

***It's a Gas: Chromatographic
Monitoring of Microbe Activity
in Lake and River Mud***

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Dept. of Biology

Mittry Lake



Las Vegas

Glen Canyon Dam

San Juan River

Flagstaff

Little Colorado River

Colorado River

Phoenix

ARIZONA

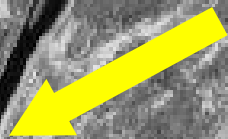
NEW MEXICO

AWC

MEXICO

Tucson

Colorado River

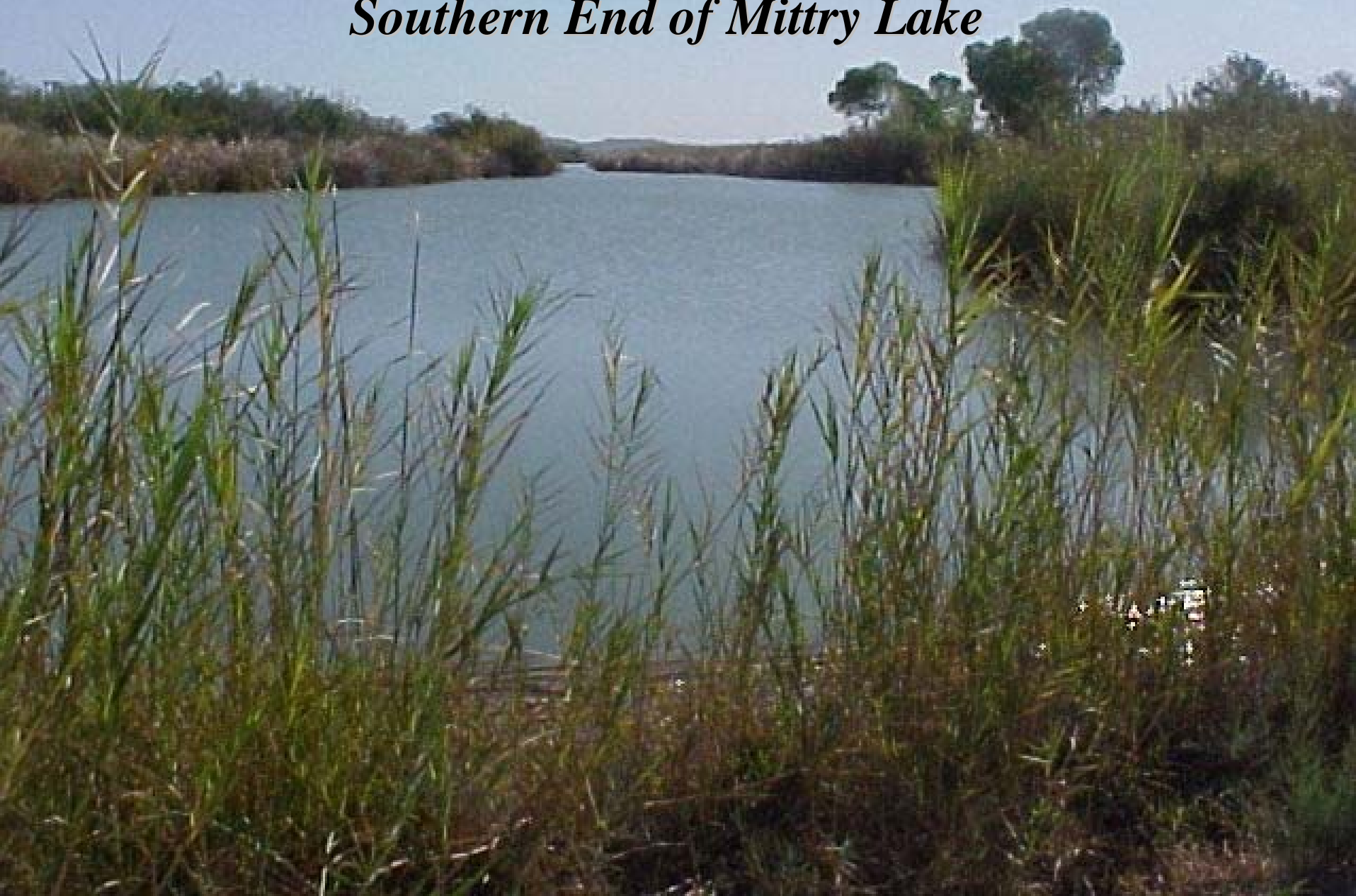


Collection site



Mittry Lake

*View from Collection Site at
Southern End of Mittry Lake*





Mittry Lake Mud

A photograph of the saline Gila River. The river is dark and still, with several wooden structures, possibly traps or small rafts, floating in it. Two people are walking away from the camera on a dirt path that runs along the right bank of the river. The person in front is wearing a light-colored shirt and a hat, and the person behind is wearing a blue jacket and jeans. The background is filled with green vegetation and trees under a clear blue sky.

