Glare and human eye physiology

Human and environmental effects of poorly designed night lighting

By Mario Motta, MD

Consequences of Light Pollution

- **Loss of the starry sky (skyglow)**
- **Visual impairment (glare, trespass)**
- **Environmental consequences**
- **Human consequences**
- **Energy waste**

CA: A Cancer Journal for Clinicians

Breast Cancer and Circadian Disruption from Electric Lighting in the Modern World

Richard G. Stevens, PhD,
George C. Brainard, PhD,
David E. Blask, PhD, MD,
Steven W. Lockley, PhD,
Mario E. Motta, MD

CANCER J CLIN 2013

AMA Policy - ‘Risk’

CSAPH Rep. 4-A-12

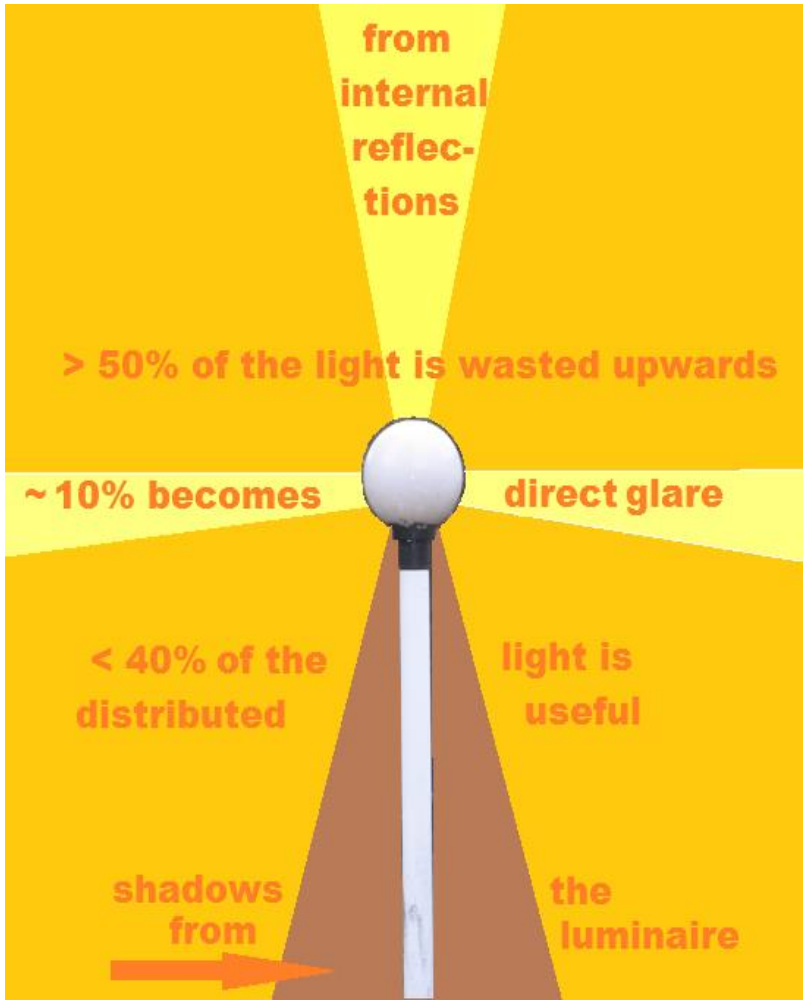
"Due to the nearly ubiquitous exposure to light at inappropriate times relative to endogenous circadian rhythms, a need exists for further multidisciplinary research on occupational and environmental exposure to **light-at-night, the risk of cancer, and effects on various chronic diseases**."

“Resolved, that our American Medical Association: Supports the need for ... developing lighting technologies at home and at work that minimize circadian disruption, while maintaining visual efficiency."

CSAPH Rep. 4-A-12. "Light Pollution: Adverse Health Effects of Nighttime Lighting". Action of the AMA House of Delegates 2012 Annual Meeting: Council on Science and Public Health Report 4 Recommendations Adopted as Amended (June 20, 2012), and Remainder of Report filed.

Glare bomb

We buy cheap fixtures that are less than 50% efficient (*"glare bombs"*), while ignoring their ever greater operating costs.



Why Does Disability Glare Make things less Visible?

- Disability Glare is caused by light scattered in the eye
- The scattered light in the eye lays a luminous veil over the retinal image. The effect of this veil is to reduce the contrasts in the retinal image.
- Mathematically :
- Contrast = (Lmax-Lmin)/Lmax+ Lmin)

What is the effect of disability glare on visibility in practice?

- For a small dark gray target, visibility distance without an opposing set of headlights is 220 meters
- When an opposing set of headlights is present, visibility distance is reduced to about 40 to 80 meters.

- From: Helmers and Becker 1975

RESOLVED That our AMA advocate that all future outdoor lighting be of energy efficient designs to reduce waste of energy and production of greenhouse gasses that result from this wasted energy use, and be it further

RESOLVED That our AMA develop and enact a policy that supports light pollution reduction efforts and glare reduction efforts at both the national and state levels; and be it further

RESOLVED That our AMA support that all future streetlights will be of a fully shielded design or similar non-glare design to improve the safety of our roadways for all, but especially vision impaired and older drivers.

Why Reduce Light Pollution?

Reducing Light Pollution Preserves our Night Sky.

Light Pollution limits our view of the beautiful starry sky.

Light Pollution impacts ground-based Astronomy.

Reducing Light Pollution is Good for the Environment.

Unnecessary light costs $2.2 billion each year in the United States alone according to the International Dark-Sky Association.

Unnecessary light increases atmospheric pollution, since producing that excess light requires about 22,000 gigawatt-hours of energy – equivalent to burning 3.6 million tons of coal.

Reducing Light Pollution is Good for People and Animals.

Unnecessary light affects human health when light trespass disrupts sleep.

Unnecessary light negatively affects animal behavior.

American Medical Association (AMA)

officially approved lighting resolutions on June 15, 2009

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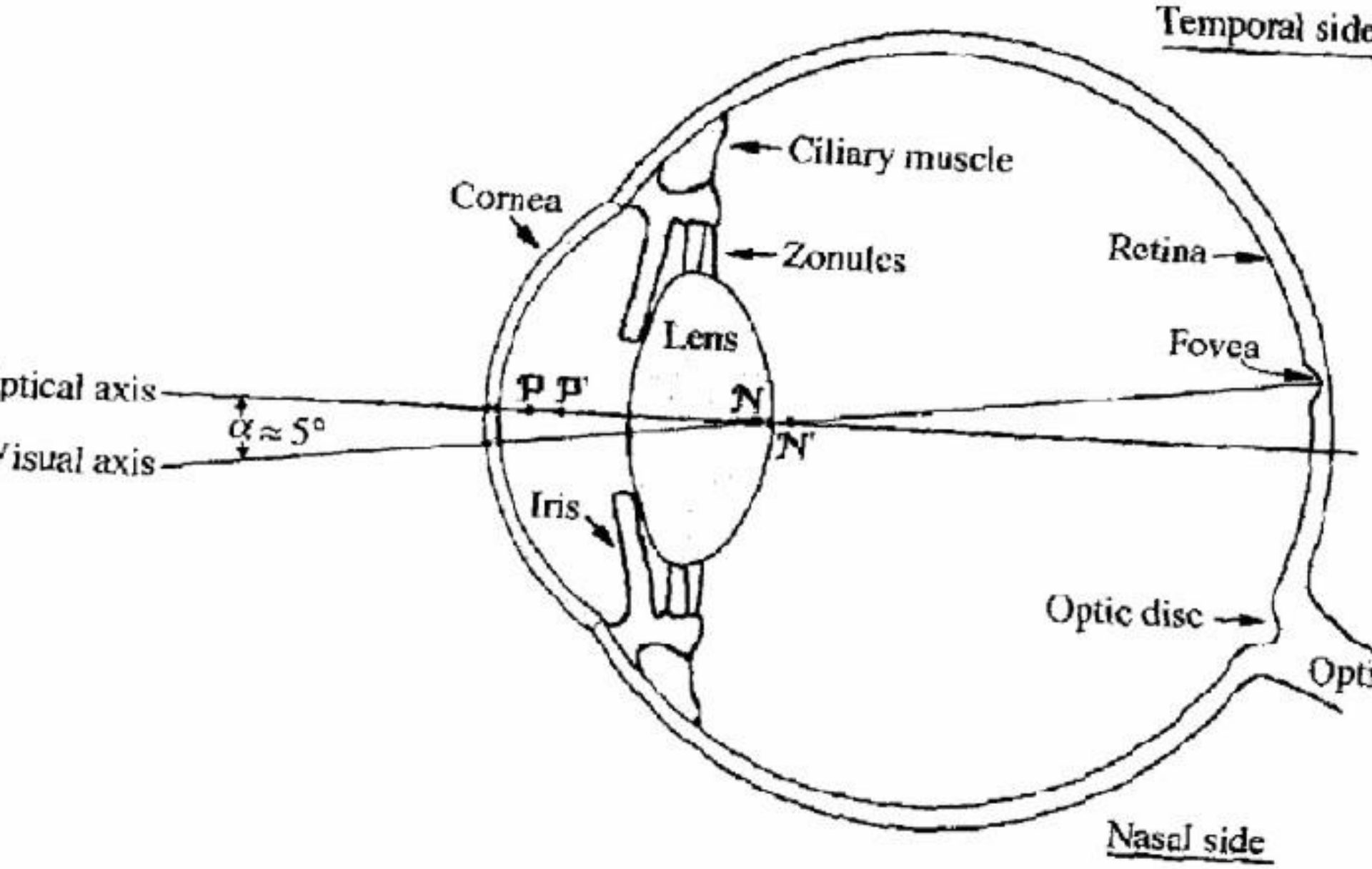
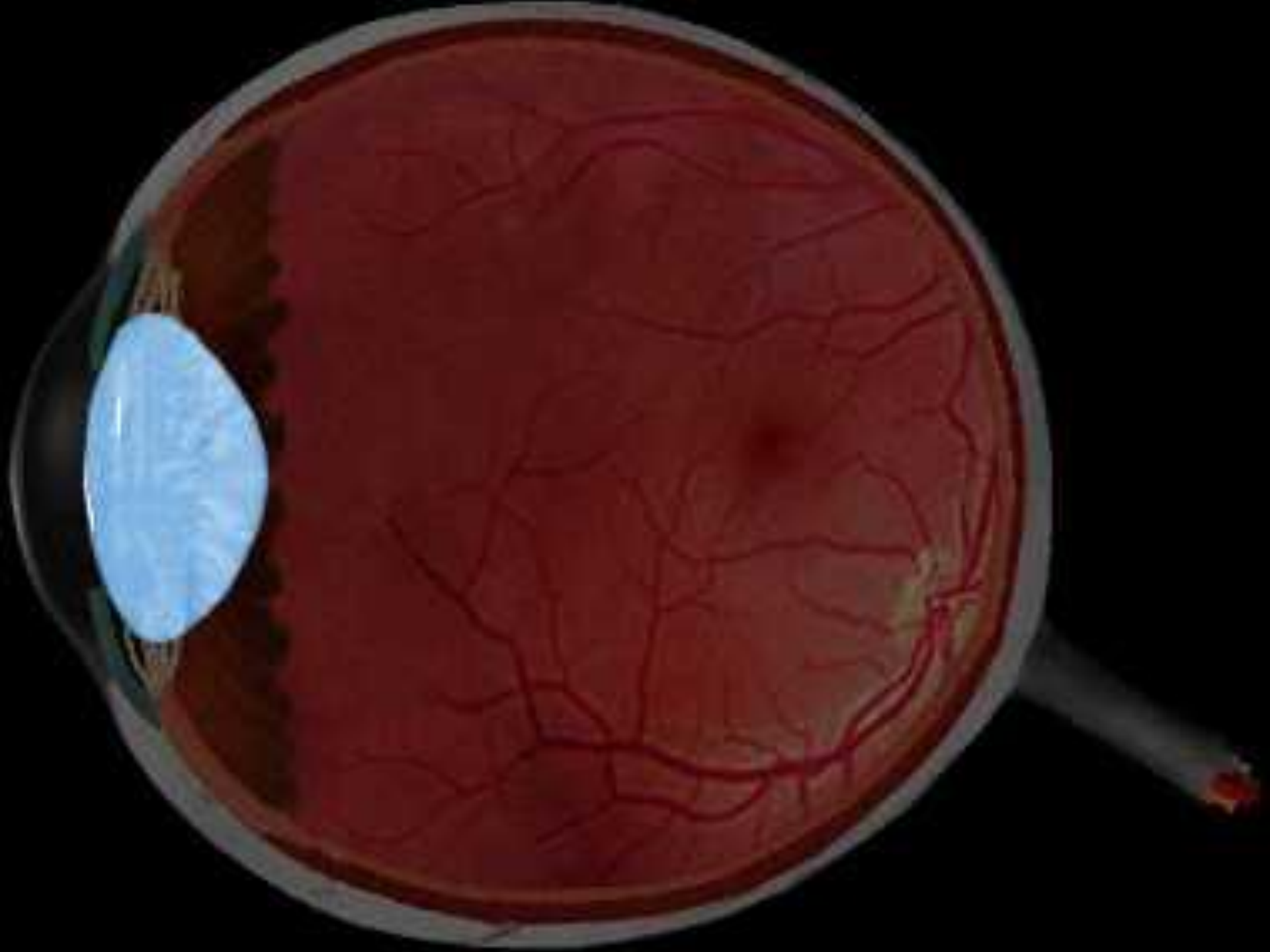
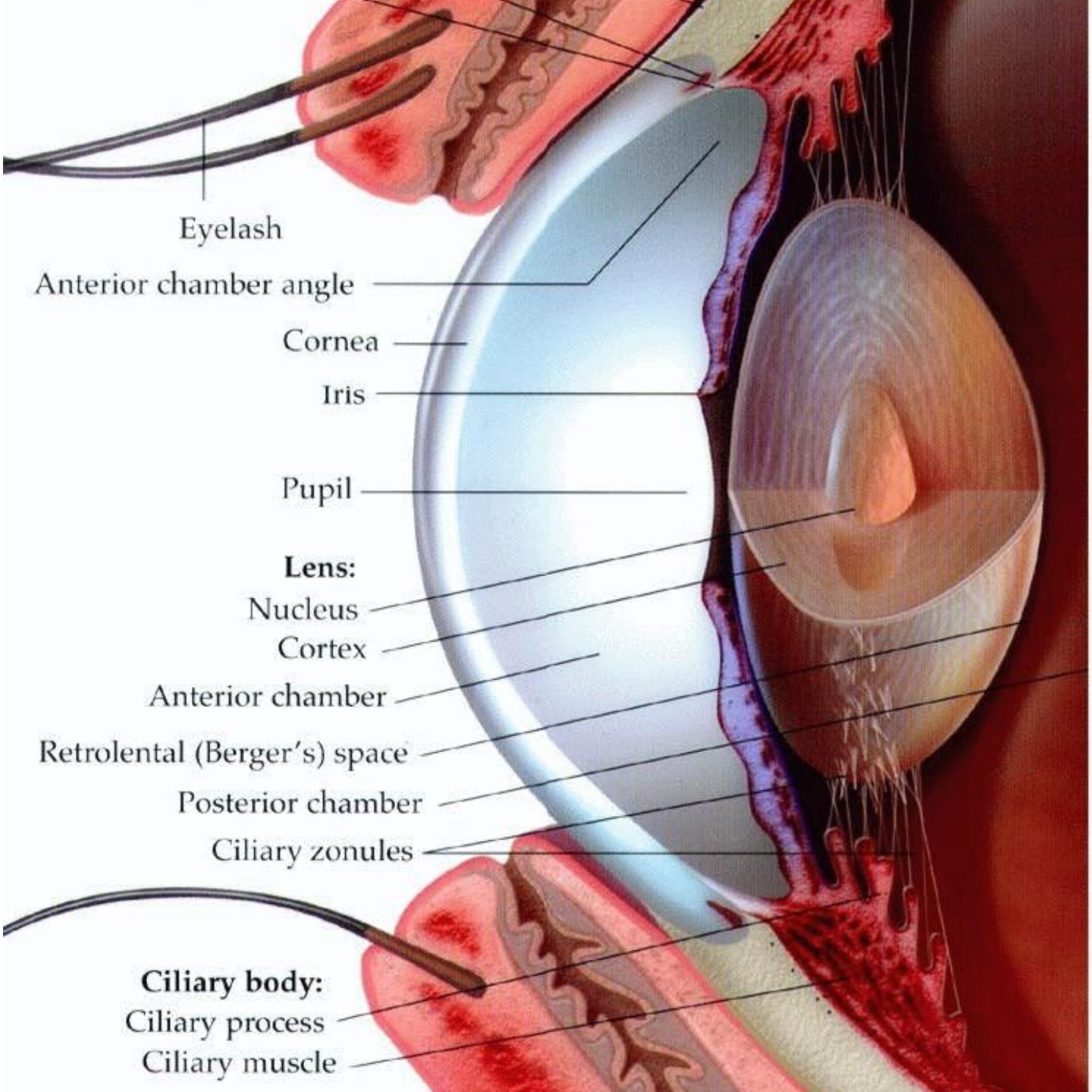

