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## **Integrated Proteomics and Metabolomics Emphasized Nutritional Benefits Driven by Lentil (*Lens culinaris* Medik) Seed Germination**

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# Integrated Proteomics and Metabolomics Emphasized Nutritional Benefits Driven by Lentil (*Lens culinaris* Medik) Seed Germination.

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## Introduction

- Lentils are small, lens-shaped legumes that are a great source of protein, fiber, and various vitamins and minerals, easy to cook and versatile in dishes, and are considered an environmentally friendly and sustainable food source.
- Until now, lentil seed germination has been poorly described. The present work displays an original systems biology approach to address this gap in knowledge.
- This study investigated lentil seeds at different germination stages and temperature conditions through a multi-omics approach, including:
  - Statistical analysis was performed on the proteome and metabolome separately to screen for markers with significant control differences;
  - Functional annotation of lentil protein-coding sequences was done based on homologous alignment against well-annotated plant genomes;
  - Study of physiological and metabolic changes during lentil germination based on annotation enrichment and Multi-Omics Integration (MOI).

## Germination Data Description

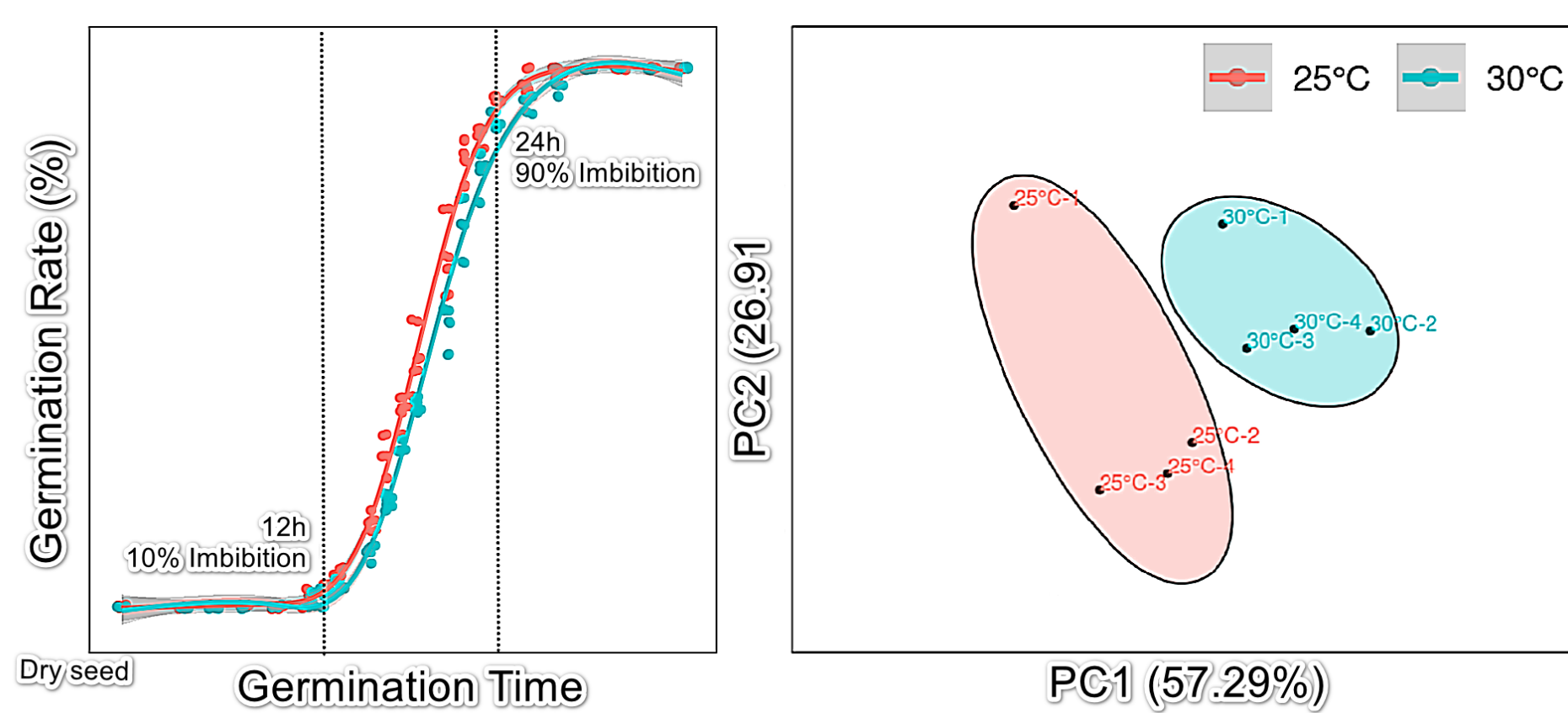


Figure 1. Germination kinetics presented by the simulating hill-function (left) and PCA projection of Germination Indices (right)