*The saline
Gila River*

Gila River mud



**Serrated
rubber septum**

**100mL
cylinder**

headspace

river H₂O

15mL

**cellophane
film**

mud

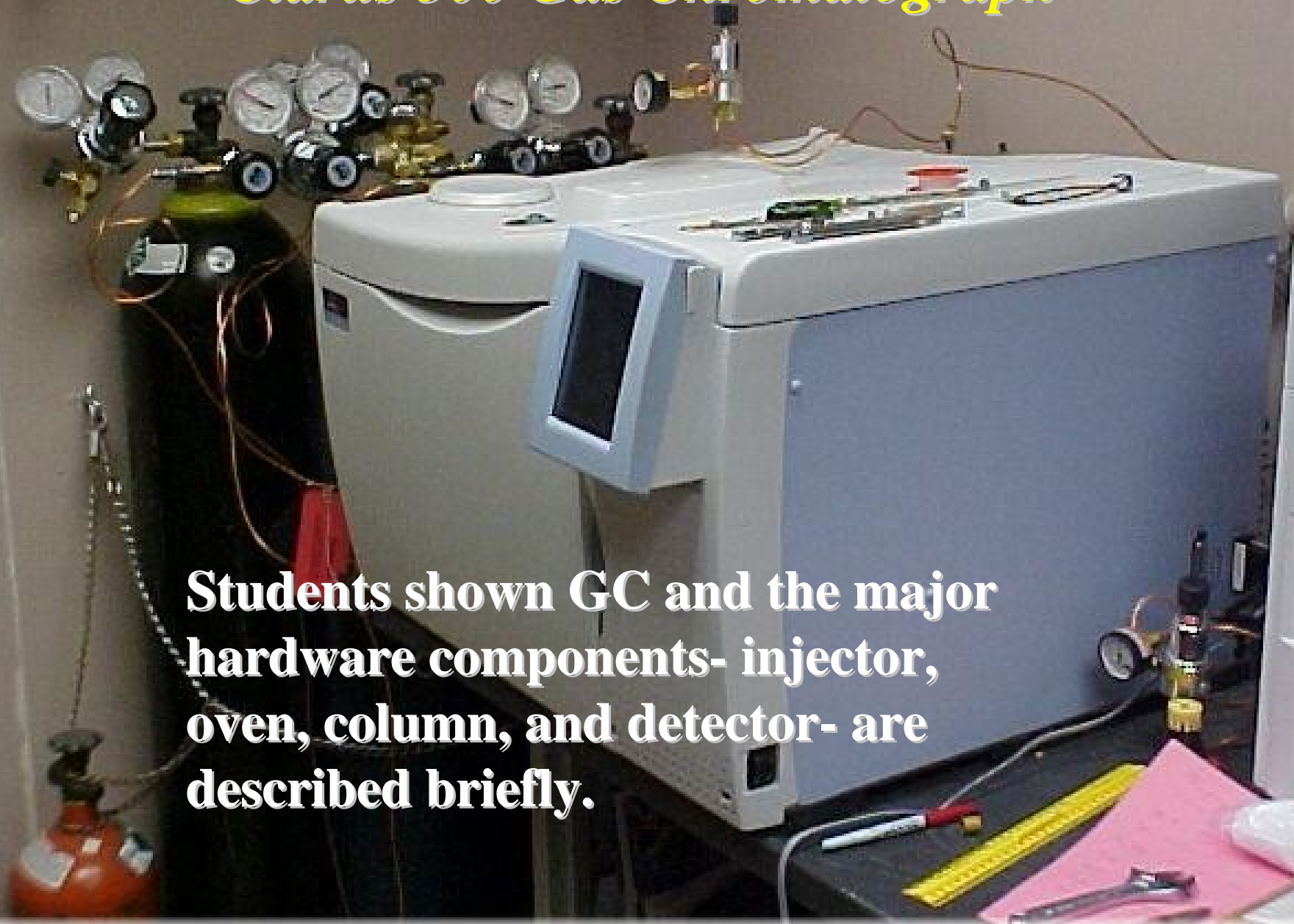
80mL



Winogradsky Columns

Clarus 500 Gas Chromatograph

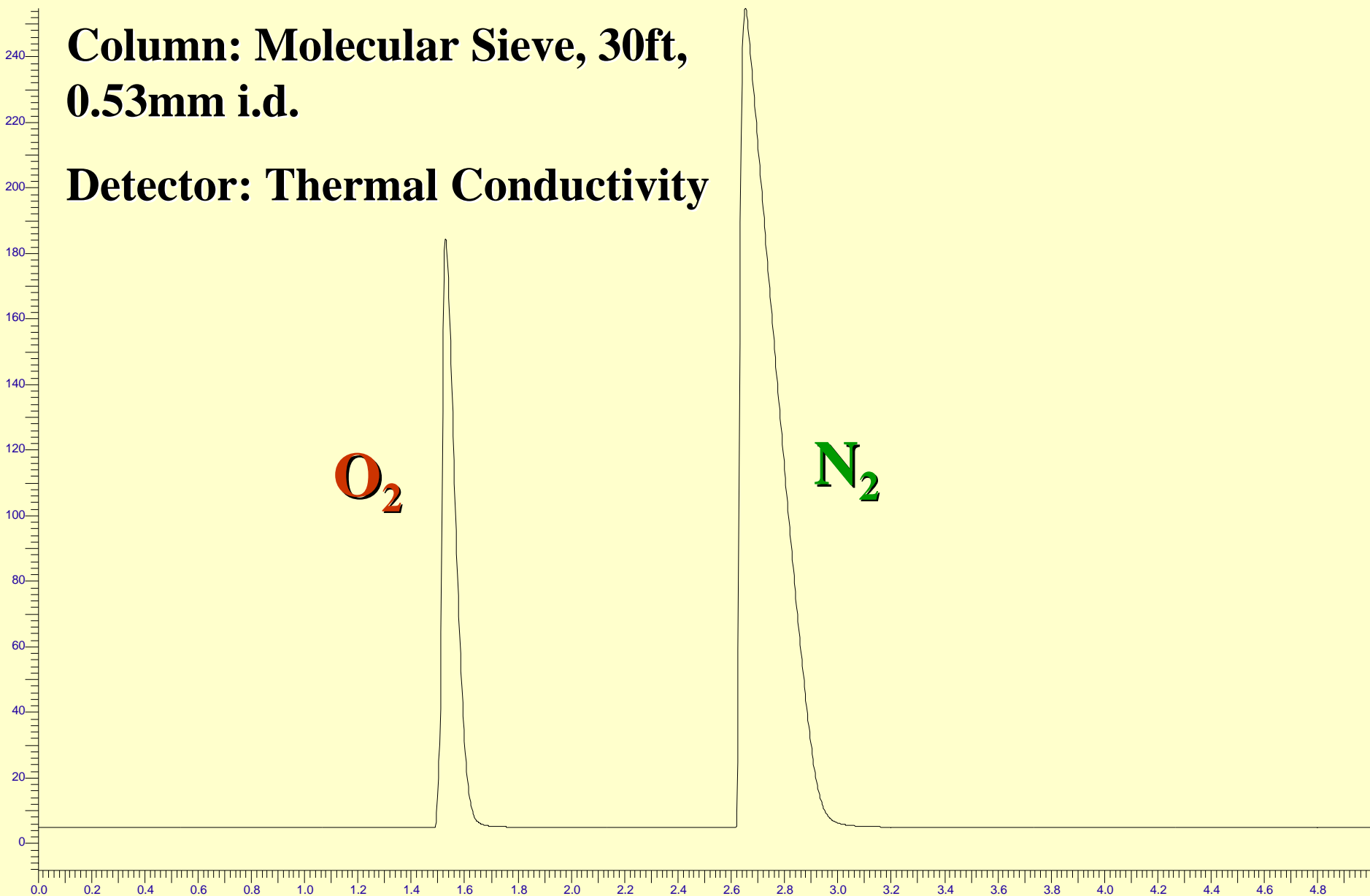
Students shown GC and the major hardware components- injector, oven, column, and detector- are described briefly.



