LIGHTING SCIENCE

ENGINEERED SPECTRUM

THE FUTURE OF SOLID STATE LIGHTING

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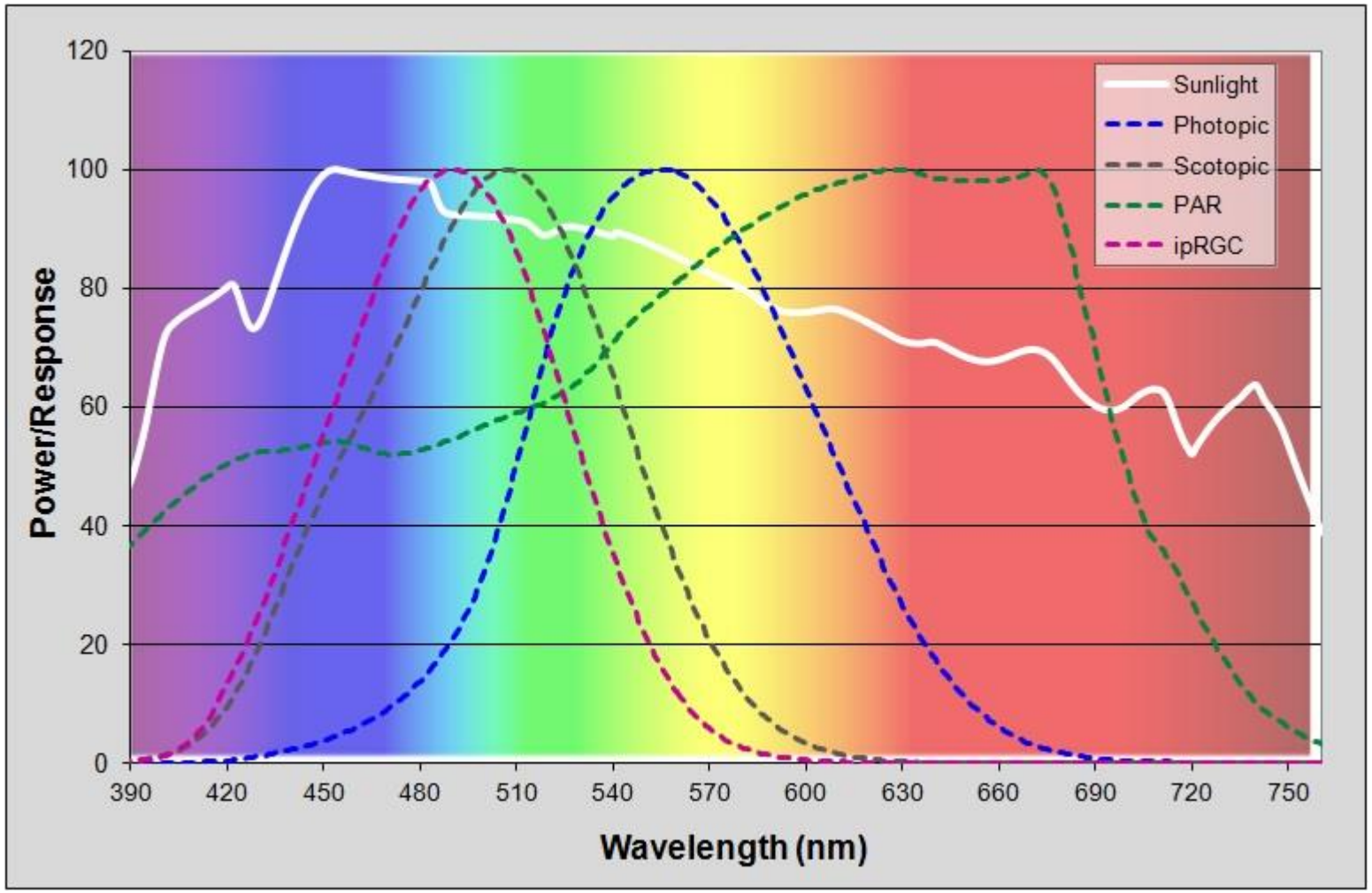
I.
LIGHT AS WE KNOW IT

THE BASICS



Photopic peak sensitivity: 555 nm

- Peak visual sensitivity in humans.
- Achieved by rods in human eyes.

Scotopic peak sensitivity: 507 nm

- Low light level visibility is achieved by cones in human eyes.
- 30 minutes of darkness is required for cones to become fully active (Tipton, 1984).