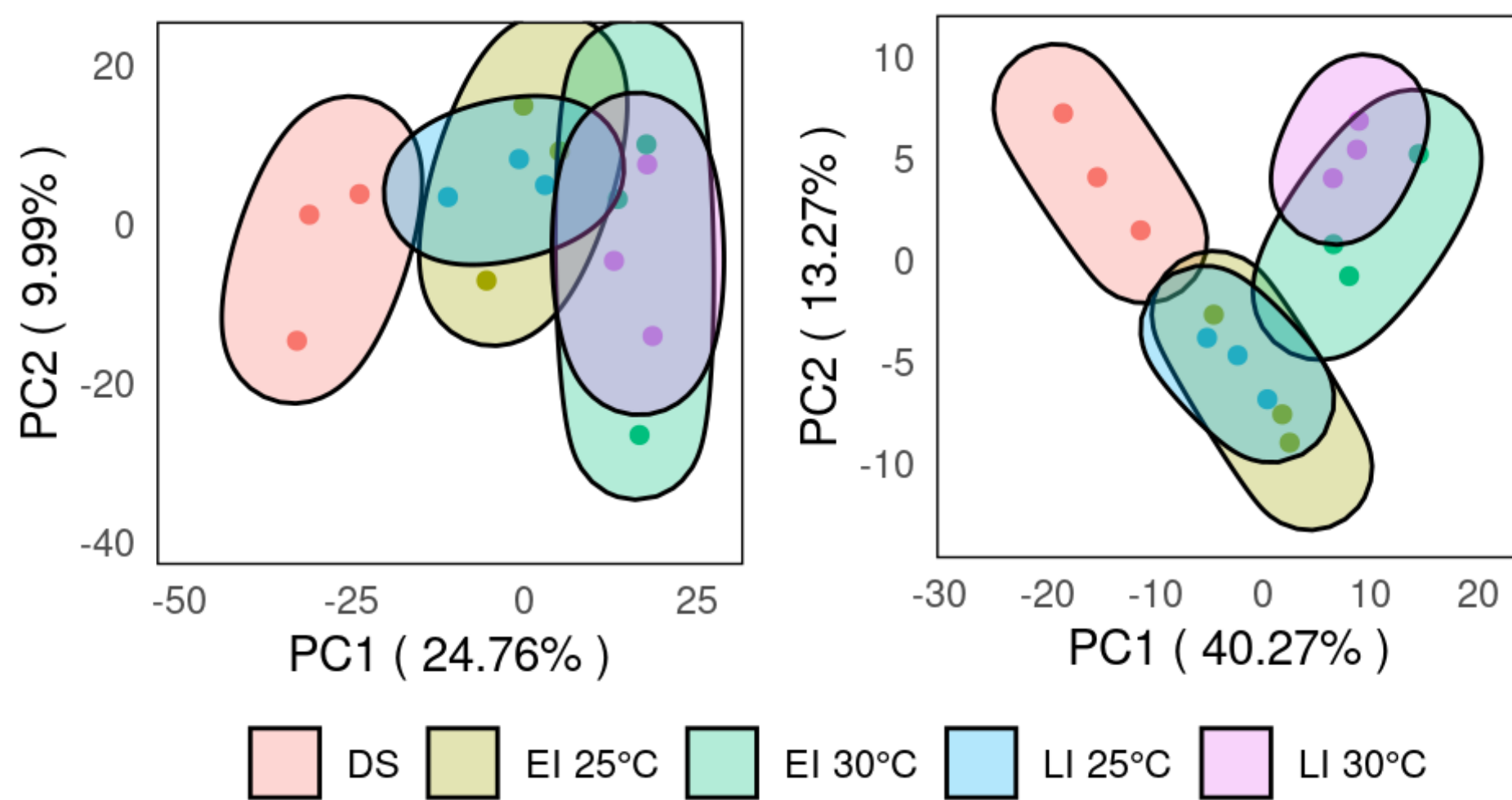


Figure 2. PCA Sample projection by 300 metabolomic features (left) and 1275 proteomic features (right)