Gas Chromatogram of Ambient Air

**Column: Molecular Sieve, 30ft,
0.53mm i.d.**

Detector: Thermal Conductivity





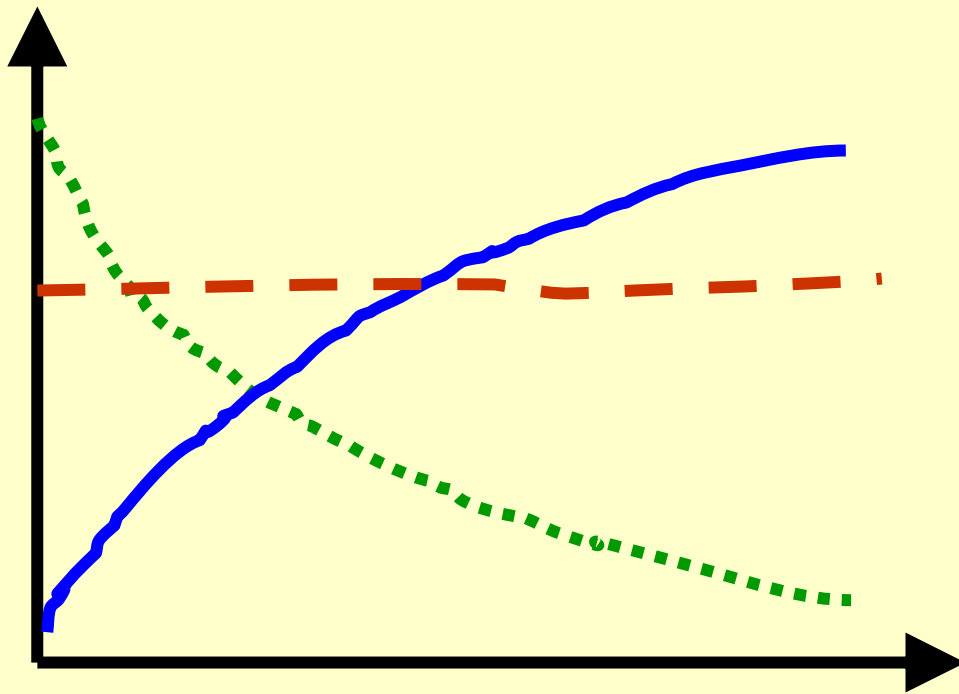
Control

Winogradsky Columns

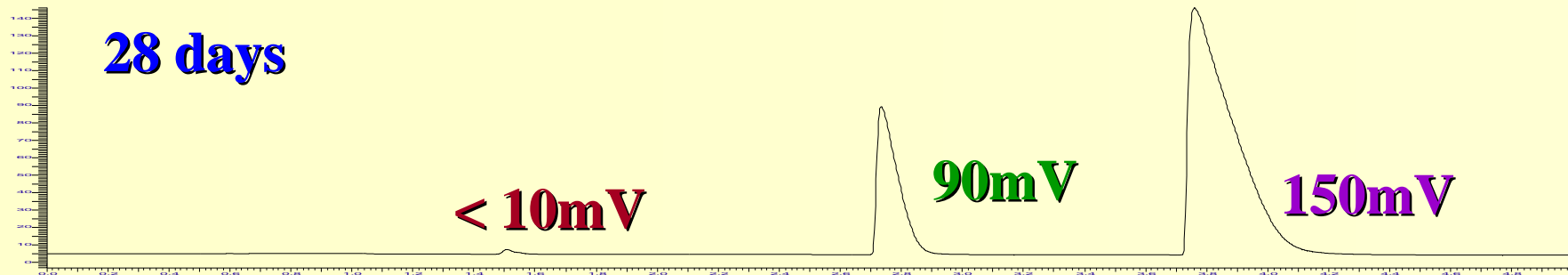
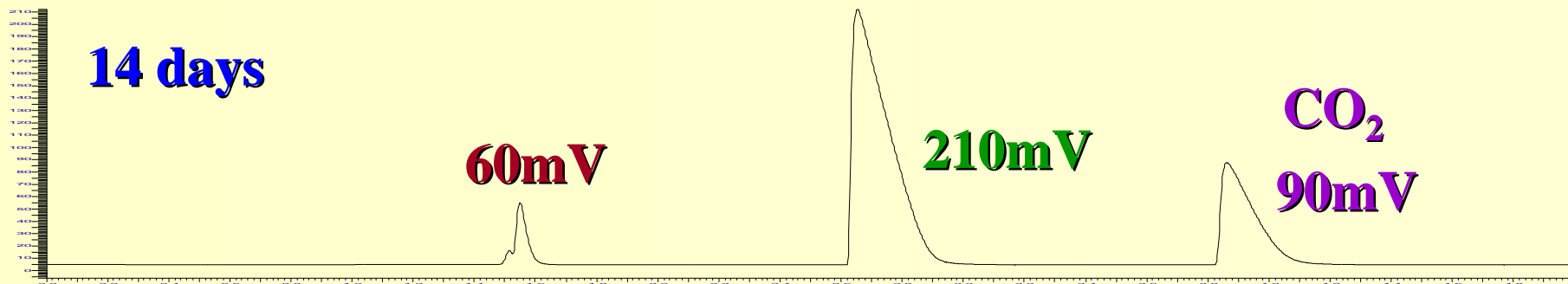
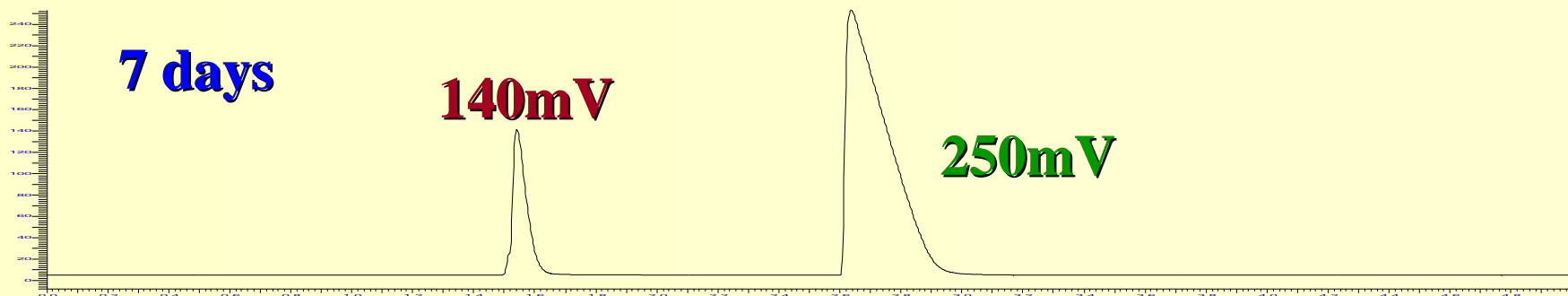
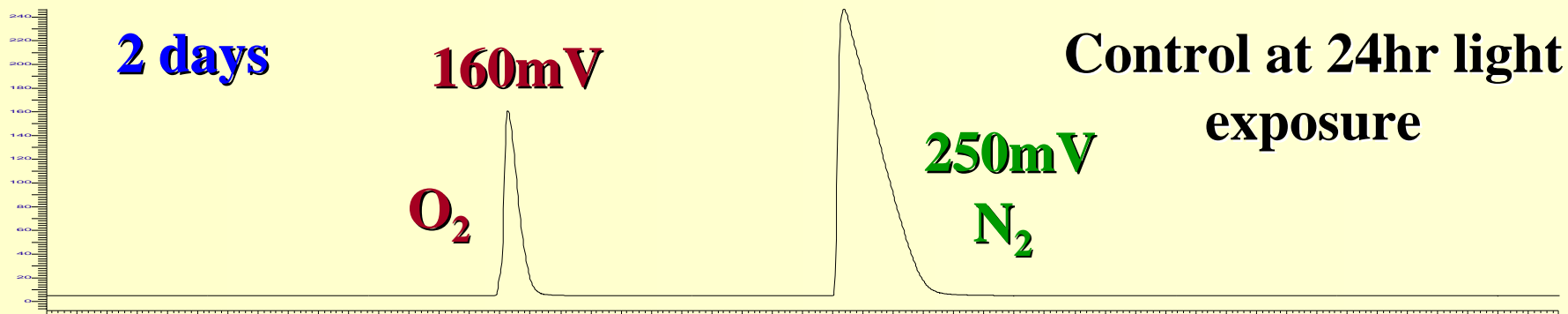
Introductory Conceptual Question:

On the axes below draw the curve for the change in O_2 and N_2 over time (x -axis).