Temporal side
Ciliary muscle
Cornea
Zonules
Retina
Lens
Fovea
ptical axis
P P'
N
α ≈ 5°
N'
Visual axis
Iris
Optic disc
Opti
Nasal side



Normal, clear lens

Lens clouded by cataract

A cataract is an opacity of the normally clear lens which may develop as a result of aging, metabolic disorders, trauma or heredity


Eyelash
Anterior chamber angle
Cornea
Iris
Pupil
Lens:
Nucleus
Cortex
Anterior chamber
Retrolental (Berger's) space
Posterior chamber
Ciliary zonules
Ciliary body:
Ciliary process
Ciliary muscle

•lens The intraocular scatter of light and glare are fairly constant until about 40 to 45 years of age, after which they increase rapidly.

•Following are the factors responsible: fluorescence which converts incident ultraviolet light (invisible) into scattered blue light (visible).
•yellowing of lens.
•senile miosis which reduces target illumination at the retina and adds to scatter from the edge of the pupil.
•"subclinical" lens opacities.

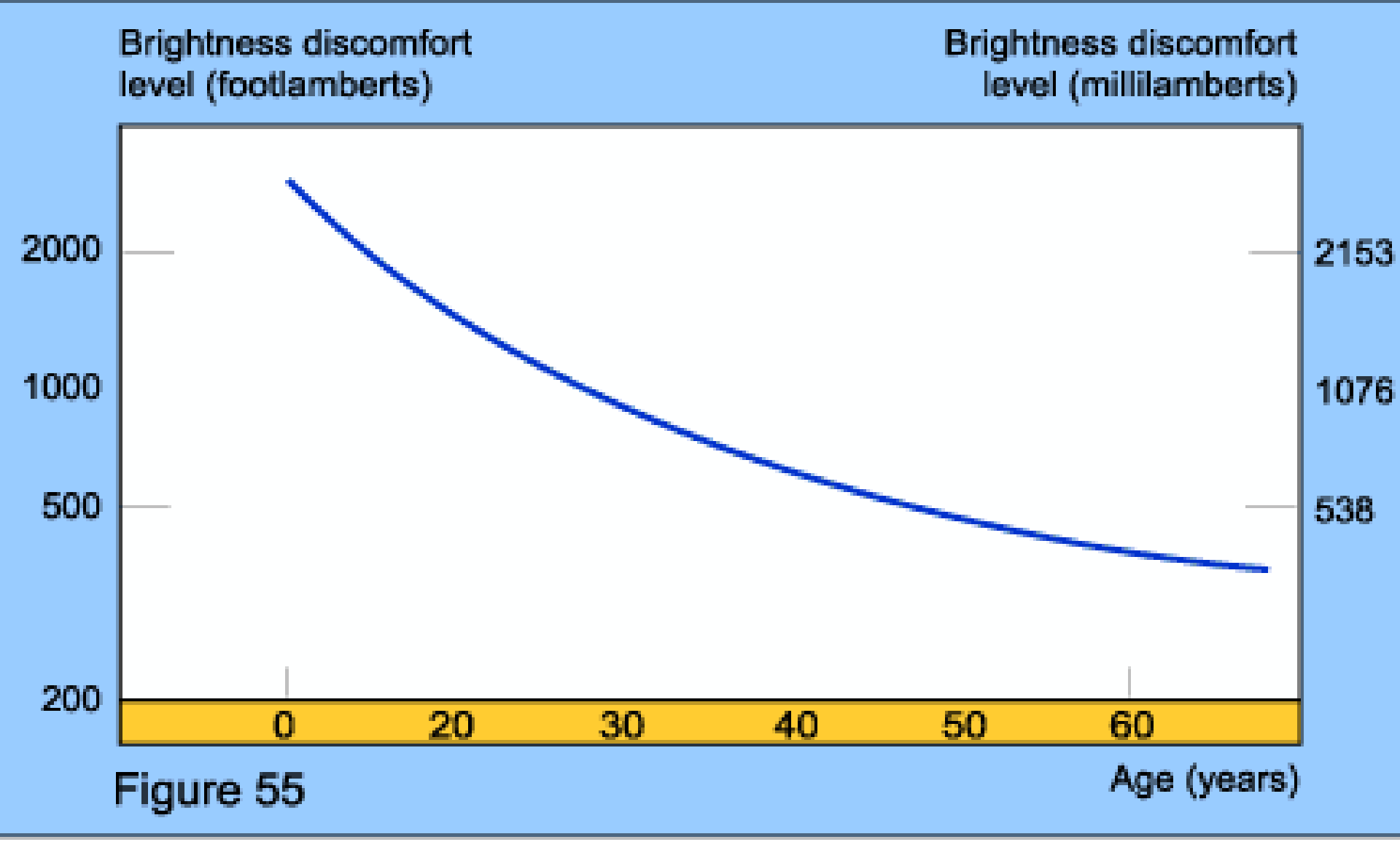


Figure 55

Figure 55 shows the relationship between discomfort glare level and age. It is based on a study (Bennett, 1977)

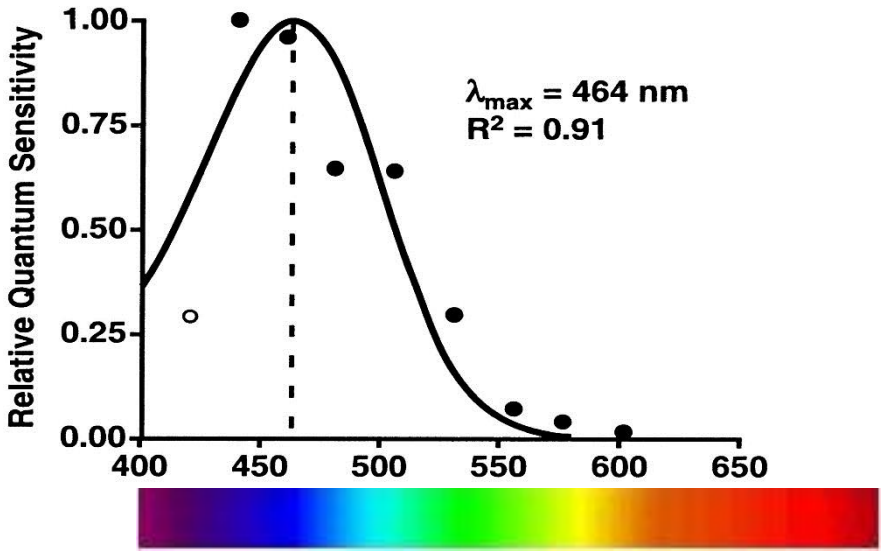
Elderly are particularly vulnerable to Disability Glare

- Elderly work on lower light levels because of greater light absorption in the eye
- The amount of light scatter is greater so the veiling luminance is higher. Visual acuity is reduced
- Older people take longer to recover from exposure to glare

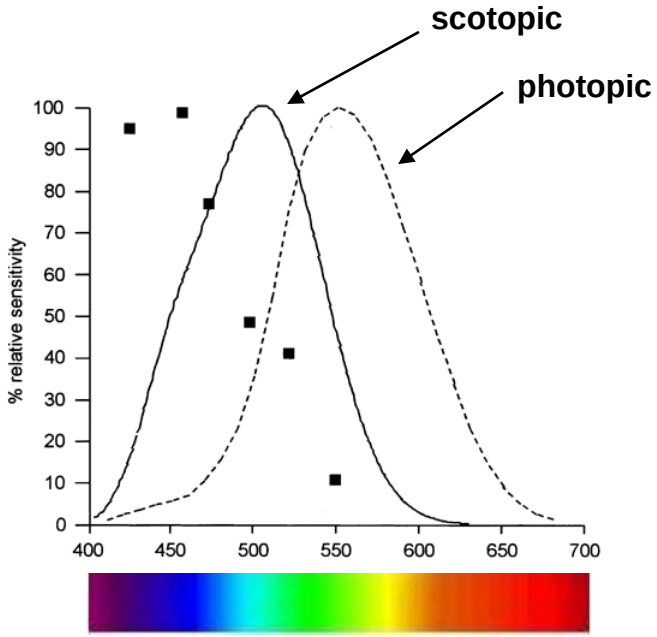
‘Non-Visual’ Photoreception

Evidence for a novel photoreceptor system

Action spectra for melatonin suppression peak at ~460 nm and do not match known rod and cone photoreceptors



