

IES TM-18-08

Light and Human Health: An Overview of the Impact of Optical Radiation on Visual, Circadian, Neuroendocrine, and Neurobehavioral Responses

Contents

1.0	Introduction	1
2.0	Overview of the Retina	2
2.1	Classical Visual Photoreceptors	2
2.2	Circadian, Neuroendocrine, and Neurobehavioral Photoreceptors	3
2.2.1	Identifying Photopigments	3
2.2.2	Action Spectra	4
2.2.3	Studies Using Blind Animals	4
2.2.4	The Discovery of Melanopsin	4
2.2.5	New Photoreceptor Identified	5
2.2.6	Blue Light Sensitivities Characterized	5
2.2.7	Experiments with Transfected Cells	6
2.2.8	Spectral Sensitivity Inconsistencies	6
2.2.9	Melanopsin Regeneration	7
2.2.10	Circadian Clock Uses Novel Receptor System	7
2.2.11	Key Mediator Role for the ipRGCs	7
3.0	Overview of the Circadian, Neuroendocrine, and Neurobehavioral Responses to Optical Radiation	8
3.1	Resetting the Circadian Clock	8
3.2	Desynchronized Pacemaker in Blind Individuals	8
3.3	Photic Signal Pathways	9
3.4	Organs with Peripheral Clocks	9
3.5	Circadian Clock Markers	9
4.0	Lighting Characteristics Affecting the Visual System	9
4.1	Quantity	10
4.2	Spectrum	10
4.3	Timing	10
4.4	Duration	10
4.5	Spatial Distribution	11
5.0	Optical Radiation Characteristics Affecting the Circadian, Neuroendocrine, and Neurobehavioral Systems	11
5.1	Quantity	11
5.2	Spectrum	13
5.3	Timing	13
5.4	Duration	14
5.5	Light Distribution	14
5.6	Adaptation (Photic History)	14
6.0	Measuring Optical Radiation for Circadian, Neuroendocrine, and Neurobehavioral Regulation	15
7.0	Conclusions	16
	References	