Explain your reasoning.

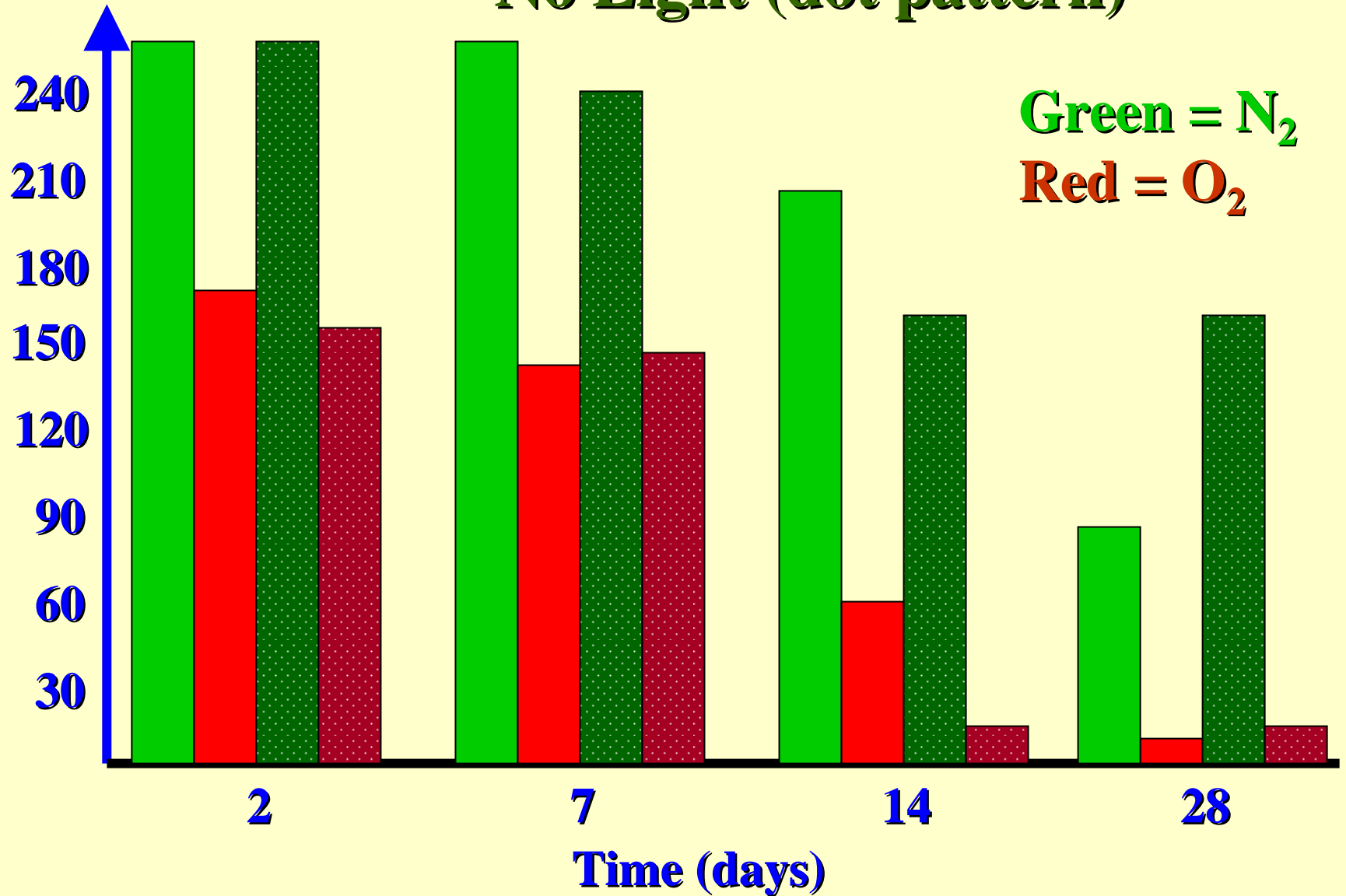


**Both light & dark
conditions for
control**



Controls: **Light Exposure** vs. **No Light (dot pattern)**

**Detector
Response**

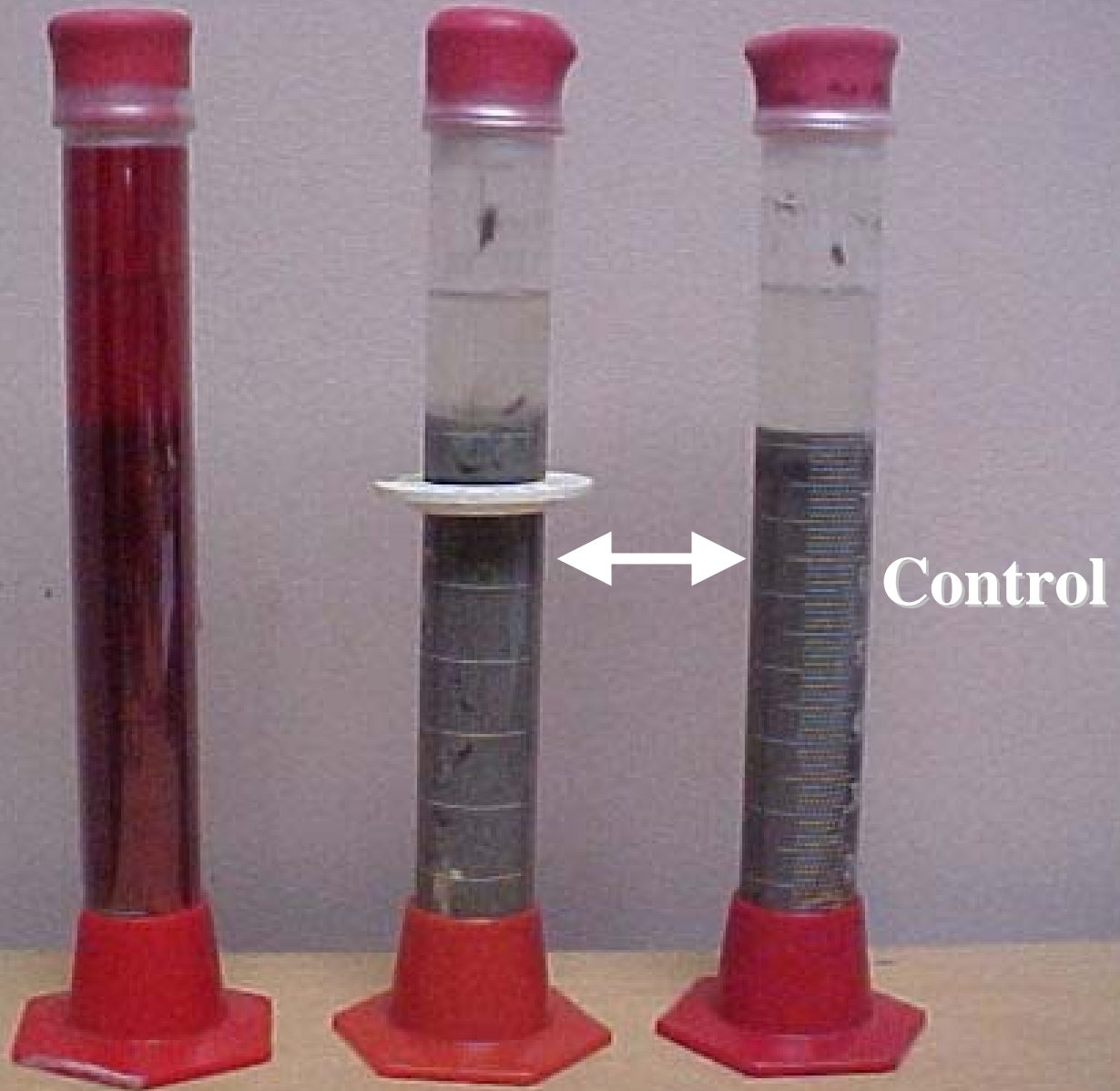


Students offer interpretation of the following GC data:

Net consumption of:

- **O₂ and N₂ over 14 days is greater under dark conditions**