- Circadian system sensitivity: 450-480 nm (Brainard et al, 2001; Thapan et al, 2001; Lockley et al, 2003)
- Sea turtle hatchling sensitivity: 380-600nm (Horch et al, 2008)
- Photosynthesis highest rates: 400-480nm and 620-680nm
- Photomorphogenesis highest rates: 600-660nm and 700-740nm

EVOLUTION AND LIGHT

- Light-harnessing genes were among the first to evolve making life possible
- Plants express **phytochromes**
- Animals express **opsins** to find food, avoid danger, and entrain circadian rhythms
- After millions of years humans have almost the same melanopsin receptor in our eyes as those first single-celled organisms
- It is not involved in vision – it projects to the suprachiasmatic nucleus to entrain our circadian rhythm—and has an affect on almost all our hormones

ENGINEERING THE SPECTRUM

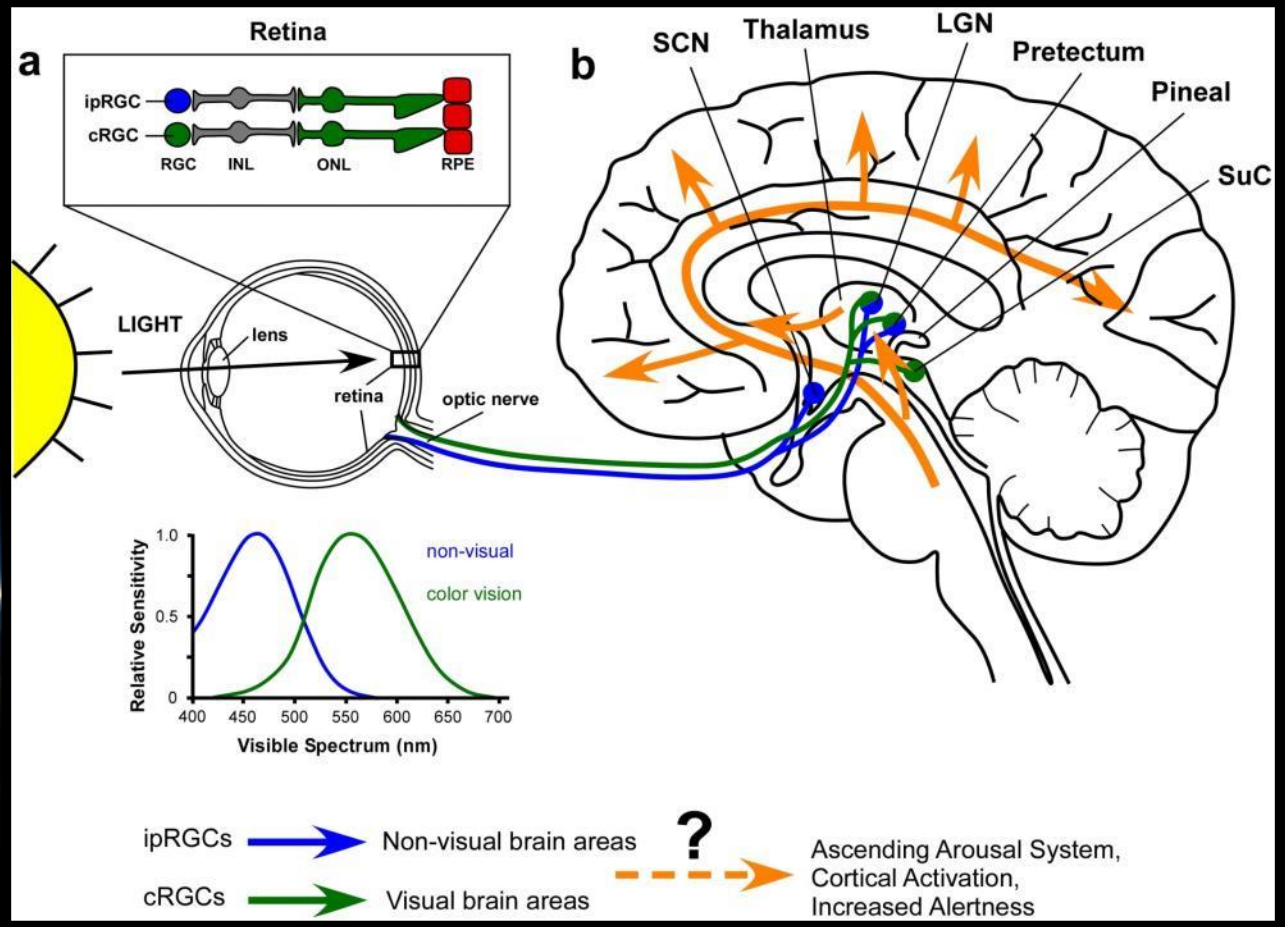
HUMAN BIOLOGY

WILDLIFE

AGRICULTURE

AESTHETIC PRESERVATION

BIOLOGICAL EFFECTS OF LIGHT



LIGHT AND HUMANS

Light can be engineered to promote alertness in shorter time and at lower intensity than other bright light therapy.[1]
Most indoor lighting today emits blue wavelengths which are harmful at night: they suppress melatonin and disrupt sleep.

- Made possible by the convergence of solid state lighting technology and coincident, ground-breaking biological discoveries

Light therapy can be easily mobilized: anywhere, anytime.

- Reversible, with no known side effects
- Non-pharmaceutical, lowers risk of chronic medical conditions (cancer, diabetes)

[1] (Brainard et al., 2001; Cajochen et al., 2005; Lockley et al., 2006; Lehrl et al., 2007)
(Riemersma-van der Lek, et al., 2008; Phipps-Nelson et al., 2003; Zeitzer et al., 2000; Cajochen et al., 2000; Lockley et al., 2006).

II.
LIGHT AND THE NEW WORLD

MODERN PROBLEMS, NEW SOLUTIONS

$300 BILLION*

PHARMACEUTICAL INDUSTRY

$58.5 BILLION**

SLEEP AIDS

$22.2 BILLION

LIGHTING INDUSTRY

*WHO 2015. Retreived from: http://www.who.int/trade/glossary/story073/en/

**BCC. 2014. Sleep Aids: Technologies and Global Markets. Retrieved from: http://www.bccresearch.com/market-research/healthcare/sleep-aids-hlc081b.html

ENHANCING BIOLOGY THROUGH LIGHT

