Can Melatonin Affect Memory Formation at Night?

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Research questions

- How does biological clock control the formation of new memories?
- What is the effect of melatonin on memory formation?
The experiments performed on zebrafish, they are:

- Small.
- Breed in large numbers.
- Less expensive.
- Diurnal.
Isolated pulse stimulator

Shock stimulus (US)

Under water opening

Light signal (CS)

An active-avoidance conditioning (AAC) paradigm
Animals entrained to 14 hours light:10 hours dark (LD) cycles.

Trained to learning criteria at two time points (ZT8 and ZT16).

Tested 24 hours later.
Animals exposed to constant darkness (DD).

Trained On 3rd and 4th day, and tested at different times.
C. Acquisition in DD
- Subj. Night:
  - Time to Learning Criteria:
    - 16: 50
    - 19: 53
    - 21: 55
    - 23: 57
    - 2: 60
    - 4: 62
    - 8: 66
    - 11: 69

- Subj. Day:
  - Time to Learning Criteria:
    - 16: 50
    - 19: 53
    - 21: 55
    - 23: 57
    - 2: 60
    - 4: 62
    - 8: 66
    - 11: 69

D. 24h Memory in DD
- Subj. Night:
  - Retention Score:
    - 16: 74
    - 19: 77
    - 21: 79
    - 23: 81
    - 2: 84
    - 4: 86
    - 8: 90
    - 11: 93

- Subj. Day:
  - Retention Score:
    - 16: 74
    - 19: 77
    - 21: 79
    - 23: 81
    - 2: 84
    - 4: 86
    - 8: 90
    - 11: 93

Note: The graphs show the time to learning criteria and retention score for different subjects under DD conditions, with time points at 16, 19, 21, 23, 2, 4, 8, and 11, and corresponding time points at 50, 53, 55, 57, 60, 62, 66, and 69 for training, and 74, 77, 79, 81, 84, 86, 90, and 93 for testing.
Melatonin was applied:

- **Before training during SD (subjective day).**
- **Directly after training.**
- **1 hour before testing.**
A

24h Memory in DD
Subjective Day

Retention Score

0.8
0.6
0.4
0.2
0.0

0 1 10 50 100
[Melatonin] (μM)

*
Animals were treated on the third day of DD for 1 hour with:

- Vehicle.
- Melatonin.
- Melatonin + melatonin receptor antagonist.
B 24h Memory in DD Subjective Day

Retention Score

Vehicle Mel Luz + Mel K185 + Mel
Animals that underwent pinealectomy and sham-operated animals were trained during:

- SD (CT8)
- SN (CT16)

on the 3rd day of DD and tested for LTM 24 hours later.
Nighttime melatonin may actively suppress memory consolidation.

This encourages further research for a similar endogenous role in humans.
THANK YOU