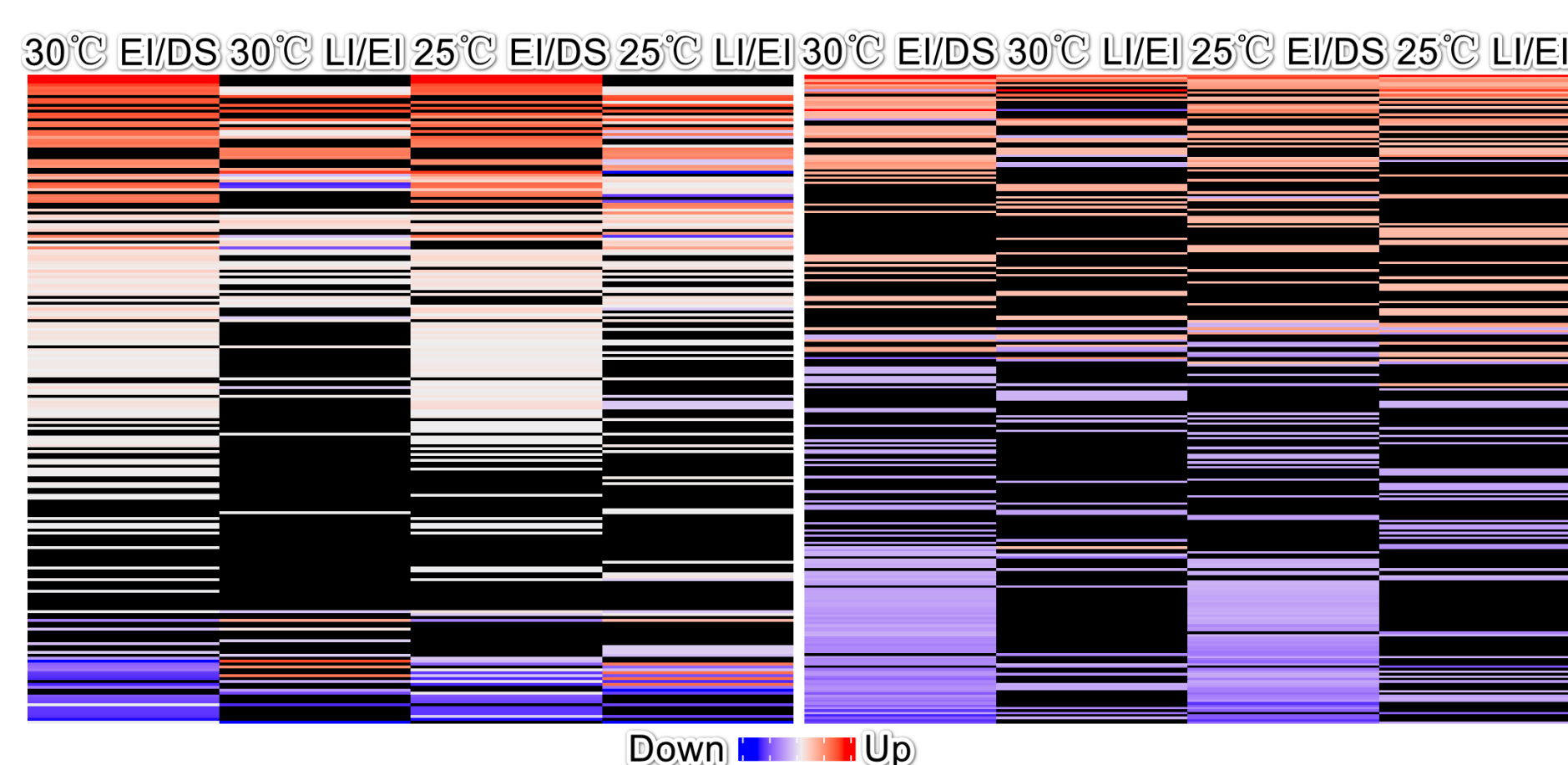


Figure 3. Metabolite Fold-Change Heat-map with total 88 significant features (left) and Protein Fold-Change Heat-map with 136 significant features (right)