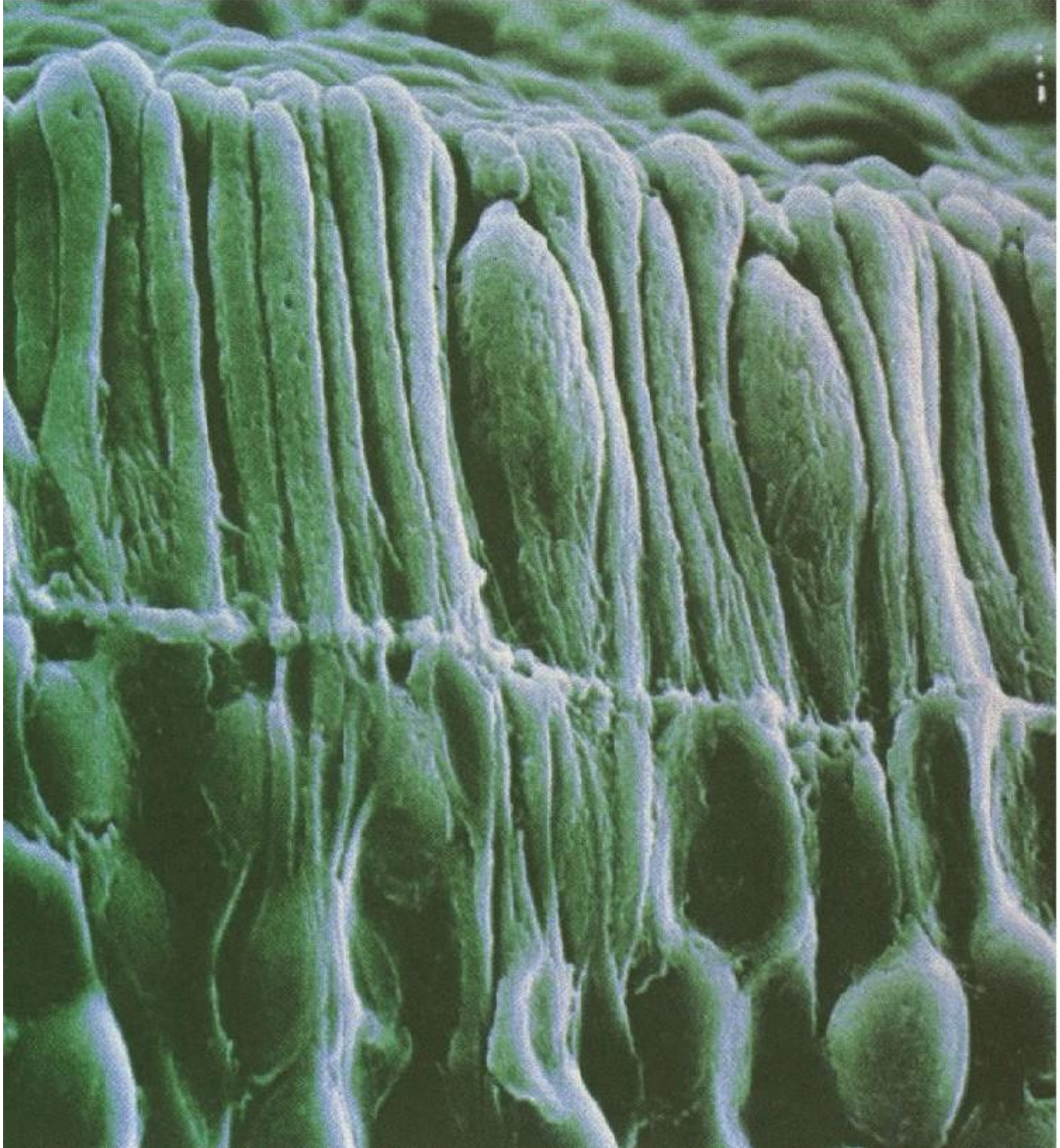
λ_{max} = 446-477 nm
90 mins exposure



λ_{max} = 459 nm
30 mins exposure

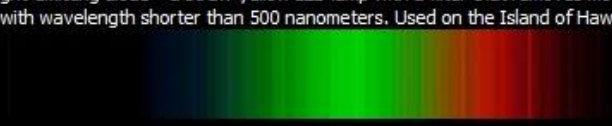
Brainard et al. J Neurosci 2001

Thapan et al. J Physiol 2001

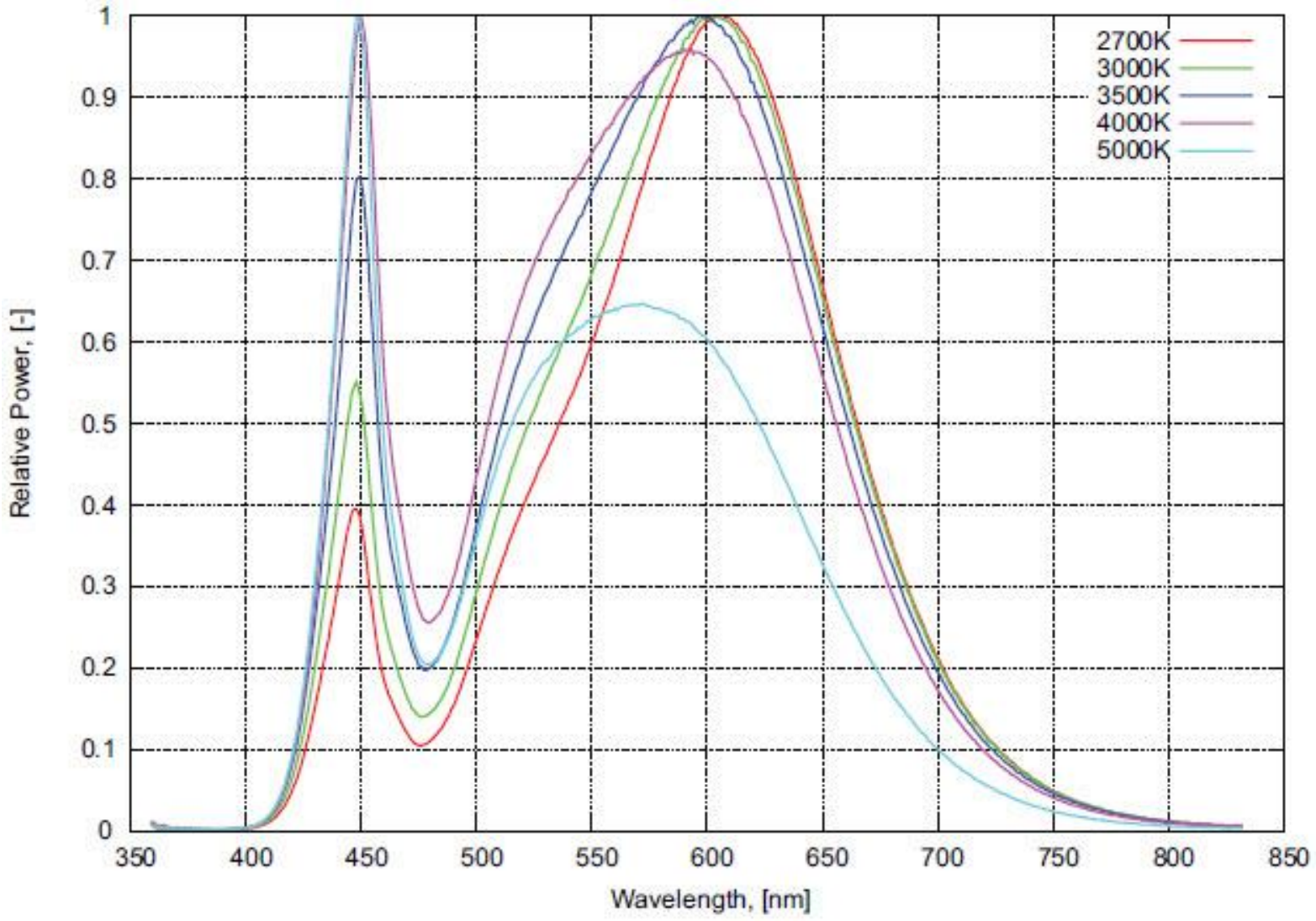


Impact of Street Lamp Spectra

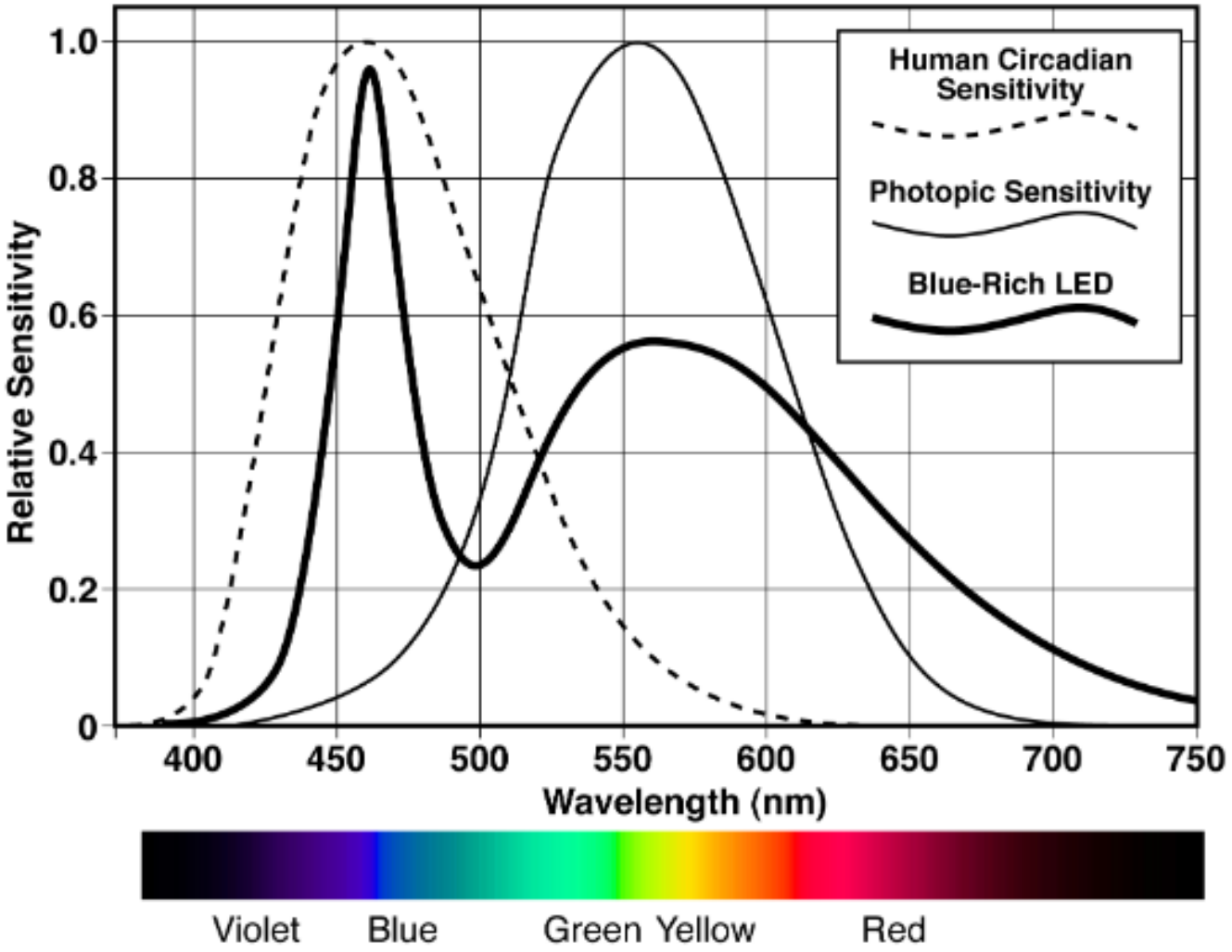
Two recently published studies (Luginbuhl et al., 2014; Aubé et al., 2013) have evaluated the visible sky glow brightness caused by the following lamp types:

Type	Description	Sky Glow* (relative to LPS)	Sky Glow* (relative to HPS)
LPS**	Low-pressure sodium – a nearly monochromatic yellow-orange light source used mostly in areas near astronomical observatories and sea turtle nesting beaches. 	**1.0**	**0.4**
HPS***	High-pressure sodium – A golden-yellow light source, widely used throughout the world. 	**2.4**	**1.0**
FLED	Filtered light-emitting diode – a straw-yellow LED lamp with a filter that removes most emission with wavelength shorter than 500 nanometers. Used on the Island of Hawai'i. 	**3.6**	**1.5**
LED 2400K	Light-emitting diode with "correlated color temperature" (CCT) of 2400K – a "warm-white" LED. This type of LED has not seen wide use. 	**4.3**	**1.8**
LED 4100K	Light-emitting diode with CCT of 4100K – a "cool-white" LED. This is a common LED type in recent LED area lighting installations. 	**6.4**	**2.7**
LED 5100K	Light-emitting diode with CCT of 5100K – a "cool-white" LED. This also is a common LED type in recent LED area lighting installations. 	**7.9**	**3.3**

White Light LED Spectral Distribution



Eye Sensitivity to Blue-Rich LED*



*" Visibility, Environmental, and Astronomical Issues Associated with Blu

Luminaire Contribution to Sky Glow*

Light Source	Efficiency (Lumens/watt)	% of Light Emitted below 500nm	Color Rendering Index
High Pressure Sodium	70-140	17.3	20-25
Low Pressure Sodium	100-200	0	0
Fluorescent	46-104	21.8	90+
Incandescent	8-17	10.7	100
Tungsten Halogen	14-24	8.5	95-100
Metal Halide	78-120	20	60-70
White LED	75-107	30	70-90+
Filtered White LED	41-75	9.5	55
Narrow Band Amber LED	25-51	0	0

Figure 4. Table of values featuring Lumens per watt (complied from catalogues), color rendering index, and percentage of light emitted below 500nm for various light sources.

- "LEDs: The Future of Street Lighting and their Effect on Astronomy," E
  Aug. 2012

Benefits of Lower LED CCT

- LEDs at and below 3000 K correlated color temperature produce*:
  - More pleasing light than LEDs of higher CCT.
  - Less glare.
  - Less potential light pollution.
  - Still a source of scatter ($\lambda \leq 500$ nm).

* https://www.darksky.org/ida-fixture-seal-of-approval/about-fsa

Blue-Rich Light: A Health Risk?

- Blue light suppresses melatonin, a hormone that influences circadian rhythms.*
  - Even dim light can interfere with a person's circadian rhythm and melatonin secretion.
- Eyes exposed to blue light experience decrease in visual acuity since blue light scatters in eye.*
- May disrupt circadian rhythm of wildlife.