- **N₂ from 14 to 28 days is considerably greater under light than dark conditions**

Light: Control vs. Winogradsky Column



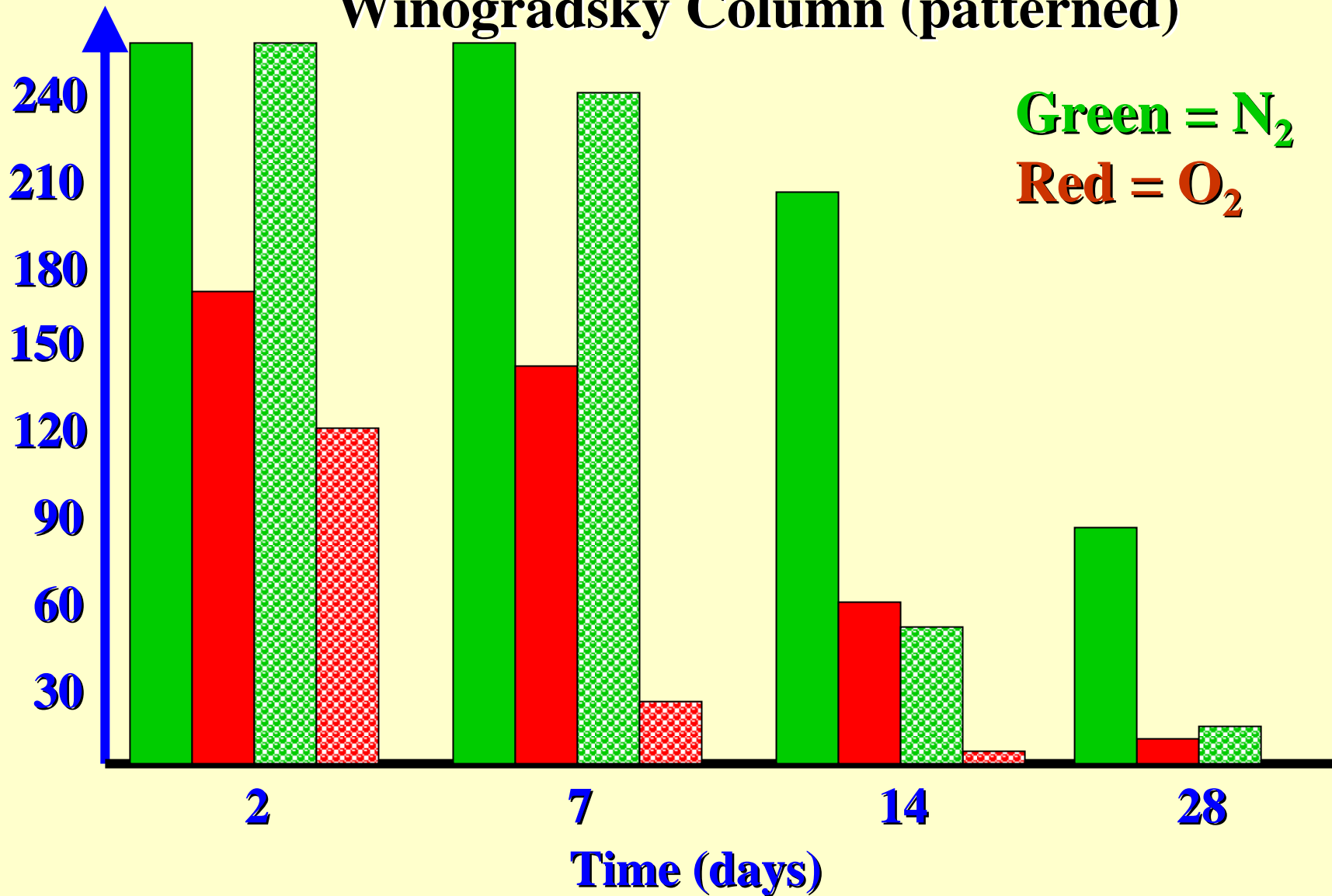
Introductory Question:

The graph below shows the change in O_2 over time (x -axis) for the control when exposed to light. On the same axes draw the curve for the change in O_2 over time for the Winogradsky column under identical light conditions. *Explain your reasoning.*



