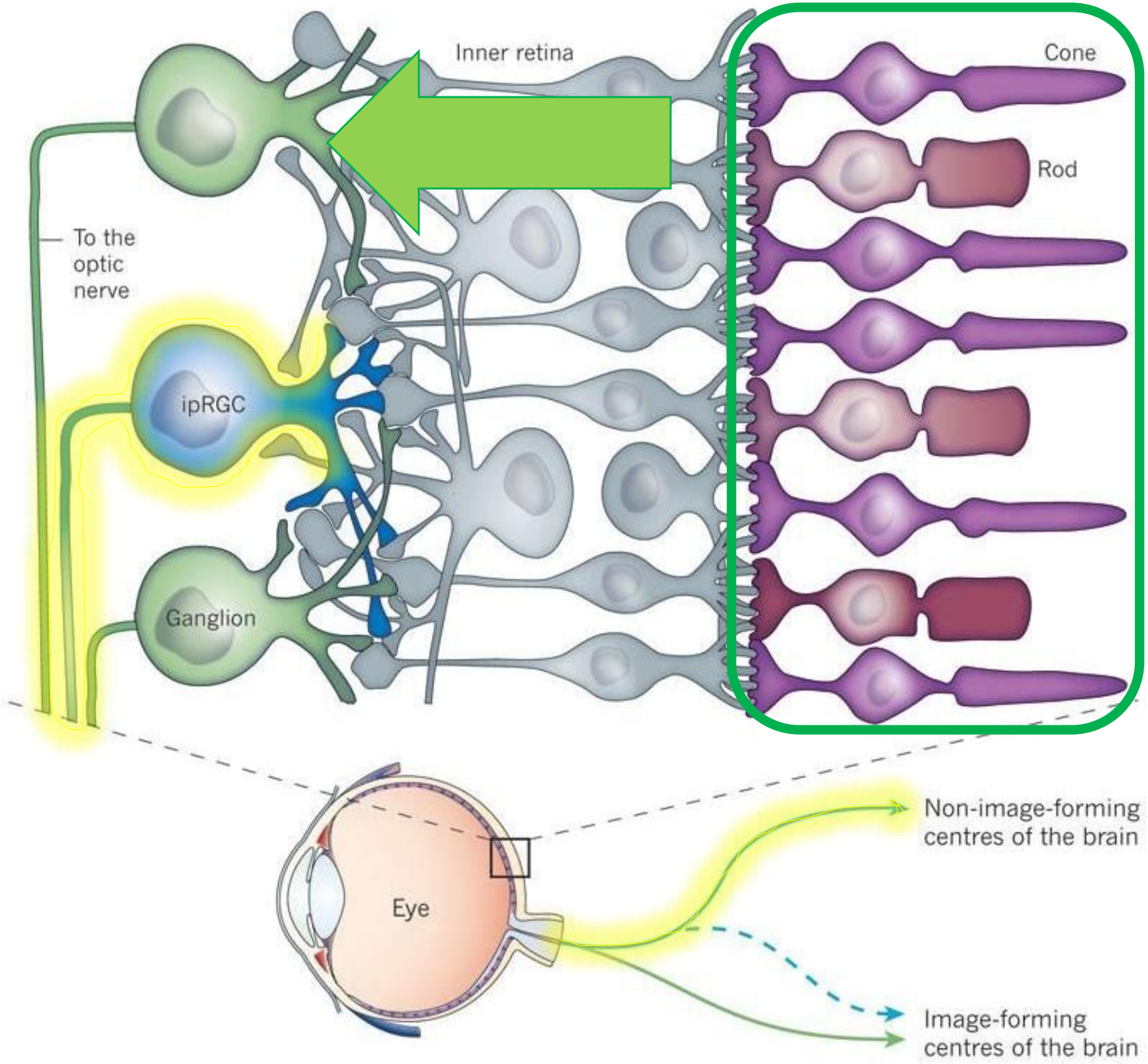
DOE Workshop - Ask Me session

Retinal physiology & individual differences

Dr. Andrew J. K. Phillips

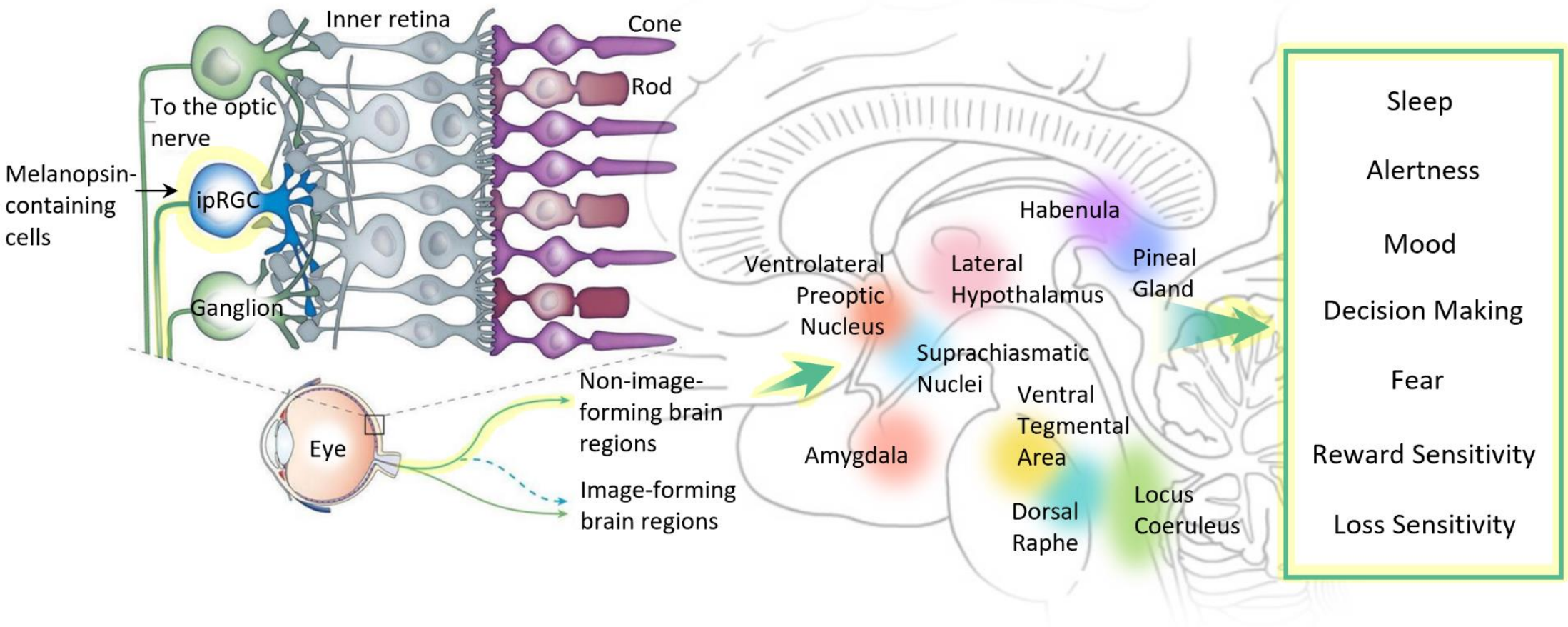


Very **blue sensitive** (peak response @480nm)

