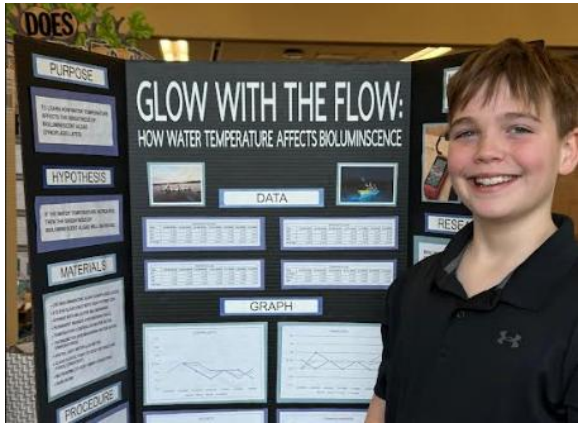
Glow with the Flow: How Temperature Affects Bioluminescence



PURPOSE

TO LEARN HOW WATER TEMPERATURE AFFECTS THE BRIGHTNESS OF BIOLUMINESCENT ALGAE (DYNOFLAGELLATES).

HYPOTHESIS

IF THE WATER TEMPERATURE INCREASES, THEN THE BRIGHTNESS OF BIOLUMINESCENT ALGAE WILL INCREASE.

MATERIALS

1. LIVE BIOLUMINESCENT ALGAE (DINOFLAGELLATES)
2. 9 CLEAR GLASS VIALS WITH TIGHT-FITTING LIDS
3. SYRINGE WITH MILLILITER (ML) MARKINGS
4. PERMANENT MARKER (FOR MARKING VIALS)
5. TEMPERATURE-CONTROLLED WATER BATHS
6. THERMOMETER (FOR MEASURING WATER BATHS TEMPERATURES)
7. DIGITAL LIGHT METER (LUX METER)
8. CLEAR PLASTIC TUBE (TO KEEP DISTANCE AND FORCE CONSISTENT)
9. METRONOME (TO KEEP TIMING CONSISTENT)
10. DARK ROOM

PROCEDURE

1. LABEL NINE VIALS (C1–C3, W1–W3, H1–H3).
2. GENTLY MIX THE ALGAE CULTURE AND ADD 10.0 ML TO EACH VIAL. SEAL ALL VIALS.
3. ON SATURDAY AT 8:00 PM, PLACE VIALS INTO TEMPERATURE BATHS:
   A. CONTROL: 21.0°C
   B. WARM: 23.0°C
   C. HOT: 26.0°C
4. FROM SUNDAY THROUGH SATURDAY, TEST ALL VIALS ONCE PER DAY AT 8:00 PM.
5. BEFORE EACH TEST, PLACE VIALS IN DARKNESS FOR 15 MINS.
6. MAKE THE ALGAE GLOW BY DROPPING VIAL IN PLASTIC TUBE AND TIMING WITH A METRONOME.
7. MEASURE THE BRIGHTEST LIGHT (LUX) AFTER THREE SECONDS USING A DIGITAL LIGHT METER AND RECORD THE DATA.
8. RECORD WATER TEMPERATURE EACH NIGHT TO CONFIRM CONSISTENT TEMPERATURE.

RESEARCH

BIOLUMINESCENT ALGAE ARE TINY OCEAN ORGANISMS CALLED DINOFLAGELLATES. THEY USE PHOTOSYNTHESIS DURING THE DAY TO MAKE ENERGY FROM SUNLIGHT. AT NIGHT, SOME DINOFLAGELLATES CAN MAKE THEIR OWN LIGHT WHEN THEY ARE MOVED OR DISTURBED. THIS LIGHT IS CAUSED BY A CHEMICAL REACTION INSIDE THE CELL.

SCIENTISTS THINK CHANGES IN WATER TEMPERATURE CAN AFFECT HOW THESE CHEMICAL REACTIONS WORK.