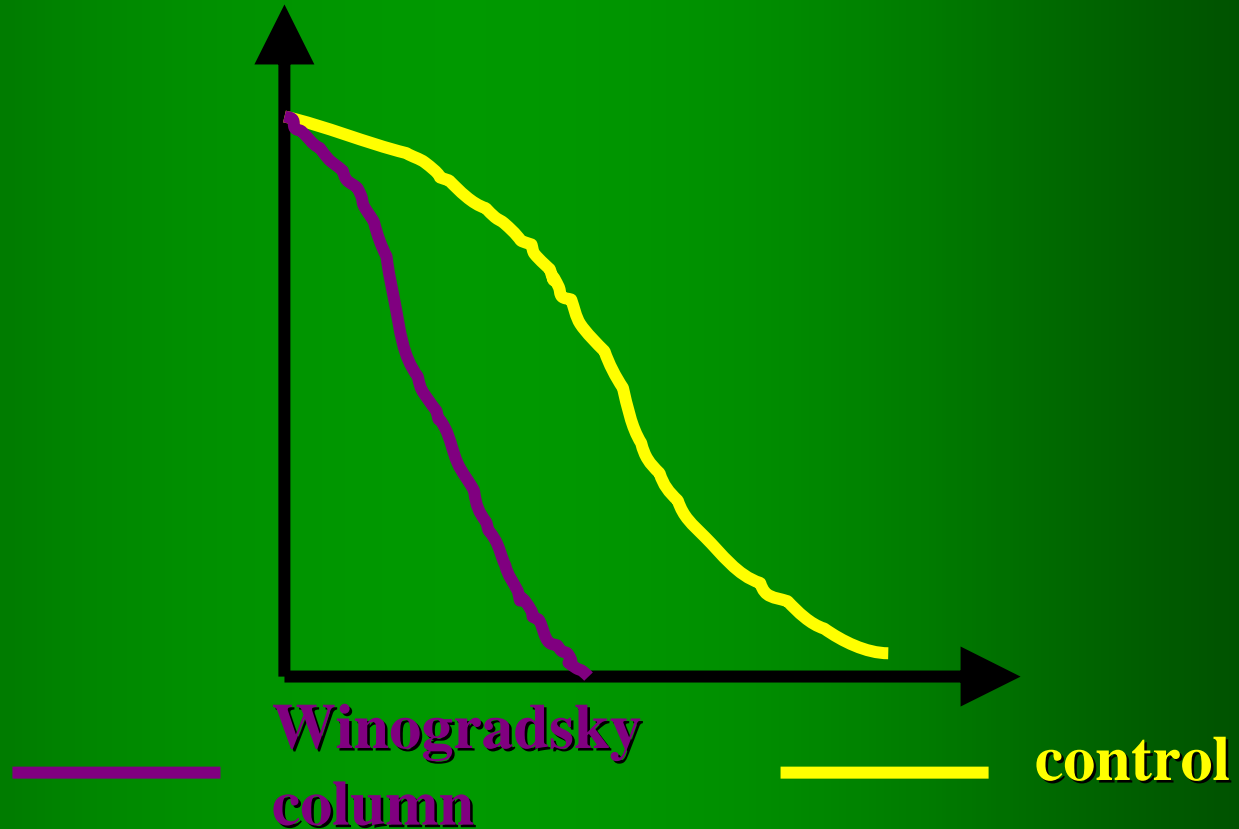
**Detector
Response**

**24hr Light: Control (solid) vs.
Winogradsky Column (patterned)**



Green = N₂
Red = O₂

The graph below shows the change in O_2 over time (x -axis) for the control when exposed to light. On the same axes draw the curve for the change in O_2 over time for the Winogradsky column under identical light conditions. *Explain your reasoning.*

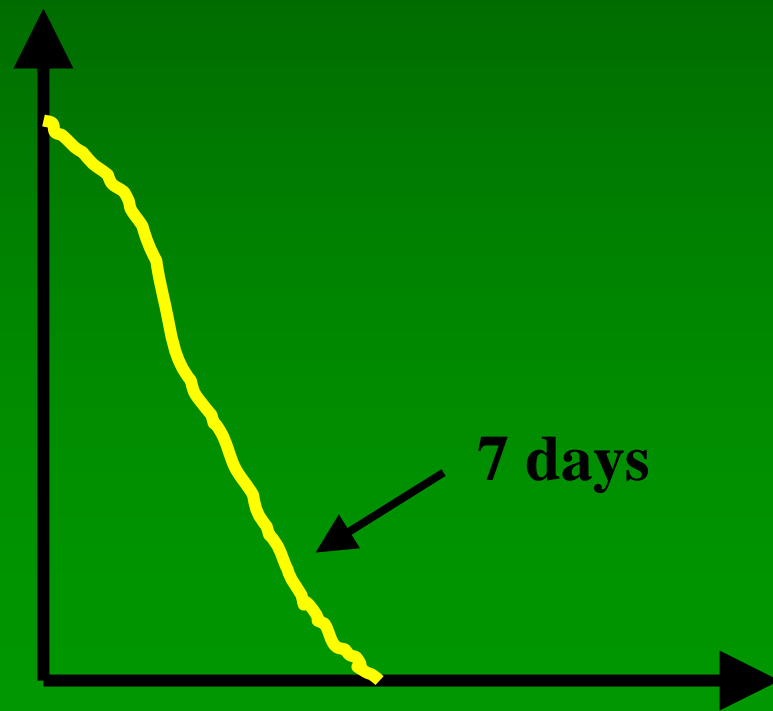




Control

Light & Dark Conditions

The graph below shows the change in O_2 over time (x -axis) for the Winogradsky column when exposed to light. On the same axes draw the curve for the change in O_2 over time under dark (no light) conditions. *Explain your reasoning.*



Light vs. Dark Exposure Regimes

2 days

O_2

N_2

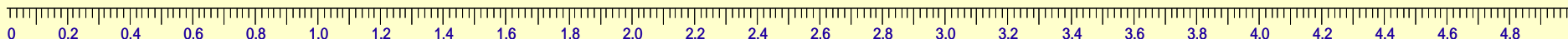
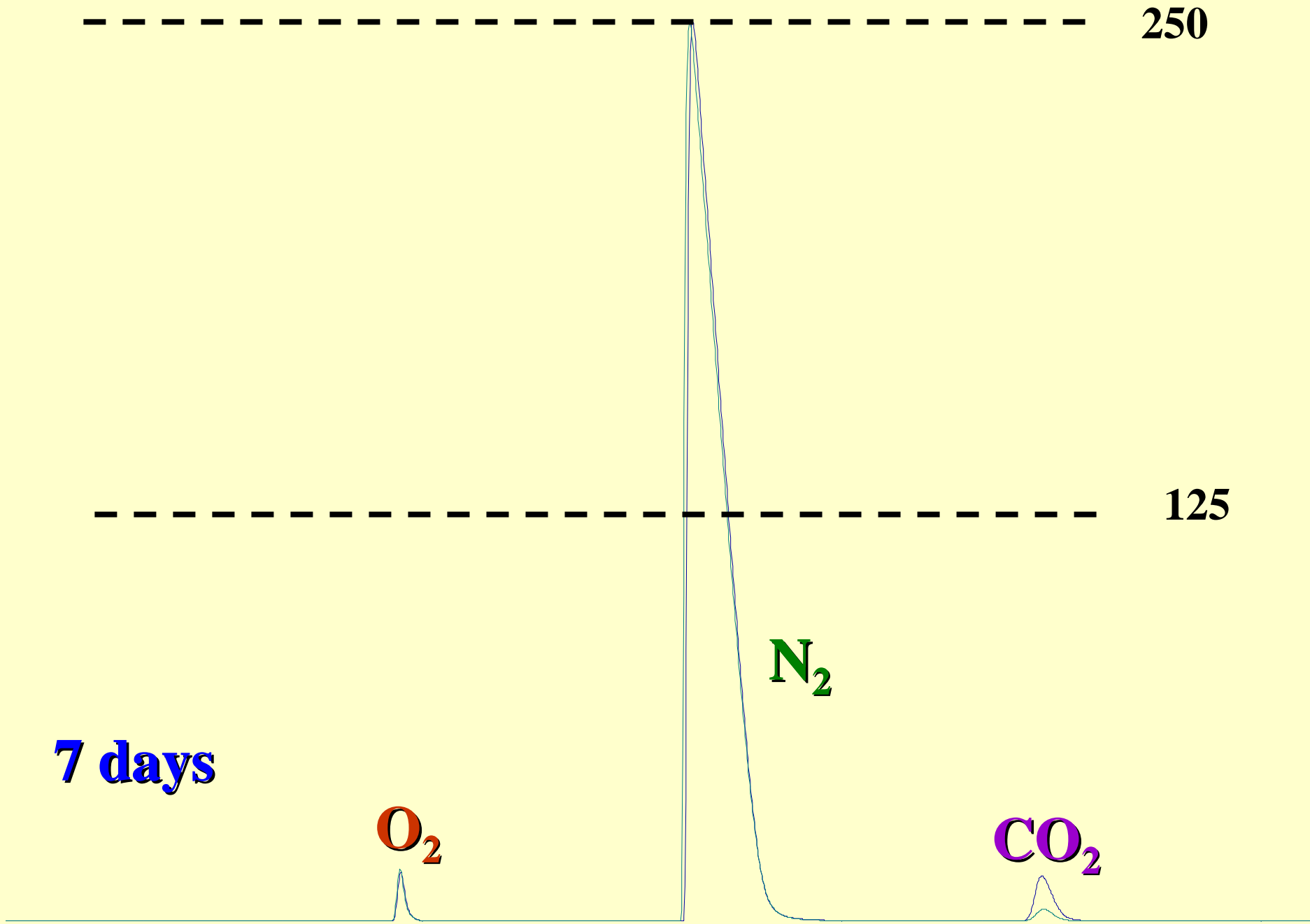
250