Prolonged activation

Sustained responsiveness (ipRGCs continue firing for long periods of exposure)

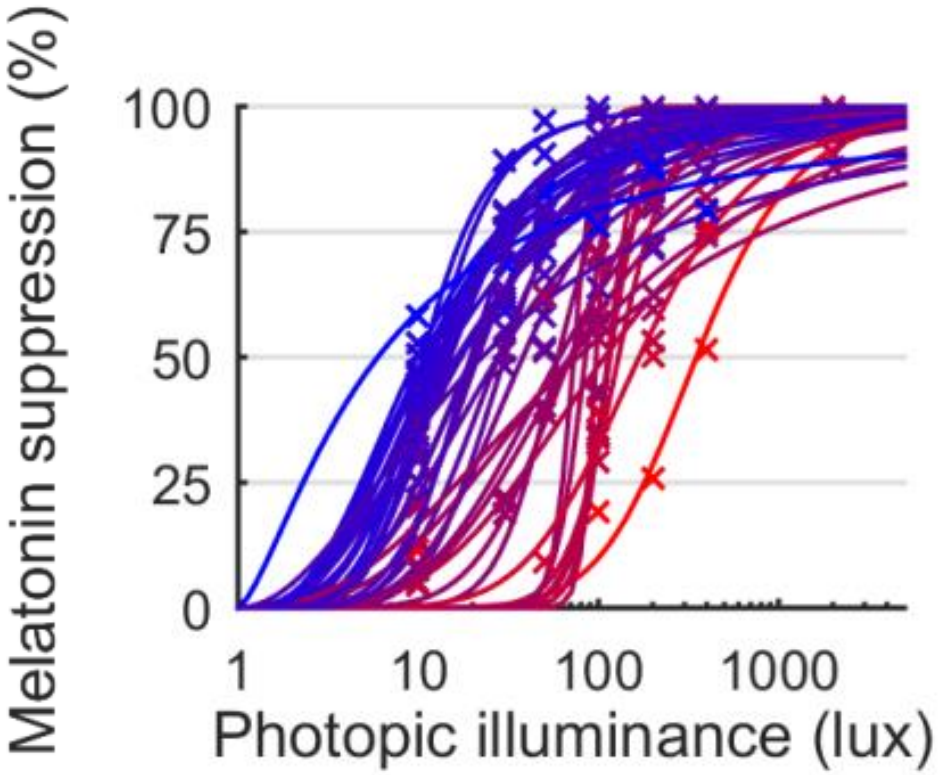
ipRGCs project to many regions of the brain