*http://www.health.harvard.edu/staying-healthy/blue-light-has-a-dark-s

Ways to Mitigate Light Pollution

- Use LEDs of the lowest possible CCT.
- Employ luminaires that minimize glare.
- Filter out light at wavelengths ≤ 500 nm.
- Use the right amount of light. Don’t over-illuminate.
- Direct the light to the ground only where it is needed.
- Reduce street light illumination levels where possible after a cut-off point in the evening.

- The transition to LEDs will increase light pollution, even if blue light is filtered out.
- Mitigate by filtering out optical radiation at wavelengths less than 500 nm. Otherwise, choose an LED of lowest possible CCT, preferably 2700 K.
- Eye is more sensitive at night, especially at blue-green wavelengths, offsetting a CCT of 2700 K.
- To compensate for LED usage, consider introducing lighting codes that require shielding of lights and switch to LPS at malls, business parks.

Glare interferes with good vision

Unshielded lighting-veiling luminance

It's hard to see in the presence of glare caused by unshielded lighting.

Can you see the pedestrians walking in front of your car?

Glare interferes with good vision

Unshielded lighting-veiling illuminance

It's hard to see in the presence of glare caused by unshielded lighting.

Can you see the pedestrians walking in front of your car?

Shielded lighting

With shielded lighting the glare Is reduced significantly.

Safety is improved.

Glare inhibits good vision, reduces security

What is wrong with these lights? Try to follow where this person goes…

Glare inhibits good vision, reduces security

She is still in the picture- can you find her?

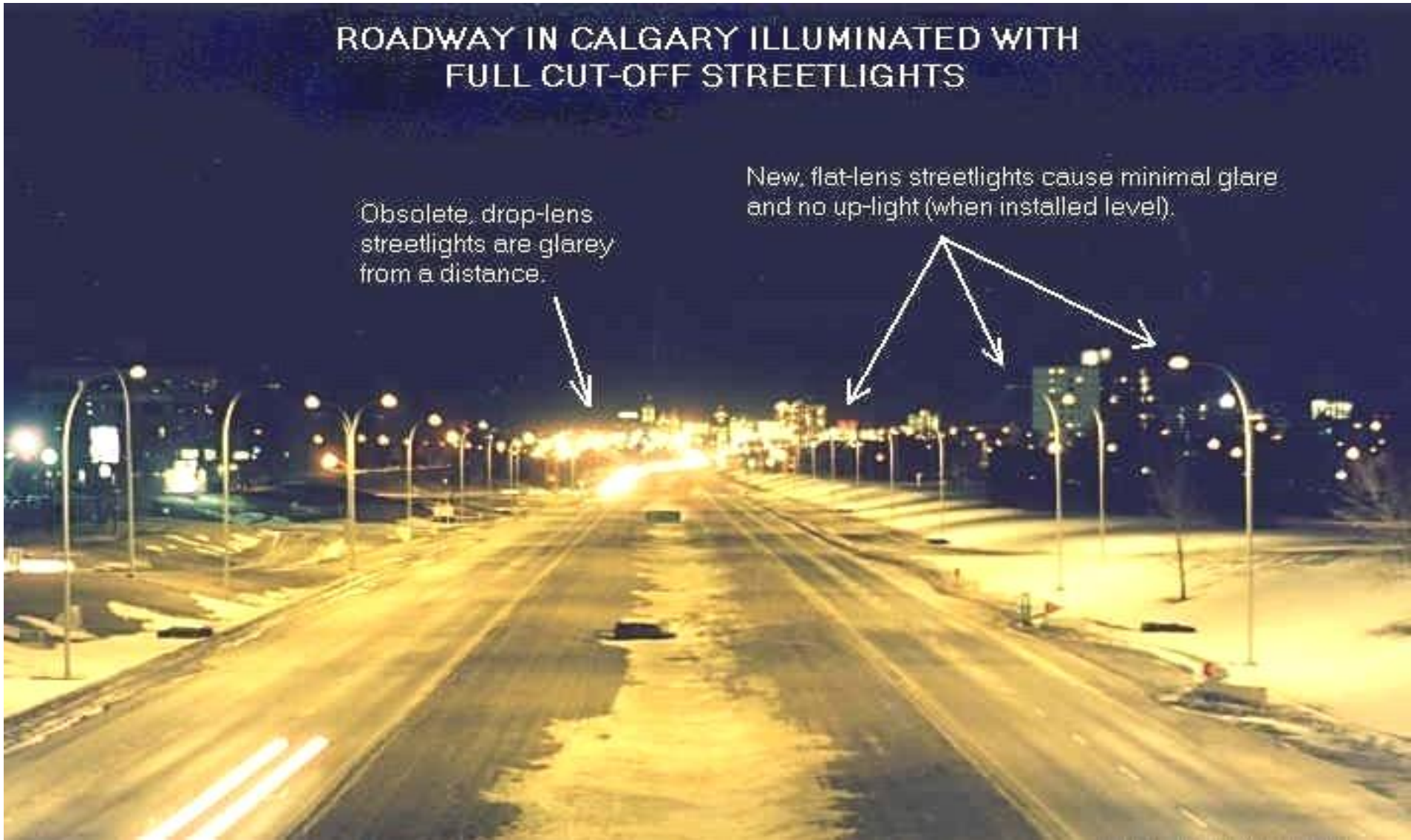
Cobrahead Streetlight innovation: Drop lens vs. Flat lens

Retrofits underway in New York Communities in advance of NY State Legislation:

East Hampton Town, East Hampton Village, Riverhead, Southampton, Brookhaven, and other municipalities

As well as entire states of Washington, Texas, New Mexico, Arizona, California.

"In Process" streetlighting conversion in Calgary, Canada to Full Cutoff fixtures, and with a reduction in wattage, saving $1.7 million tax dollars every year. **(ROI 4 yr)**



Church, Prospect and Pleasant St

Is this light burned out?

No!, it never sees night to turn on.


Salem
Haunted Happenings
Salem

Salem. All glare light, street dark. Cannot even read sign under light

All glare and shadows, poor for pedestrians, tacky

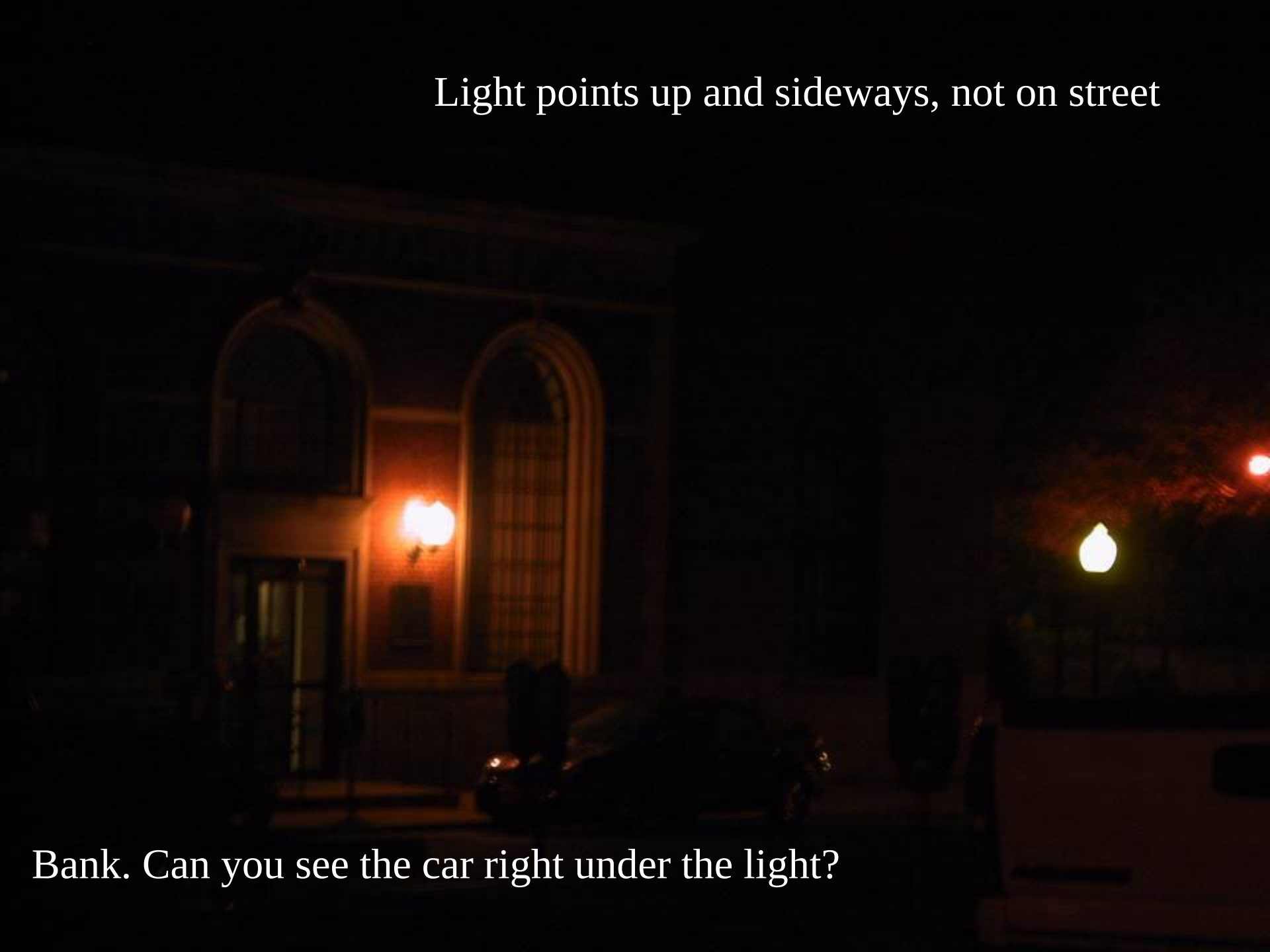
Main St. lights go in windows, not the street.

Main St, Glare and poor public safety. Worse with rain or snow

Bass Ave., Glare Bomb, and public safety hazard

Bad Business lighting! All glare, poor visibility

Great lighting, pleasant, good visibility


Light points up and sideways, not on street
Bank. Can you see the car right under the light?

Not the worst, but still glare, and poor. Building lights upward

The correct way to light, safe and efficient

Glare poor lot lighting

Good lot lighting

What are they thinking? Prison atmosphere

East Hampton, NY, Main Street
“Before” post top fixtures changed

Glare was debilitating to drivers and pedestrians, causing accidents

85 Montauk “Carriage Light” Conversions

Bulb
moved
up
under
opaque
cap

The Long Island Manufacturer, Magniflood,

re-designed their own fixture

- Reduction of 100 watts each fixture gives better illumination
- Light bulb recessed into cap conceals glare
- Headlights able to light pedestrians in the center of the road
- Reduction of glare, light trespass, and skyglow

“Bright lighting sells” ?
Customer reaction to improved lighting

Original fixtures

Full cutoff fixtures

“The percentage of drivers turning in to the station and the mean number of gallons of gasoline sold daily increased immediately following the change of lighting from the drop-lens, non-cutoff luminaires to the flat-lens, full-cutoff luminaires”

An Evaluation of Three Types of Gas Station Canopy Lighting
P.R. Boyce, C.M. Hunter, and S.L. Vasconez, Lighting Research Center
Rensselaer Polytechnic Institute

Can anyone see the steps?

Anyone want this house as a neighbor?

Direct Glare Light Sources Are Used by “Bad Guys” for Hiding

George Fleenor, Bradenton, FL
IDA

Shielded Lights Reduces Contrast, Showing What's Hidden

George Fleenor, Bradenton, FL
IDA

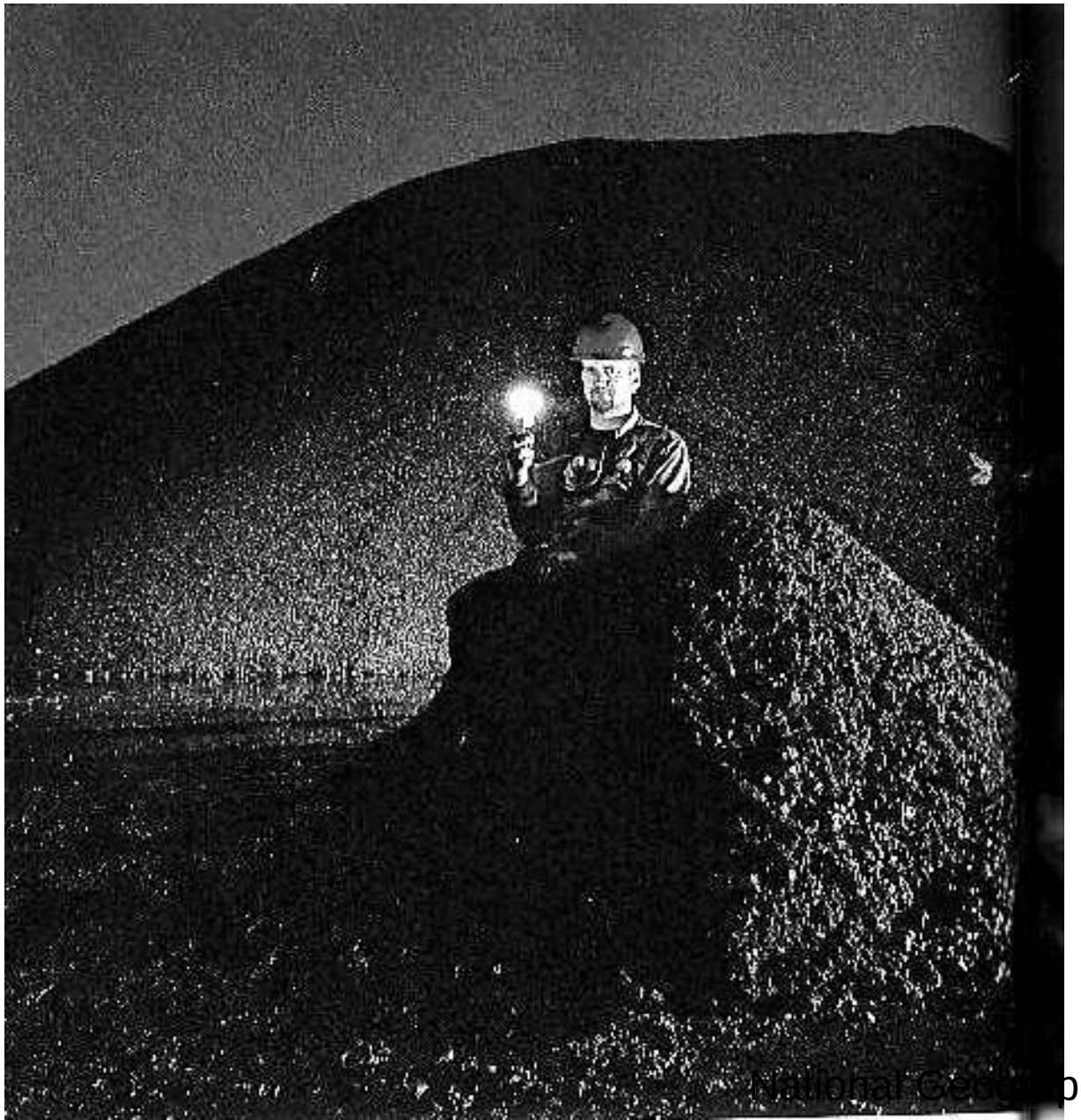
On which street would you feel safer?