185

125

60





14 days

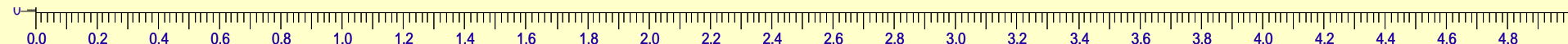
O₂

N₂

CO₂

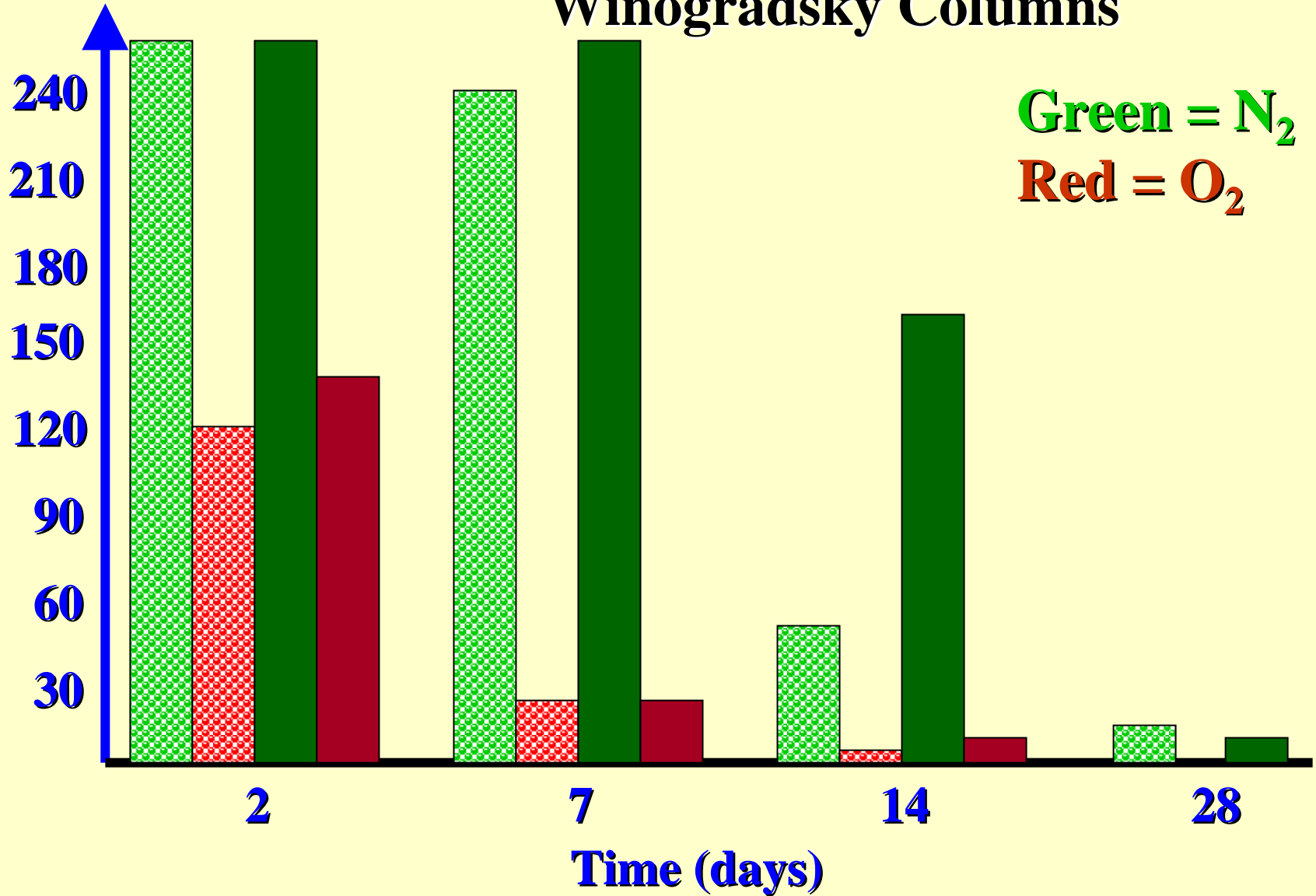
140

70

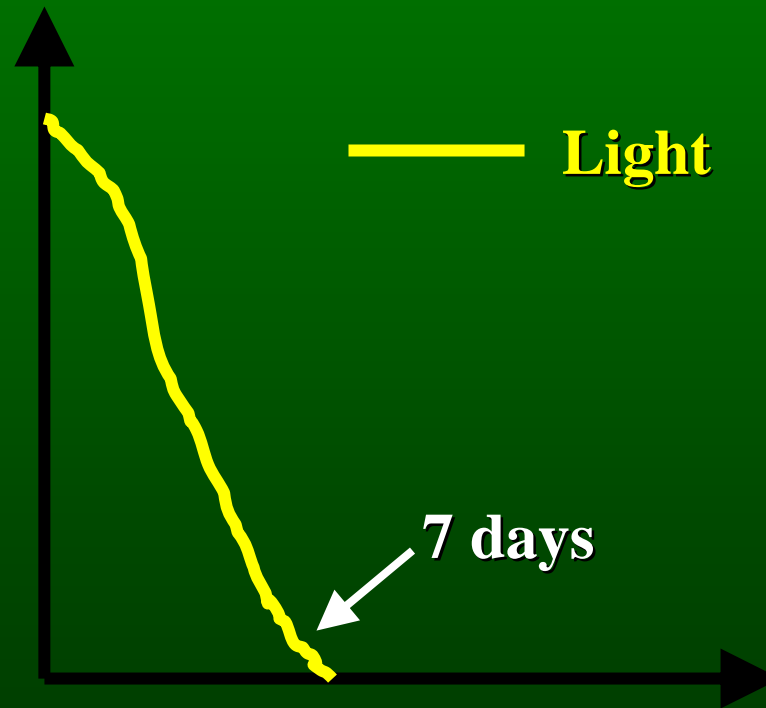


**Detector
Response**

**Light (patterned) vs. Dark (solid)
Winogradsky Columns**



The graph below shows the change in O_2 over time (x -axis) for the Winogradsky column when exposed to light. On the same axes draw the curve for the change in O_2 over time under dark (no light) conditions. *Explain your reasoning.*