DATA

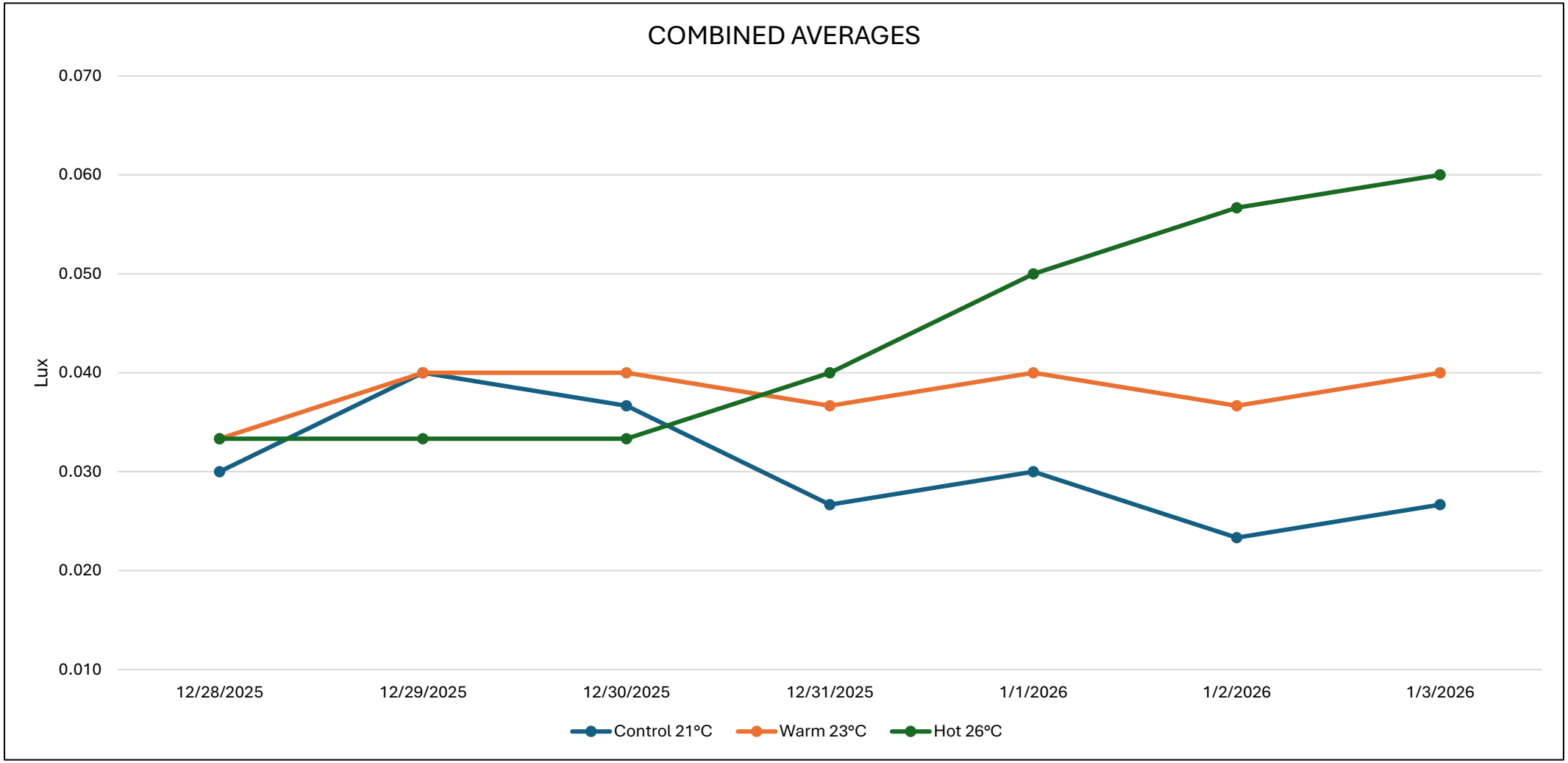
Control 21°C (in Lux)							
Vial	12/28/2025	12/29/2025	12/30/2025	12/31/2025	1/1/2026	1/2/2026	1/3/2026
C1	0.03	0.04	0.03	0.02	0.03	0.02	0.03
C2	0.03	0.04	0.04	0.03	0.03	0.03	0.02
C3	0.03	0.04	0.04	0.03	0.03	0.02	0.03
Average	0.030	0.040	0.037	0.027	0.030	0.023	0.027

Warm 23°C (in Lux)							
Vial	12/28/2025	12/29/2025	12/30/2025	12/31/2025	1/1/2026	1/2/2026	1/3/2026
W1	0.04	0.03	0.04	0.03	0.04	0.03	0.03
W2	0.03	0.05	0.04	0.04	0.04	0.04	0.04
W3	0.03	0.04	0.04	0.04	0.04	0.04	0.05
Average	0.033	0.040	0.040	0.037	0.040	0.037	0.040

Hot 26°C (in Lux)							
Vial	12/28/2025	12/29/2025	12/30/2025	12/31/2025	1/1/2026	1/2/2026	1/3/2026
H1	0.04	0.03	0.03	0.04	0.04	0.05	0.05
H2	0.03	0.03	0.03	0.03	0.05	0.06	0.07
H3	0.03	0.04	0.04	0.05	0.06	0.06	0.06
Average	0.033	0.033	0.033	0.040	0.050	0.057	0.060

Combined Averages (in Lux)							
Vial	12/28/2025	12/29/2025	12/30/2025	12/31/2025	1/1/2026	1/2/2026	1/3/2026
Control	0.030	0.040	0.037	0.027	0.030	0.023	0.027
Warm	0.033	0.040	0.040	0.037	0.040	0.037	0.040
Hot	0.033	0.033	0.033	0.040	0.050	0.057	0.060

GRAPH


COMBINED AVERAGES
0.070
0.060
0.050
0.040
0.030
0.020
0.010
Lux
12/28/2025
12/29/2025
12/30/2025
12/31/2025
1/1/2026
1/2/2026
1/3/2026
Control 21°C
Warm 23°C
Hot 26°C

CONCLUSION

THE RESULTS SHOWED THAT WATER TEMPERATURE AFFECTED HOW BRIGHTLY THE ALGAE GLOWED OVER TIME. AT FIRST, ALL GROUPS GLOWED ABOUT THE SAME. AFTER SEVERAL DAYS, THE HOT GROUP (26.0°C) BECAME MUCH BRIGHTER THAN THE CONTROL AND WARM GROUPS. THIS SHOWS THAT HIGHER TEMPERATURES CAN INCREASE BRIGHTNESS AFTER THE ALGAE HAVE TIME TO ADJUST.