Interindividual variability

- There are large differences between people in how light affects the circadian system
- This is seen for a range of different non-visual responses (melatonin suppression, phase shifting, effects on sleep, etc.)
- As well as individual differences in the healthy population, there are systematic changes in non-visual light sensitivity with age
- Also differences in non-visual light sensitivity in certain clinical populations (e.g., depression, bipolar, delayed sleep)

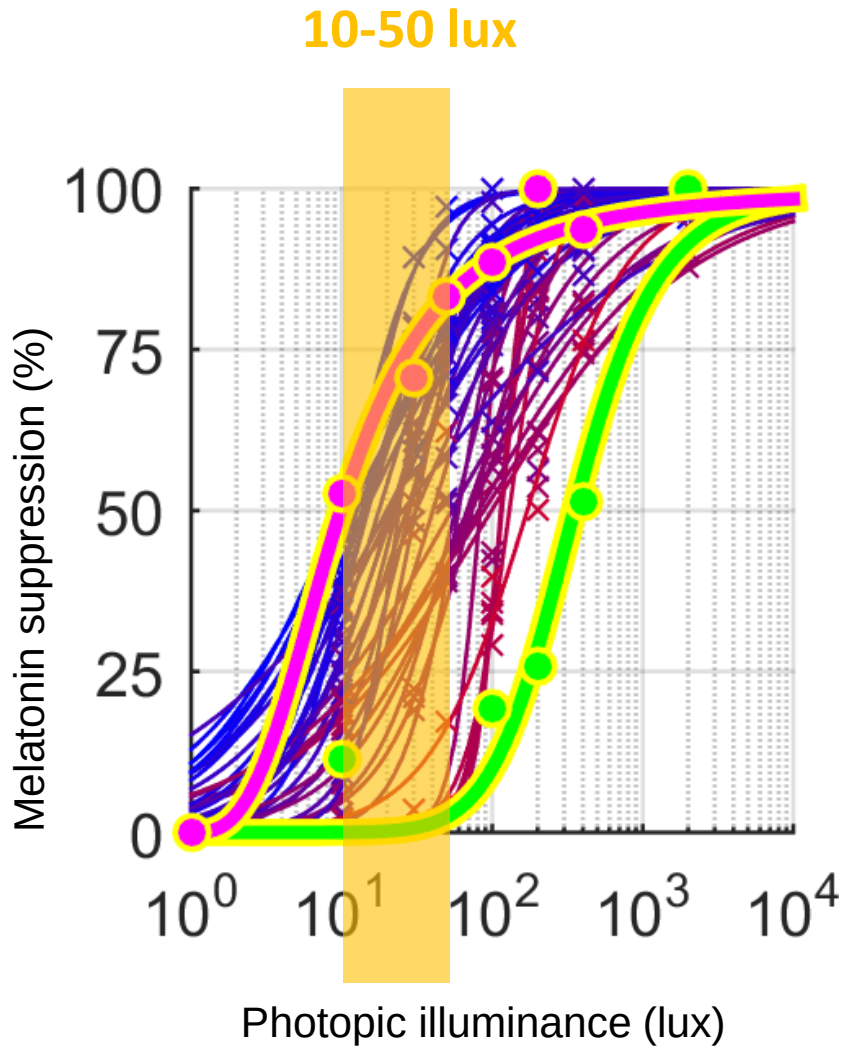
Differences in melatonin suppression



Some individuals have 50% melatonin suppression in response to 6 lux, whereas others have 50% melatonin suppression in response to 350 lux

A >50-fold difference in sensitivity between individuals

Highest and lowest sensitivity individuals register typical indoor lighting very differently



Interindividual differences in sensitivity are most pronounced in the typical indoor lighting range

This is an intensity range we would have experienced for only minutes per day under the natural solar light cycle

We have now created an environment that selectively causes circadian disruption for some individuals more than others

Take-home messages

- The non-visual pathway for light is different from the visual pathway for light
- The non-visual effects of light, for long periods of exposure, are predominantly driven by **melanopsin**
- There are big differences between individuals in sensitivity to the non-visual effects of light
- This needs to be considered for lighting design, especially in the context of typical ‘standard observer’ models