Poorly designed street lights actually decrease visibility!

The production of wasted light costs ~$110,000,000,000 per year globally.

It's time for a change! Join the IDA today, and enjoy better lit streets in the future!

One Half Ton of coal is burned to light 10 lamps of 100 watts of incandescent dusk-to-dawn lighting



National Geographic Magazine


Positive proof of global warming.
18th Century
1900
1950
1970
1980
1990
2006

Flora and fauna have evolved over hundreds of millions of years in a bright day - dark night cycle, with moon phase stimulated behaviors.

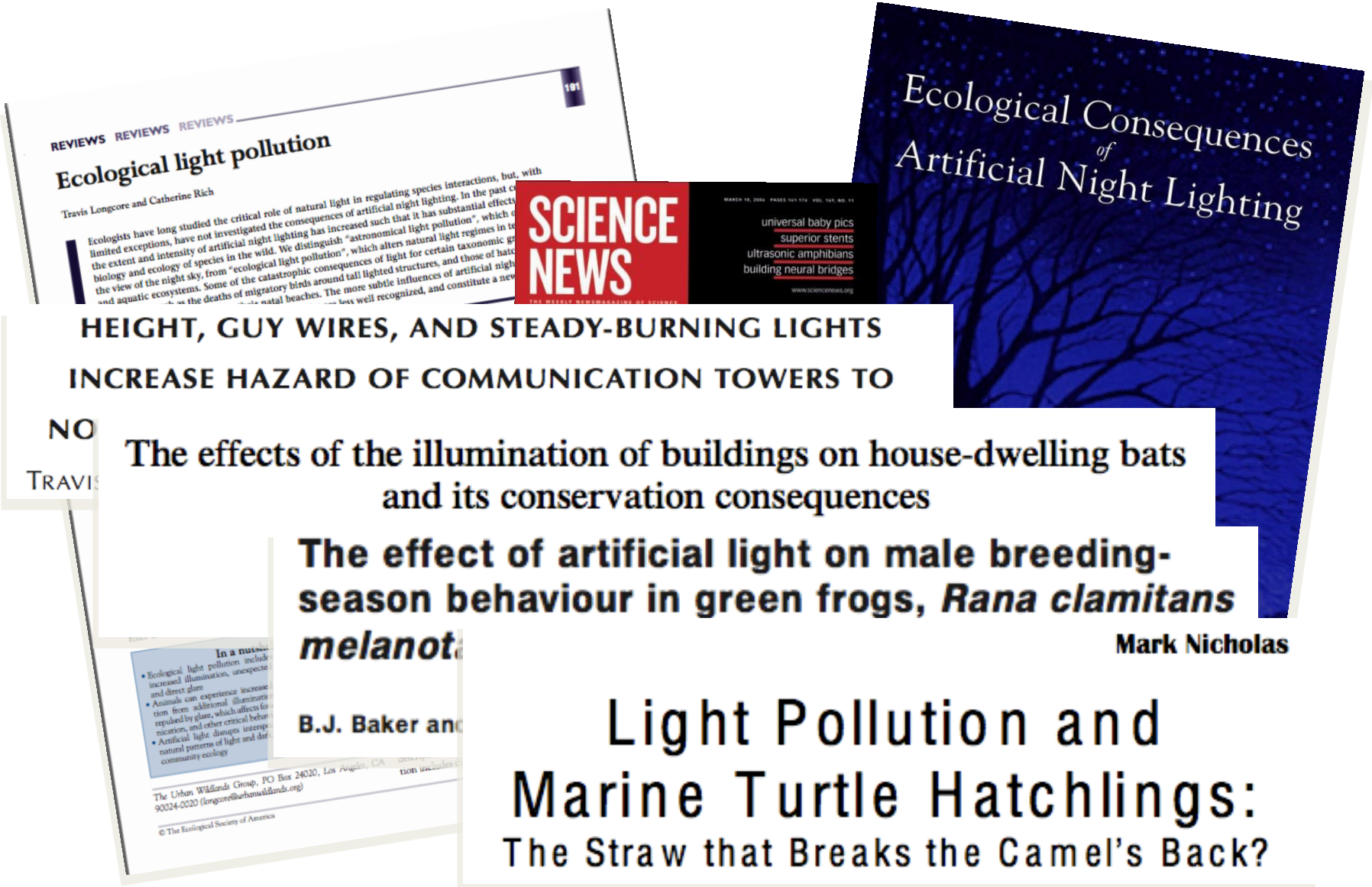
Light Pollution dramatically disrupts habitats and behaviors of:

- Birds (more than 100 million song birds die every year due to upwardly directed night lighting)
- Amphibians
- Fish
- Insects
- Mammals

Night lighting results in ecological disturbances and mortality of individuals and entire species in ways that being discovered in every study conducted.

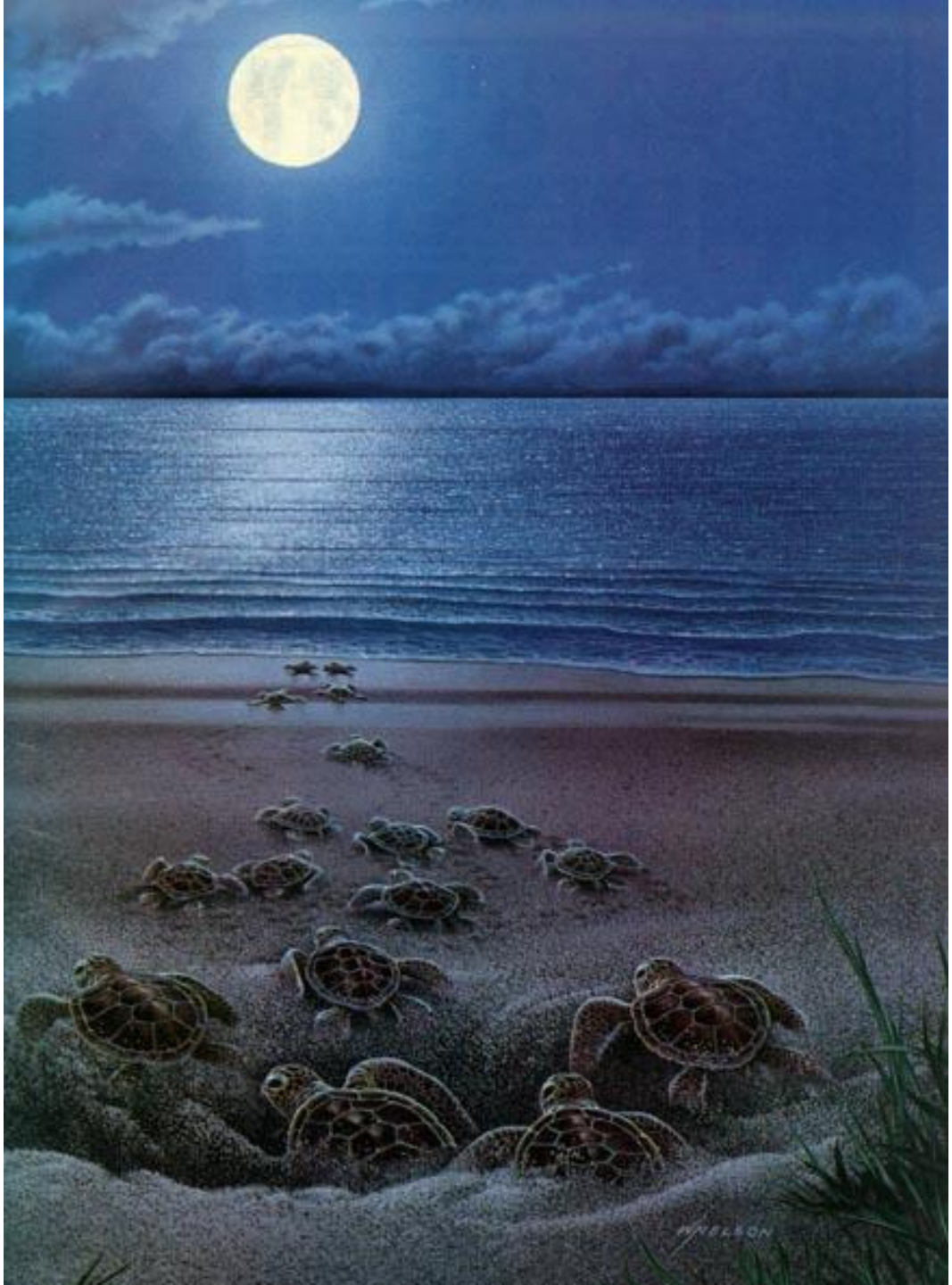
"Ecological Consequences of Artificial Night Lighting", UCLA, 2002

"Ecology of the Night Symposium", Muskoka Heritage Institute, September, 2003


REVIEWS REVIEWS REVIEWS
Ecological light pollution
Travis Longcore and Catherine Rich
SCIENCE NEWS
universal baby pics
superior stents
ultrasonic amphibians
building neural bridges
Ecological Consequences of Artificial Night Lighting
HEIGHT, GUY WIRES, AND STEADY-BURNING LIGHTS
INCREASE HAZARD OF COMMUNICATION TOWERS TO
The effects of the illumination of buildings on house-dwelling bats and its conservation consequences
The effect of artificial light on male breeding-season behaviour in green frogs, Rana clamitans melanot
Mark Nicholas
B.J. Baker an
Light Pollution and Marine Turtle Hatchlings:
The Straw that Breaks the Camel's Back?


Lights can be lethal.


One night at one lighted tower:
175 birds of 23 species.




Sundial Bridge

Impacts of Poor Outdoor Lighting Practices

Environmental Impact – Plants:

Photoperiodism controls a plant's growth & reproductive activities & is governed by the lengths of the day & night.

It tells a plant when to stay dormant, sprout, grow leaves, flower, & shed leaves in time for winter.

It is affected by a mere fraction of the visible red & near infrared light levels needed for photosynthesis.

Night lighting alters plant's natural photoperiodism, upsetting their development.

Light source	Wavelengths	Potential effect emitted on trees
Fluorescent	High blue, low red	Low
Incandescent	High red and infrared	High
Mercury vapor	Violet to blue	Low
Metal halide	Green to orange	Low
High pressure sodium	High in red to infrared	High

William R. Chaney, Purdue University, Forestry and Natural Resources
http://www.ces.purdue.edu/extmedia/FNR/FNR-FAQ-17.pdf

Amagansett, NY tree holding leaves longer in the same pattern as the semi cutoff fixture, not achieving full dormancy before winter weather sets in, shortening tree life.

Myths of Outdoor Lighting

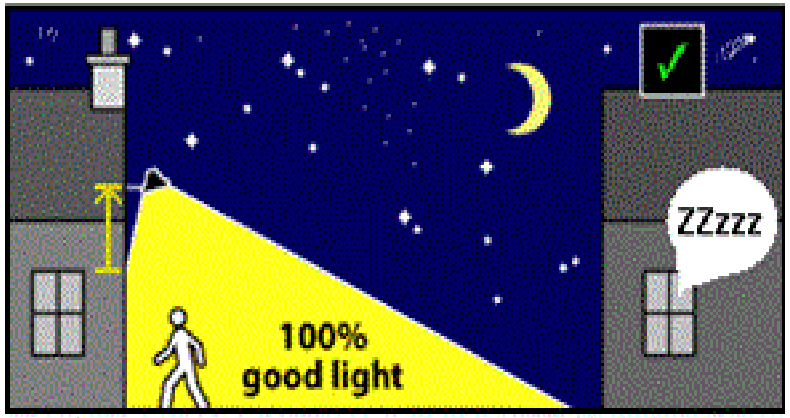
Myth: "More light means more security."

