CRI — Color Rendering Index (Ra)

Color fidelity, strain, and indirect stress biology

Definition

Fidelity of color appearance vs. a reference. High CRI improves accurate perception of materials/skin tones.

Recommended Ranges

|  |  |
| --- | --- |
| Optimal | Ra ≥80 (classrooms), Ra ≥90 (art/labs). |
| Caution | Ra 70–79 (non-critical areas only). |

Biological Effects

Hormones (Endocrine)

Indirect effect: poor fidelity → visual discomfort/strain → sympathetic & HPA activation → cortisol↑ in susceptible students.

Skin (Photobiology & Peripheral Clocks)

No direct biochemical change; CRI is a fidelity metric, not dose of wavelengths.

Nervous System (ipRGC → SCN → CNS)

Spectral gaps that degrade color constancy increase cortical load (V1/V4), promoting fatigue and reduced attention.

Biochemical Pathways (Mechanistic Detail)

Visual strain → sympathetic output (NE/Epi) → co-activates HPA (CRH→ACTH→cortisol).

Retinal glutamate demand ↑ under difficult perception → ATP use and oxidative stress risk ↑.

Classroom Recommendations

Specify Ra ≥80 for classrooms; ≥90 for labs/art.

Avoid spectra with deep troughs affecting educational materials and skin tones.

Quick Checklist

CRI verified in luminaire data.

Spot-check color charts at desk level.

References

EN 12464-1 — Indoor workplaces (CRI guidance).

Visual strain literature related to low-fidelity spectra.