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**Permanent:** 3307 31<sup>st</sup> Ave,  
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Bayside WI 53217

# Hunter Gene Carlson

## Education

December 2025 | Honors, B.S in Bioinformatics  
Marquette University, Milwaukee WI  
3.502 | Graduated Cum Laude

## Relevant Work and Research Experience

*Summer 2025*

**Undergraduate Researcher: Plant Molecular Biology Lab**

**Dr Michael Schlappi, Milwaukee WI**

Studied cold tolerance on a molecular level in *Oryza sativa* (Rice), with an emphasis on the gene expression differences seen between tolerant and sensitive subspecies.

*September 2025 – Present*

**Research Technician: Sleep, Circadian Rhythm and Metabolism Lab**

**Dr. Deanna Arble, Milwaukee WI**

Oversee genotyping and colony maintenance, coordinate new experiments, and support undergraduate and PhD research projects. Conduct independent studies investigating neural mechanisms underlying physiological responses in mouse models.

## Projects

### Plant Molecular Biology

- Performed RNA-seq analysis on six *Oryza sativa* subspecies, including cold-tolerant WIR, cold-sensitive Caro, and four recombinant lines. Applied WGCNA to build co-expression networks and identify modules with divergent expression, followed by DESeq2 differential expression analysis. Integrated both approaches to prioritize candidate genes and regulatory pathways associated with cold tolerance and stress response.
- Designed and generated CRISPR/Cas9 constructs for targeted gene knockouts and overexpression of candidate genes associated with cold tolerance and sensitivity. Performed molecular cloning and plant transformation to introduce constructs into *Oryza sativa*. Cultivated transgenic lines and validated successful genome editing events through PCR screening and sequence verification.

### Sleep, Circadian Rythm and Metabolism

- Conducted an HCVR experiment using immunohistochemistry targeting five separate brain regions to identify regions activated by CO<sub>2</sub> exposure in both lean and obese mice. Included plethysmography of mice in response to both room air and 8% CO<sub>2</sub>.
- Established and optimized a new RNAscope workflow to measure MC4R transcript levels in lean vs. obese mice, focusing on the paraventricular nucleus, arcuate nucleus, periaqueductal gray, and brainstem. Independently planned and conducted a 12-animal study (2 images/region/animal) and carried out quantitative image analysis with QuPath and Fiji.
- Performed intravitreal injections of AAV-DTA to selectively ablate melanopsin-expressing cells and assessed functional outcomes by recording pupillary light reflex using infrared video imaging.
- Collaborated with a rotating PhD student in a partner lab to investigate the effects of morphine and light exposure on respiratory function. Measured tidal volume, minute ventilation, and breathing frequency using a 36-hour plethysmography, with subcutaneous administration of saline and morphine, followed by a 3-hour light pulse.
- Developed a computational pipeline to automate the processing and analysis of raw respiratory data collected from plethysmography recordings, enabling efficient extraction of key physiological measurements and reducing manual analysis time. Designed and implemented a user-friendly web application interface to allow non-programming lab members to easily execute analyses and obtain interpretable results.

## **Bibliography**

**Carlson, H.**, Himelblau, E., Chikwendu, C., Schläppi M., (2026) Gene Expression Differences between Cold-Tolerant and Cold-Sensitive Rice. Poster Presentation. Marquette University, Milwaukee, WI.

**Carlson, H.**, Himelblau, E., Chikwendu, C., Schläppi M., (2025) Rice Under Ice; Investigating the Genes behind Cold Survival. Poster Presentation. Marquette University, Milwaukee, WI.

## **Honors and Awards**

**Undergraduate Research Award in Biological Sciences**

2025-2026

**Recognition of Outstanding Research and Presentation at the Undergraduate Biology Poster Session**

2025-2026

**Marquette University Core Honors Program**

2021-2026

## **Research Interests**

1. Environmental Regulation of Gene Expression and Phenotypic Responses
2. Neurobiology of homeostasis and metabolic regulation
3. Molecular Genetics and Cellular Mechanisms of Disease

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## Research Skills

**Molecular Biology:** DNA extraction; primer design; cloning and bacterial transformation; PCR; RT-qPCR; gel electrophoresis; Nanodrop quantification; RNA interference (RNAi); CRISPR-Cas9-mediated targeted mutagenesis; gene knockout and overexpression approaches.

**Neuroanatomical & Histological Techniques:** Intravitreal AAV injections; subcutaneous and intraperitoneal injections; brain harvesting and cryosectioning (cryostat); retinal dissection; immunohistochemistry; RNAscope in situ hybridization.

**Physiology & Imaging:** Whole-body plethysmography; pulmonary light reflex (PLR); hypercapnic ventilatory response testing; fluorescent imaging using Keyence microscopy.

**Animal and Colony Upkeep:** Mouse colony management; colony census tracking and organization; breeding; weaning; genotyping; animal identification procedures including ear punching and tail snipping; mouse handling and restraint (scruffing); health monitoring and documentation; euthanasia procedures; compliance with institutional animal care and use guidelines (IACUC).

## Computer and Programming Skills

**Programming & Data Analysis:** R; Python; Jupyter Notebook; Anaconda; GraphPad Prism; Microsoft Excel.

**Bioinformatics & Genomics:** RNA-seq analysis; differential gene expression analysis; Bioconductor; DESeq2; WGCNA network analysis; BLAST; Ensembl; biomaRt.

**Image & Behavioral Analysis:** ImageJ/Fiji; QuPath; DeepLabCut.

## Relevant Courses

|             |                                         |
|-------------|-----------------------------------------|
| Spring 2024 | Genetics                                |
| Spring 2024 | Evolutionary Biology                    |
| Spring 2024 | Biostatistical Methods/Models           |
| Summer 2024 | Cell Biology                            |
| Fall 2024   | Biochemistry/Molecular Basis of Biology |
| Fall 2024   | Genomics and Bioinformatics             |

Spring 2025

Molecular Evolution

Spring 2025

Experimental Genetics