Poorly executed security lights create glare & deep shadows that reduces *visibility* & aids criminals.

Bright lighting gives an *illusion* of security. It can induce people to take risks that are not justified by the overall situation.

Remember, criminals need light too!

BADLY AIMED 500W HALOGEN FLOODLIGHT



WELL AIMED 100W FLOODLIGHT

Myths of Outdoor Lighting

Myth: "Security Lighting reduces crime in urban outdoor areas."

The "Chicago Alley Lighting Project" (CALP)

In 1998, the city of Chicago tried to reduce crime by increasing lighting levels on the streets and alleys.

The Research and Analysis Unit of their Illinois Criminal Justice Information Authority defined two different neighborhood areas, with very similar characteristics in demographics, socio-economic status & crime levels to be an experimental & a control area to their investigation of the effects.

http://www.icjia.state.il.us/public/pdf/ResearchReports/Chicago%20Alley%20Lighting%20Project.pdf

Myths of Outdoor Lighting

Myth: "Security Lighting reduces crime in urban outdoor areas." : CALP

In multiple steps, the city:

- "upgraded & improved" the city's 175,000 streetlights, which illuminate the arterial & residential streets.
- repaired & upgraded the lighting in & around viaducts and in Chicago Transit Authority stations.
- boosted lighting levels in alleys across the city.

The plan increased the alley lighting from 90 Watt bulbs to 250 Watts.

The intent of the program was to *increase <u>feelings</u> of safety* and *decrease crime in the alleys*.

http://www.icjia.state.il.us/public/pdf/ResearchReports/Chicago%20Alley%20Lighting%20Project.pdf

Myths of Outdoor Lighting

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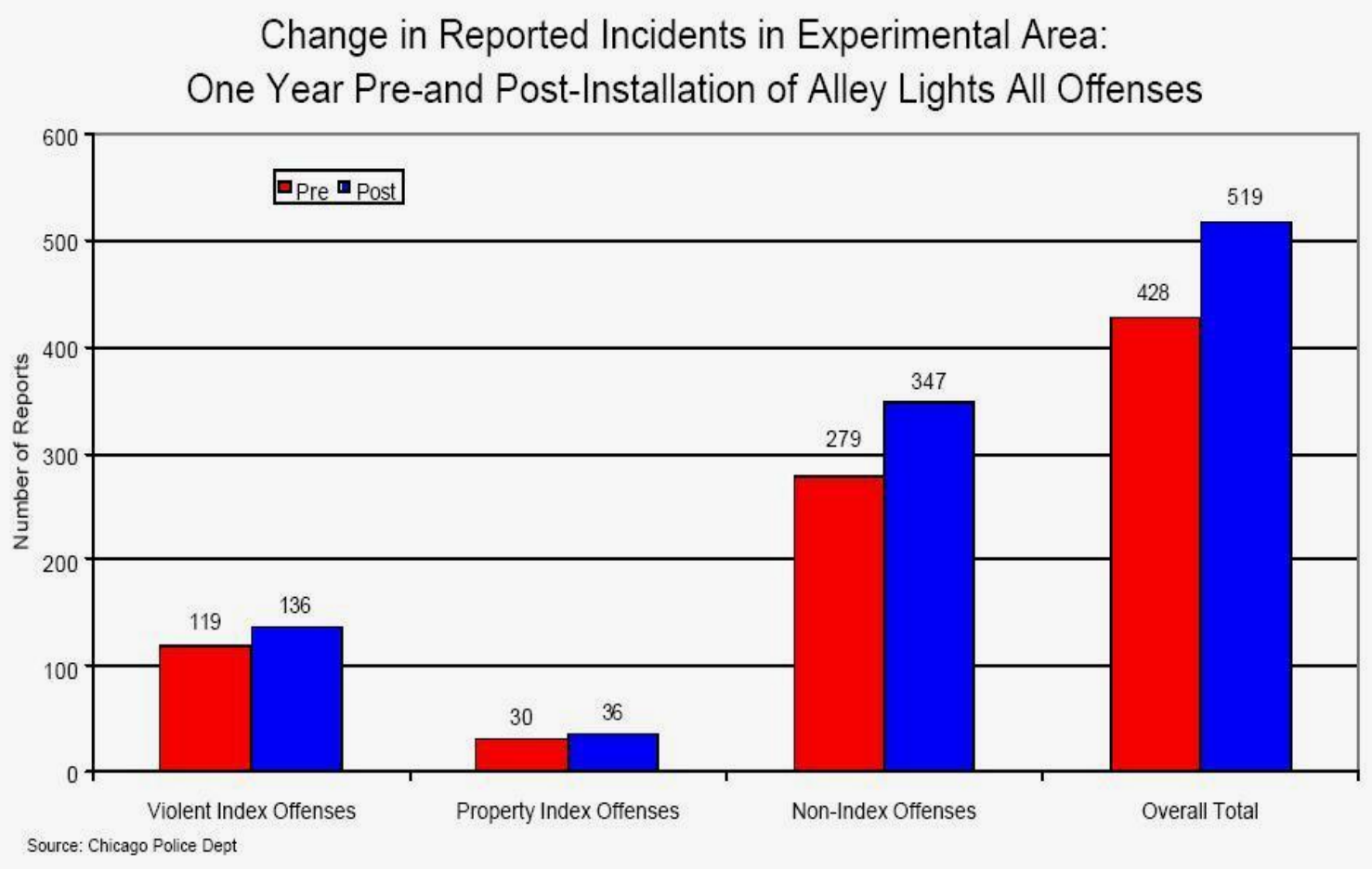

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+21%

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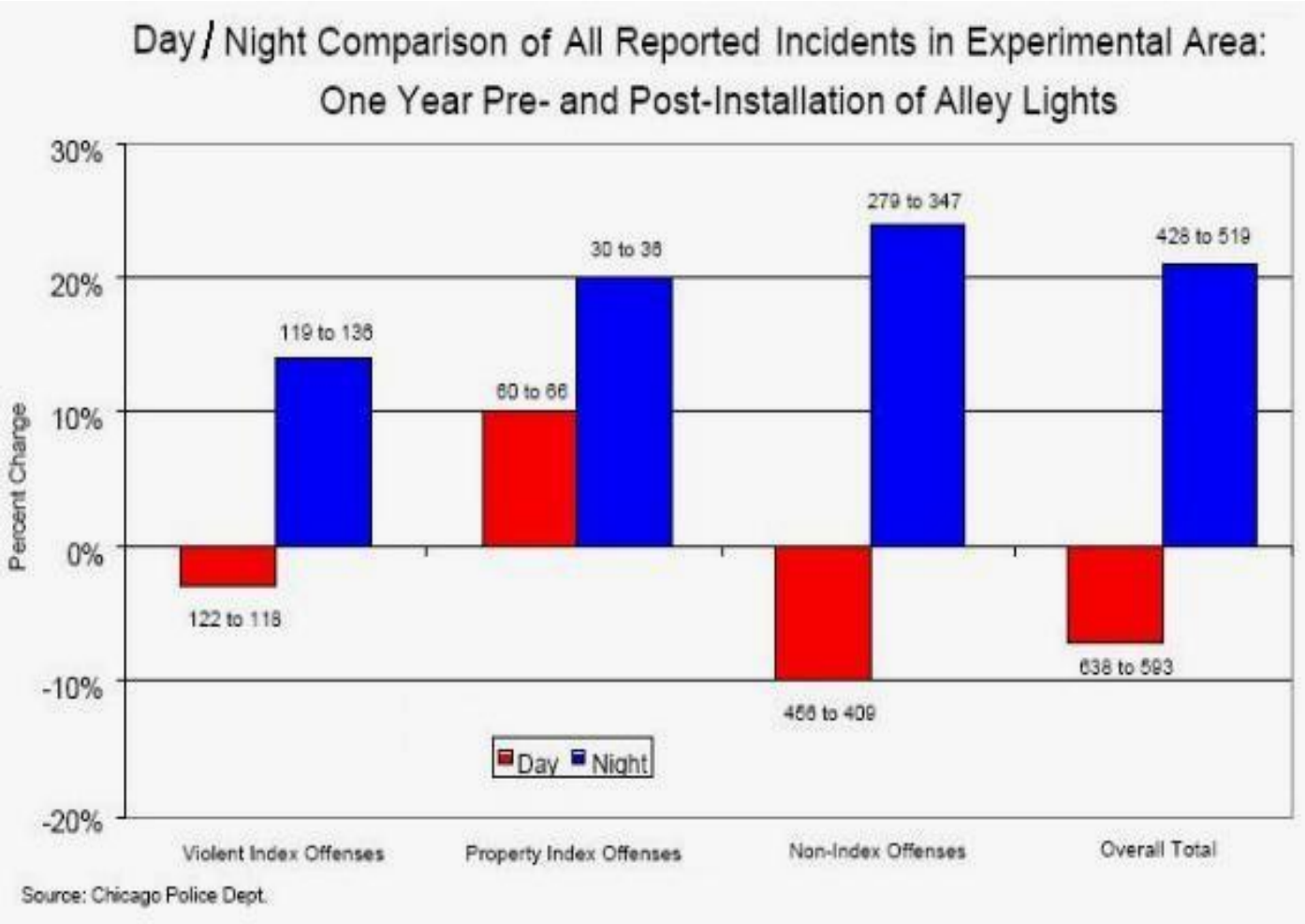
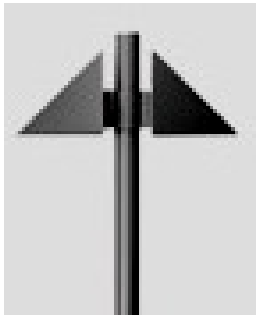


1 Most effective Solution for Light Pollution: use shielded Fixtures

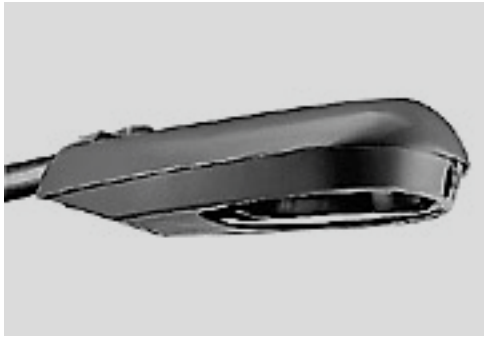













Impacts of Poor Outdoor Lighting Practices

Economic Impact:

Electricity Cost of Waste Outdoor Lighting, United States - 2010

Sector	Number of Consumers	Consumption avgKWh/month	Consumption avgKW/year	Consumption totalKWh/Year	Rate $/KWh	2010 Total$	Overall Avg$/KWh
Residential	124,937,469	920	11040	1,379,309,657,760	$0.1126	$155,310,267,464	
Commercial	17,562,726	6,339	76068	1,335,961,441,368	$0.1036	$138,405,605,326	
Industrial	774,713	108,567	1302804	1,009,299,195,252	$0.0683	$68,935,135,036	
				3,724,570,294,380		$362,651,007,825	$0.0974
	(22% of total elec)		**Lighting**	819,405,464,763.60		$79,783,221,722	
	(8% of lighting)		**Outdoor Lighting**	65,552,437,181.09		$6,382,657,738	
	(30% of Outdoor Lighting)		**Waste Outdoor Lighting**	19,665,731,154.33		$1,914,797,321	

2010 Waste Outdoor Lighting $/yr **$1,914,797,321**

$$\$1.914 \times 10^9 \times \frac{1\ kWh}{\$0.0974} \times \frac{1\ U.S.gal}{36.6\ kWh}$$

$$= Energy\ equivalent\ of$$

$$537\ million\ gallons\ of\ gasoline$$

All that energy is radiated up away to space every year!

