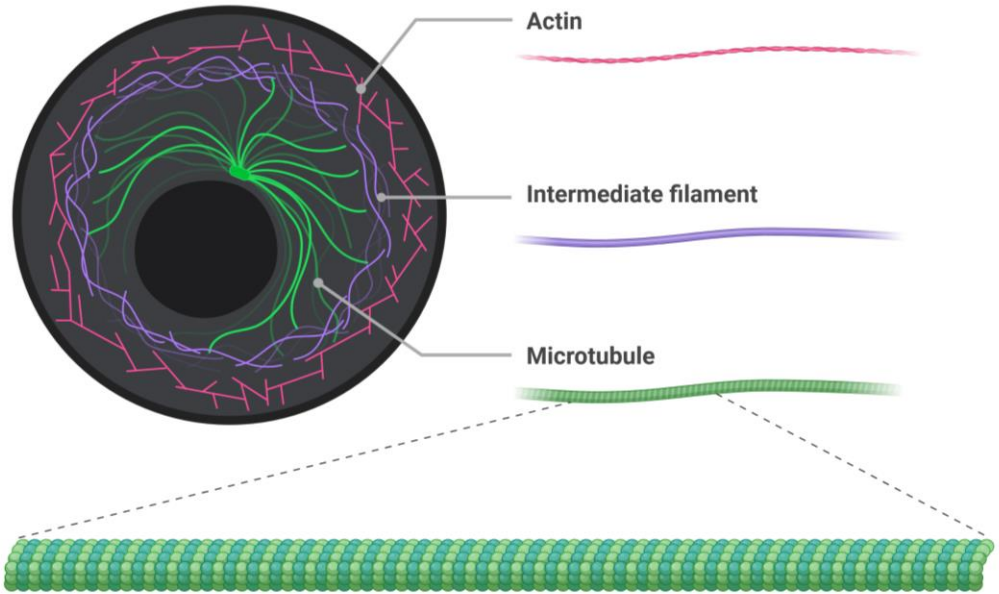


STRUCTURAL PROTEINS

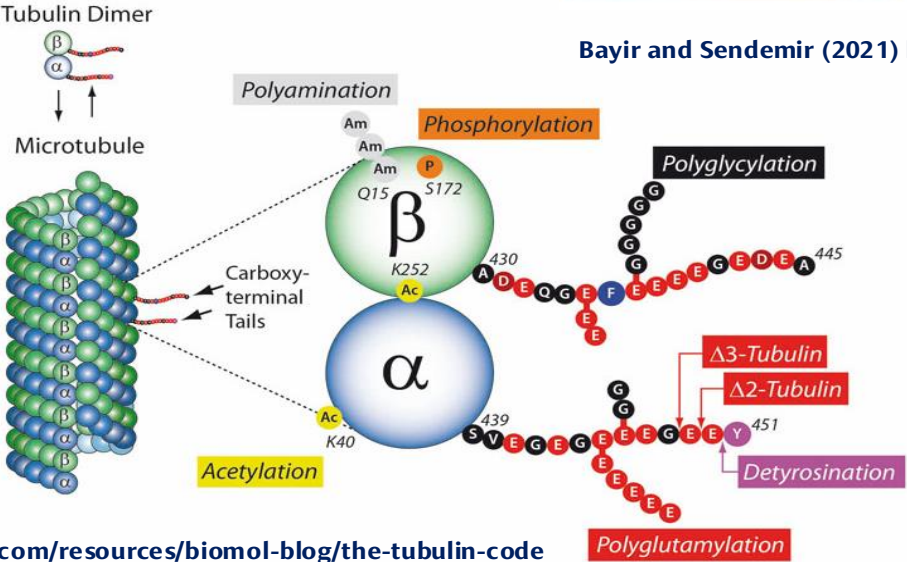
DRAKES



DUCKS



Bayir and Sendemir (2021) <https://doi.org/10.3390/cells10061400>



CONCLUSIONS

- 1) The addition of 1% dietary zeolite induces moderate yet biologically significant changes in the cecal mucosa of both ducks and drakes.
- 2) These changes are sex-dependent, with males and females exhibiting distinct protein expression patterns across various biological pathways.
- 3) Zeolite influences cecal structural proteins by increasing tubulin alpha-1 and vimentin-1 in males, suggesting enhanced cytoskeletal remodeling and improved gut barrier integrity. In females, these proteins are downregulated, indicating diminished structural adaptation and weaker epithelial stability.
- 4) Zeolite increases the expression of cecal HSP90 in ducks, suggesting heightened cellular stress. However, in drakes, HSP90 expression is decreased, indicating either lower stress levels or improved mucosal stability.

CONCLUSIONS

- 5) In males, zeolite enhances mitochondrial activity in cecal mucosa cells ($\uparrow$ ATP Synthase β , $\uparrow$ IDH3A), promoting oxidative metabolism. In females, these proteins are downregulated, suggesting impaired mitochondrial function and a shift toward alternative energy pathways.
- 6) Zeolite reduces the expression of glycolytic enzymes in the cecal mucosa of males, indicating a reliance on mitochondrial respiration. In contrast, these enzymes are upregulated in females, likely compensating for a reduced oxidative capacity.
- 7) Zeolite also affects creatine and glycosaminoglycan metabolism, with sex-specific alterations. In the cecal mucosa of males, there was a decrease in creatine kinase U-type and UDP-glucose 6-dehydrogenase expression, suggesting reduced energy buffering and tissue repair needs. In females, these proteins are upregulated, likely reflecting increased energy demands and tissue turnover.



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THANK YOU FOR ATTENTION