## Omics Profiling/GO Enrichment

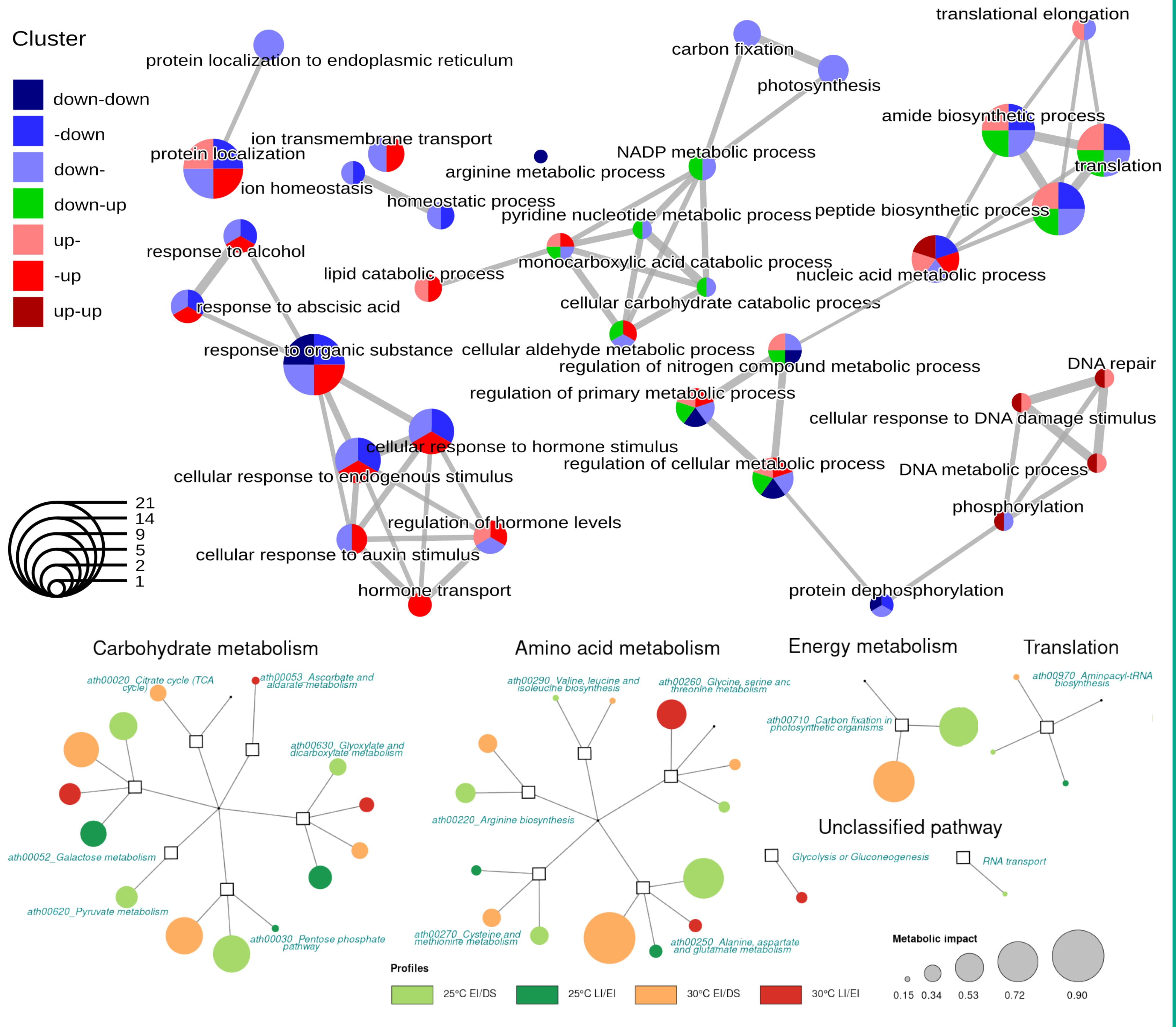


Figure 4. Top Proteomic GO enrichment (In total 1377 biological processes) by statistical profiles (above) and Top KEGG pathway enrichment (In total 85) network from Multi-Omics Integration (below)

## Conclusions

- This is the first descriptive analysis about Lentil seed germination by Multi-Omics approach. with no significant differences found in the germination patterns of the two different temperature treatments
- The metabolic dynamics give us the guidance of improving the nutritional quality of Lentil seed as food.
- The biological process revealed the important physiological turn-over during germination process, including central metabolism, hormone signaling, response to abiotic/biotic stress etc.

## Future Work

- Adding another omics dimensions (eg. transcriptomics) to reinforce the model interpretability .
- We will access the reproducibility of our results

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