Light Pollution = Air Pollution

- Every kilowatt causes release of:
  - 1.3 pounds carbon dioxide
  - 2 grams sulfur dioxide
  - 1.6 grams nitric oxide

Yearly:

- 62 billion kWh = 40 million tons of CO_2
  = 1.4 million tons SO_2
  = 1.1 million tons NO

Light Pollution affects Human Health*

- Interferes with circadian rhythms
- Air and water pollution related health problems
- Melatonin suppression
- Sleep disturbances
- Suspected in rise in childhood leukemia
- Glare into roadways creates dangerous conditions for drivers and pedestrians
- Loss of our natural nocturnal environment contributes to loss of connection to nature and the inspiration of a star filled night sky

* Researchers: Blask, Pauley, Brainard, Rea, Schernhammer, Crain

Light-at-Night Hypothesis

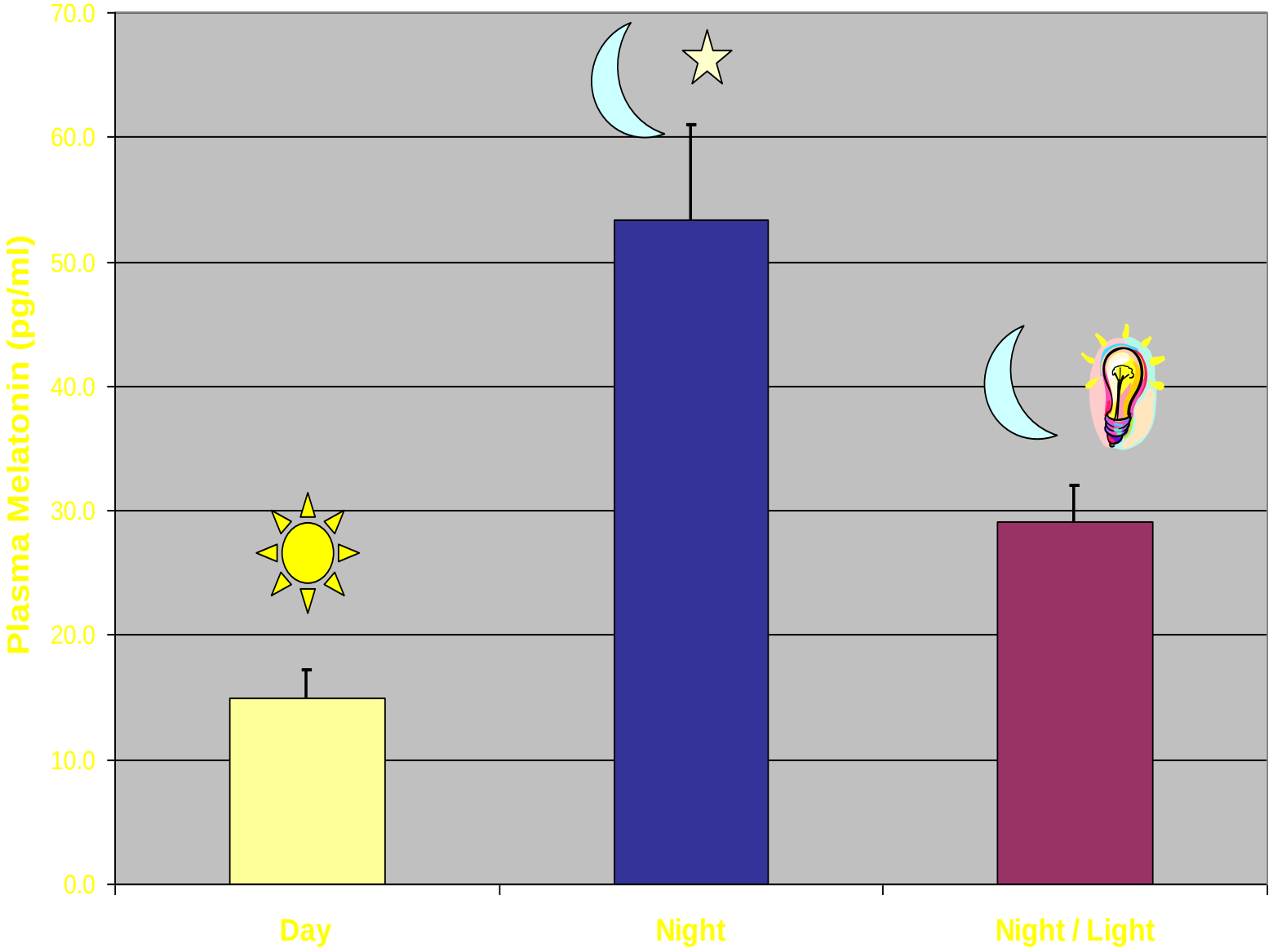
Stevens, R.G., *Amer. J. Epidemiology* 125:556-561, 1987

Exposure to light at night suppresses pineal-gland melatonin production, which may explain some of the high and unaccounted for risk of breast cancer in industrialized 24-hr/day societies (shift work & fat intake at night).

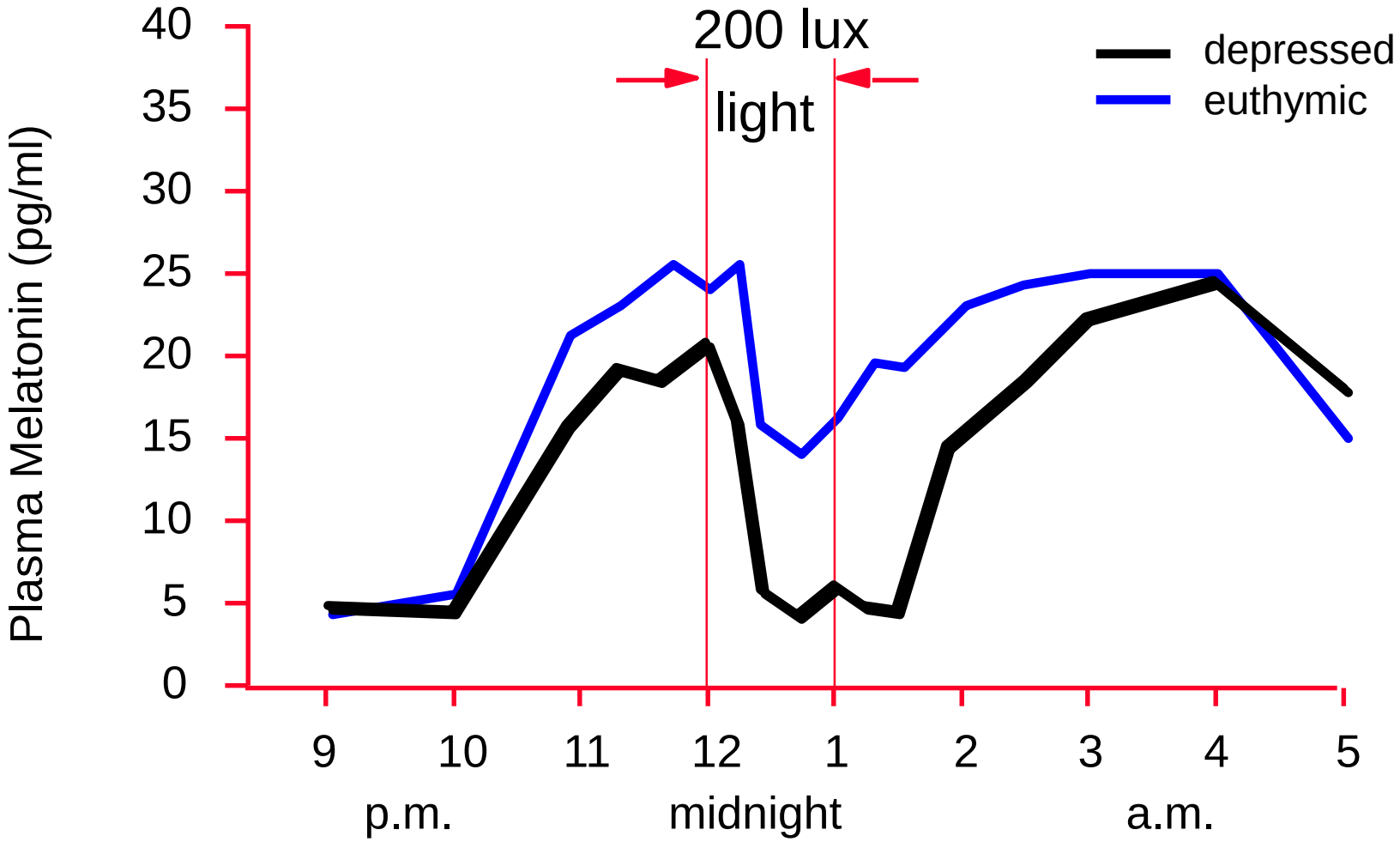
exposure to light at night suppresses

Electric Light & Circadian Disruption

Melatonin Levels in Human Blood Plasma



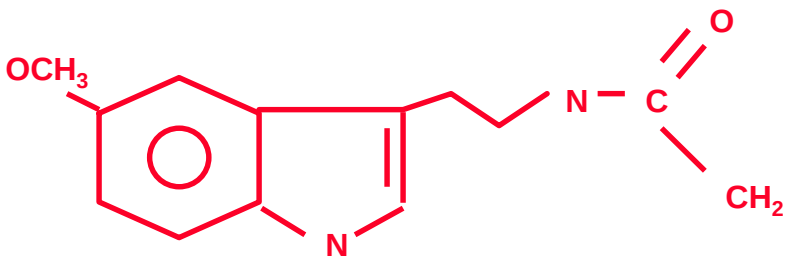
Melatonin Rhythm



McIntyre et al, Lancet, 335:488, 1990

Melatonin

- monoamine hormone
  - pineal gland
  - strong daily rhythm
    - low during day
    - high at night
- mood & depression
- reproductive physiology - antigonadotropic?
- fights breast cancer?
  - inhibits breast cancer in rats
  - slows human breast cancer cells in culture



Response from American Cancer Society

The American Cancer Society now discusses night work as being a cancer risk factor. Their web page has the following statement:

Night Work

Several studies have suggested that women who work at night -- for example, nurses on a night shift -- may have an increased risk of developing breast cancer. This is a fairly recent finding, and more studies are looking at this issue. Some researchers think the effect may be due to changes in levels of melatonin, a hormone whose production is affected by the body's exposure to light, but other hormones are also being studied.

http://www.cancer.org/Cancer/BreastCancer/DetailedGuide/breast-cancer-risk-factors

Non-Visual Photoreception

Multiple neuroendocrine and neurobehavioral responses

- Light is the most powerful time cue for resetting the circadian pacemaker and ensuring correct synchronization of the internal clock with the environment

- Failure to entrain the circadian pacemaker results in sleep disorders, fatigue, performance problems, hormone and metabolic disorders

- Common examples include the circadian desynchronization caused by shift-work, jet-lag and Advanced- and Delayed Sleep Phase Disorder

Non-Visual Photoreception

Multiple neuroendocrine and neurobehavioral responses

- Circadian entrainment
- Circadian phase shifting

- Melatonin suppression
- Subjective alertness / EEG
- Neurobehavioral performance
- Cortisol stimulation
- Cardio- and thermoregulation
- Pupillary reflex
- Stimulation of clock gene expression

- Photoperiodism and seasonality
- Solar navigation

Non-Visual Photoreception

Properties of light affecting circadian photoreception

- **Intensity**
- **Timing**
- **Pattern**
- **Light history**
- **Wavelength**

Light Applications - General

- **Non-pharmacological sleepiness countermeasure**
- **Safe, reversible, short-acting, inexpensive**
- **High levels of caffeine use illustrate need**

  - Offices, schools, colleges, factories, control rooms…
  - Military, security, transport (pilots, captains, truck/car/train drivers)
  - Safety-sensitive occupations (physicians, nurses, nuclear…)
  - Anywhere where enhanced alertness and safety is important

- **Challenge is to incorporate these benefits into design**
- **Lighting design to optimize visual and non-visual effects**
- **Flexible, ‘smart’ lighting systems with user interaction**

genetic differences in light sensitivity?

JCEM ONLINE

Brief Report—Endocrine Research

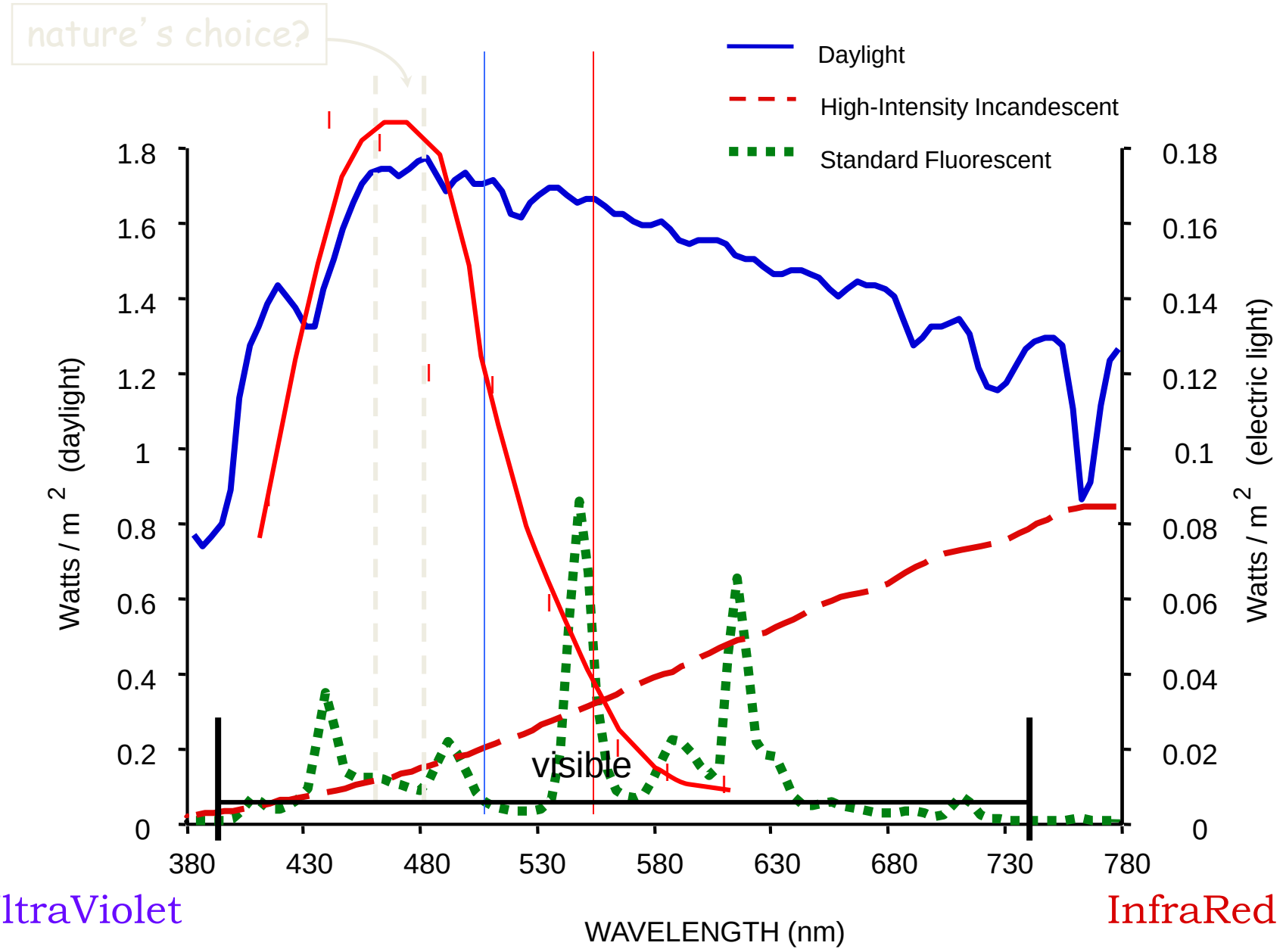
Human Melatonin and Alerting Response to Blue-Enriched Light Depend on a Polymorphism in the Clock Gene*PER3*