Light: Open vs. Red Cellophane Column



**No difference
over time**



Control

Acknowledgements



National Science Foundation
WHERE DISCOVERIES BEGIN

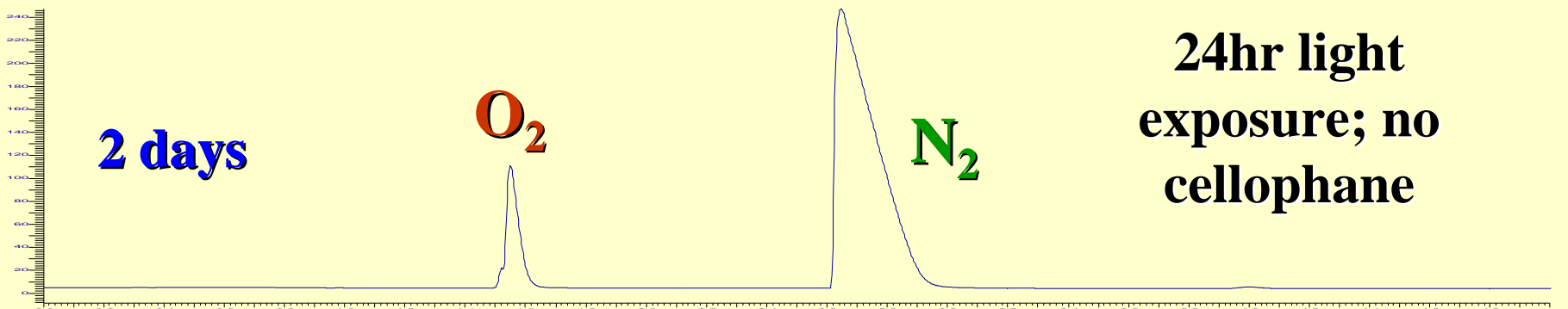
- **Course, Curriculum, & Laboratory Improvement (CCLI) grant (DUE- 0310264)**
- **My lovely wife & two children**

24hr light exposure; no cellophane

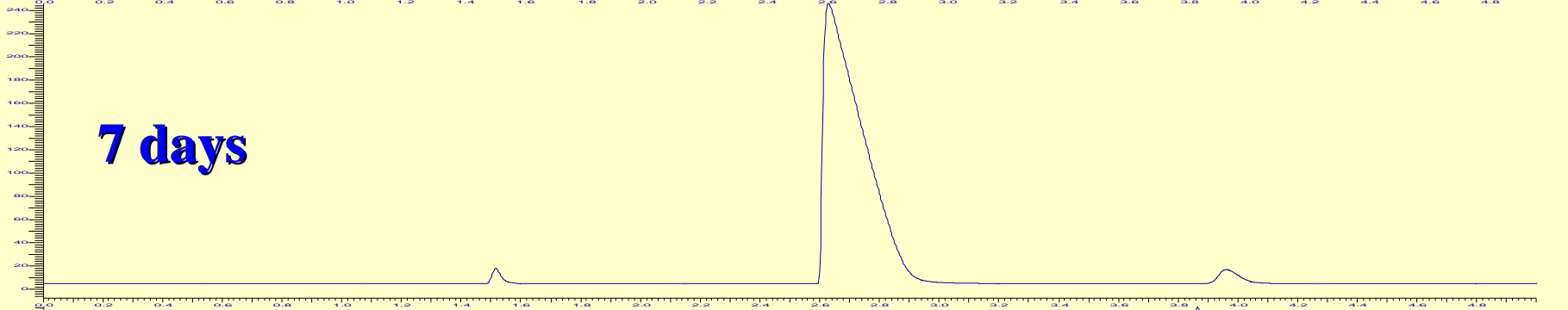
2 days

O₂

N₂

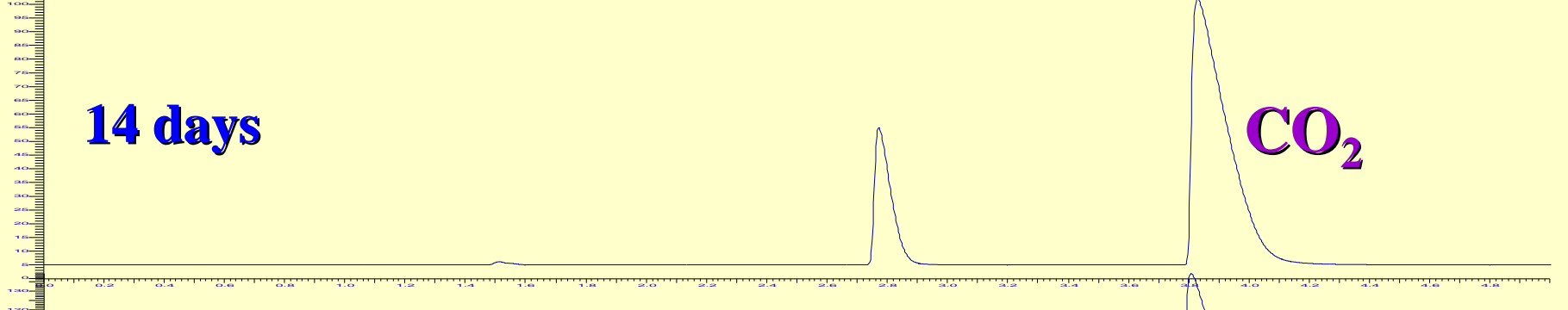


7 days

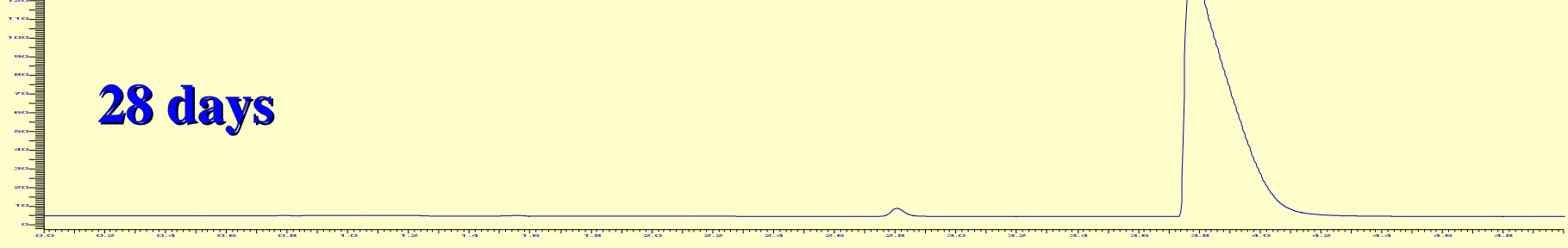


14 days

CO₂



28 days



- **Compare and contrast the GC results for the control against the Winogradsky columns (or non-controls).**