Exposure Duration — Daily Light Dose

Time × spectrum × intensity for robust entrainment

Definition

Cumulative non-visual light exposure across the day. Both intensity and spectrum matter; morning/forenoon exposure is most impactful.

Recommended Ranges

|  |  |
| --- | --- |
| Optimal | 2–4 h/day of adequate vertical melanopic exposure (≥250 mEDI) in the morning/early afternoon. |
| Caution | <2 h/day or irregular schedules (risk of weak entrainment/delayed sleep). |

Biological Effects

Hormones (Endocrine)

Stable daily dose entrains melatonin onset and cortisol amplitude; supports mood and daytime alertness.

Adequate daytime light supports serotonin synthesis → nighttime melatonin via AANAT/ASMT.

Skin (Photobiology & Peripheral Clocks)

If outdoor daylight is included: UVB converts 7-dehydrocholesterol → previtamin D3 → vitamin D3 (liver/kidney activation to calcitriol).

Nervous System (ipRGC → SCN → CNS)

SCN stabilization improves hippocampal LTP and memory consolidation; reduces daytime sleepiness/inattention.

Biochemical Pathways (Mechanistic Detail)

CLOCK/BMAL1 drive PER/CRY transcription; PER/CRY proteins inhibit their own activators (negative feedback). Light via SCN sets the phase.

Vitamin D: skin cholecalciferol → 25(OH)D (liver) → 1,25(OH)₂D (kidney) → VDR-mediated gene transcription affecting immune/neural pathways.

Classroom Recommendations

Schedule brightest/most blue-enriched scenes in first school hours; calmer/warmer scenes later.

Encourage outdoor breaks when feasible to supplement daylight dose.

Quick Checklist

Morning light block achieved (≥2 h).

Scene schedules mapped to timetable; holidays and seasonality considered.

References

Brown TM et al. (2022) — Guidance on timing and reporting of non-visual light.

Chronobiology literature: PER/CRY entrainment and cognitive outcomes.