Sarah L. Chellappa, Antoine U. Viola, Christina Schmidt, Valérie Bachmann, Virginie Gabel, Micheline Maire, Carolin F. Reichert, Amandine Valomon, Thomas Götz, Hans-Peter Landolt, and Christian Cajochen

Centre for Chronobiology (S.L.C., A.U.V., C.S., V.G., M.M., C.F.R., A.V., T.G., C.C.), Psychiatric Hospital of the University of Basel, CH-4012 Basel, Switzerland; The CAPES Foundation/Ministry of Education of Brazil (S.L.C.), CEP 22641-310 Brasilia-DF, Brazil; and Institute of Pharmacology and Toxicology (V.B., H.-P.L.), University of Zurich, CH-8032 Zurich, Switzerland

Conclusions: We provide first evidence that humans homozygous for the *PER3* 5/5 allele are particularly sensitive to blue-enriched light, as indexed by the suppression of endogenous melatonin and waking theta activity. Light sensitivity in humans may be modulated by a clock gene polymorphism implicated in the sleep-wake regulation. **(*J Clin Endocrinol Metab* 97: E433–E437, 2012)**

Spectra of Natural and Artificial Light

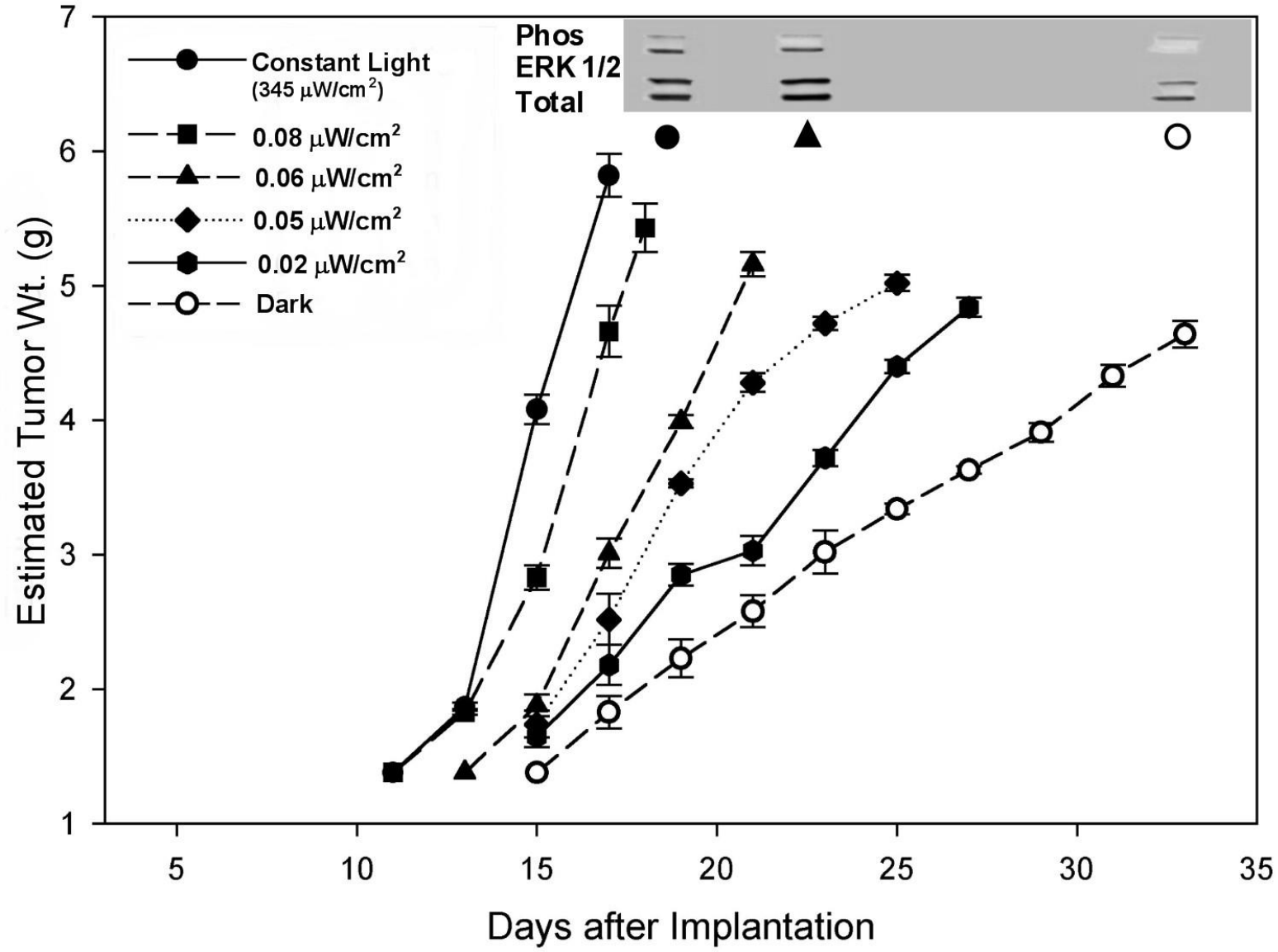


Experimental Evidence

- Bassett Research Institute, NY
- MCF-7 (human breast cancer cells) grown to tumors in nude mice
- transplanted to adult nude rat
  - inguinal region
  - one artery in, one vein out
- light-at-night to the rat increases tumor growth dose-dependently

Blask DE, et al., Cancer Research, 65:11174-84, 2005

GROWTH RATES vs. LIGHT INTENSITY FOR HUMAN BREAST CANCER XENOGRAFTS



The night is full of plants and animals that depend on darkness for a healthy habitat.

"The stars guide our way, when we migrate at night."

"I can see in the dark, thank you"

"Trees need to sleep at night"

"The blight of urban sky glow stops children from wishing on stars, and lovers from counting them. Light pollution severs our human connection to the beautiful celestial creatures of the night."

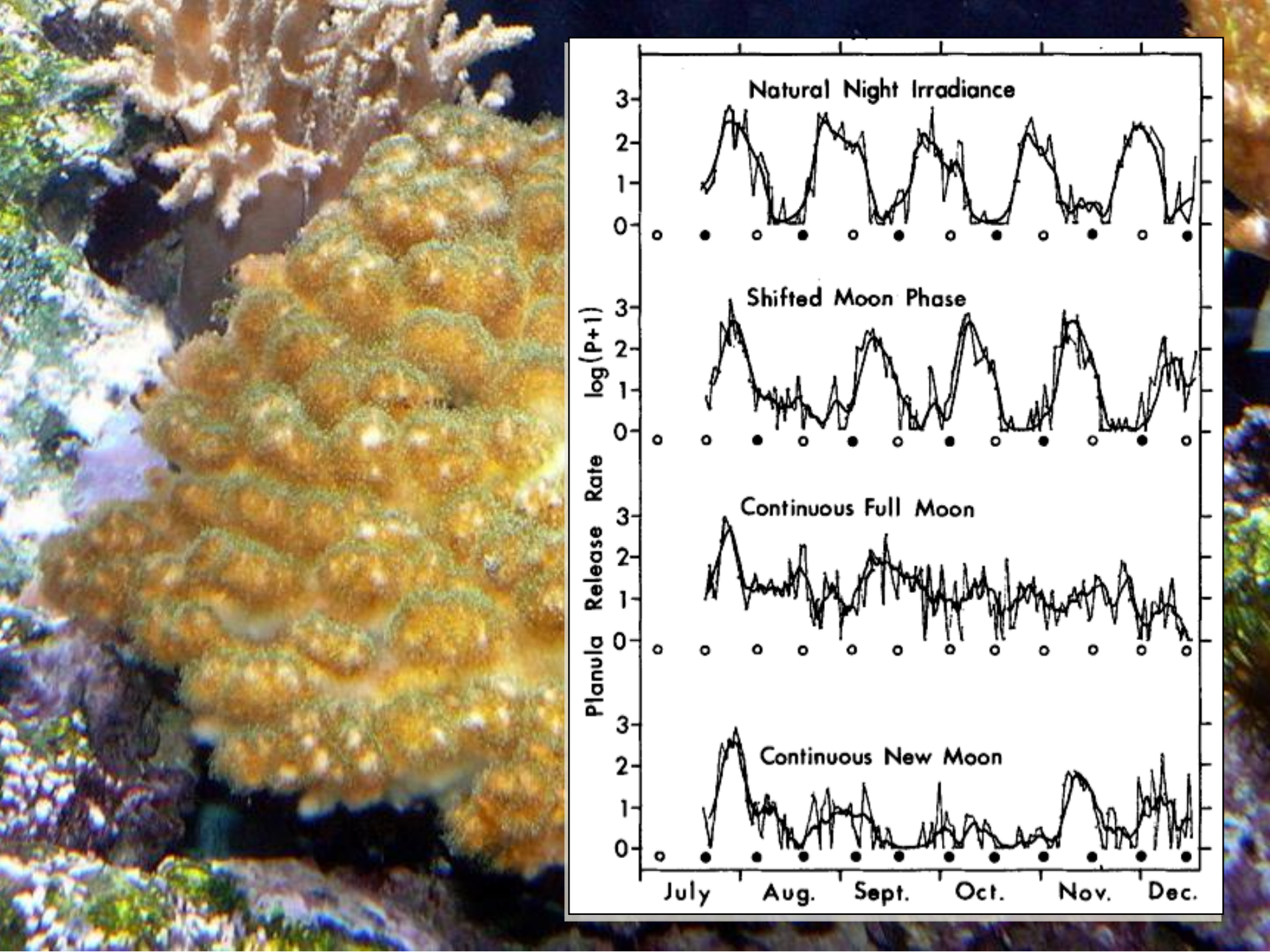
—Dava Sobel, author of Galileo's Daughter

"Thanks for saving the stars"

In your local library for kids:
There Once Was A Sky Full of Stars

Illustrations: Karen Fredericks
Design: JV Advertising & Design 4/04

Light interferes with reproductive behaviors.


Natural Night Irradiance
Shifted Moon Phase
Continuous Full Moon
Continuous New Moon
Planula Release Rate log(P+1)
3
2
1
0
July
Aug.
Sept.
Oct.
Nov.
Dec.


Bilicki
RESEARCH CONCLUDES:
WE ARE DESTROYING EARTH.
COULD YOU KINDLY REPHRASE THAT IN EQUIVOCAL, INACCURATE, VAGUE, SELF-SERVING AND ROUNDABOUT TERMS THAT WE CAN ALL UNDERSTAND?
GOVERNMENT


Innovative solutions can protect
ecosystems and public safety.


Monte Patria , Chile


‘Nature needs the night.’
Longcore & Rich 2007

Response of the American Medical Association

The American Medical Association passed UNANIMOUSLY their resolution #516 , which has them take the stance that :

… Whereas, Emitted glare light is wasted light and accounts for about 40% of the light emitted by standard streetlights (cobras), it is therefore a significant source of wasted electricity, and this contributes to excess carbon dioxide production and possibly global warming; and

Whereas, Numerous states (Arizona, Arkansas, Connecticut, Delaware, Hawaii, Maine, Michigan, Montana, New Mexico, Rhode Island, Texas, Vermont, Virginia, Wyoming), many municipalities, and several countries have now enacted Light pollution control measures; and

Whereas, Light pollution control legislation is being proposed in Congress; and

Whereas, Streetlight glare causes decreased nighttime visibility by pupil constriction, and thus leads to diminished nighttime visibility and creates a safety hazard [1,2,3,4,5,6,7]; and

Whereas, Many older citizens are significantly affected by glare as the eye ages, leading to unsafe driving conditions [8,9,10,11,12,13,14,15]; and

Whereas, Glare light is also light trespass and is intrusive and unwanted in households and dwellings; and

Whereas, Light trespass has been implicated in disruption of the human and animal circadian rhythm, and strongly suspected as an etiology of suppressed melatonin production, depressed immune systems, and increase in cancer rates such as breast cancers [16,17,18,19,20,21,22]; and

Whereas, Light trespass disrupts nocturnal animal activity and results in diminished various animal populations' survival and health [23]; therefore be it

RESOLVED, That our American Medical Association advocate that all future outdoor lighting be of energy efficient designs to reduce waste of energy and production of greenhouse gasses that result from this wasted energy use (New HOD Policy); and be it further

RESOLVED, That our AMA support light pollution reduction efforts and glare reduction efforts at both the national and state levels (New HOD Policy); and be it further

RESOLVED, That our AMA support efforts to ensure all future streetlights be of a fully shielded design or similar non-glare design to improve the safety of our roadways for all, but especially vision impaired and older drivers.

http://www.ama-assn.org/ama1/pub/upload/mm/475/refcome.pdf