- Enhance human physiology
- Regulate circadian rhythms
- Detect and control disease

- Combat depression
- Activate weight loss
- Provide prescriptive lighting

APPLICATIONS IN THE BUILT ENVIRONMENT

SMARTER CLASSROOMS

OPTIMIZED HOSPITALITY

SAFER WORKFORCE

BIOLOGICALLY ENHANCED HOMES

SANITIZED ENVIRONMENTS

AIR QUALITY CONTROL

PRODUCTIVE WORKPLACES

CUSTOMIZED RETAIL

ASSISTED LIVING

EFFECTIVE HOSPITALS

ENHANCING AGRICULTURE THROUGH LIGHT

- Increase plant growth
- Uniform light for maximized crop yield
- Nontoxic pest control

- Extend plant life
- Increase nutrient value
- Optimize and manage fruiting cycle

DISEASE PREVENTION THROUGH LIGHT

In 2015, there were roughly 214 million malaria cases and an estimated 438,000 malaria deaths.*

- **Malaria**
- **West Nile Virus**
- **Dengue Fever**
- **Zika Virus**
- **Encephalitis**
- **Yellow Fever**

Insects are extremely sensitive to specific wavelengths in both the visible and invisible (to humans) wavelengths and use them as behavioral cues (Hu X., Leming M.T., et al., 2013)

*-WHO. 2016. Retrieved from: http://www.who.int/features/factfiles/malaria/en/

BEYOND AESTHETICS

FOOD DISPLAY WITH INCREASED SHELF LIFE

ART PRESERVATION THROUGH OPTIMIZATION

COLOR-ENHANCED RETAIL ENVIRONMENTS

III.
ON THE HORIZON

GENESIS™

High Efficiency Primary Up-light with Tunable Biological Spectrum

Dimmable

Wireless Connectivity

Indoor Air Quality Monitoring

Color-Tunable Light Shade

Intelligent Spectral Control

INSECT TRAP

ISSUE:
Existing insect control devices require regular changing of propane tanks and can be quite ineffective, sometimes even eliminating the pollinators that your garden needs. Poor design forces users to hide the device, limiting effectiveness.

SOLUTION:
Use advanced spectrum control to lure insects to a trap that can discriminate among insects, and is powered by the sun. Design an elegant device that users are proud to show off.

Our proprietary spectrum control technology enables us to build an unparalleled pest control device with the power to discriminate among insects and effortlessly eliminate pests from backyards everywhere.

Half Day Fishing
Sails 10:30 am
ORLANDO