07/11/2022

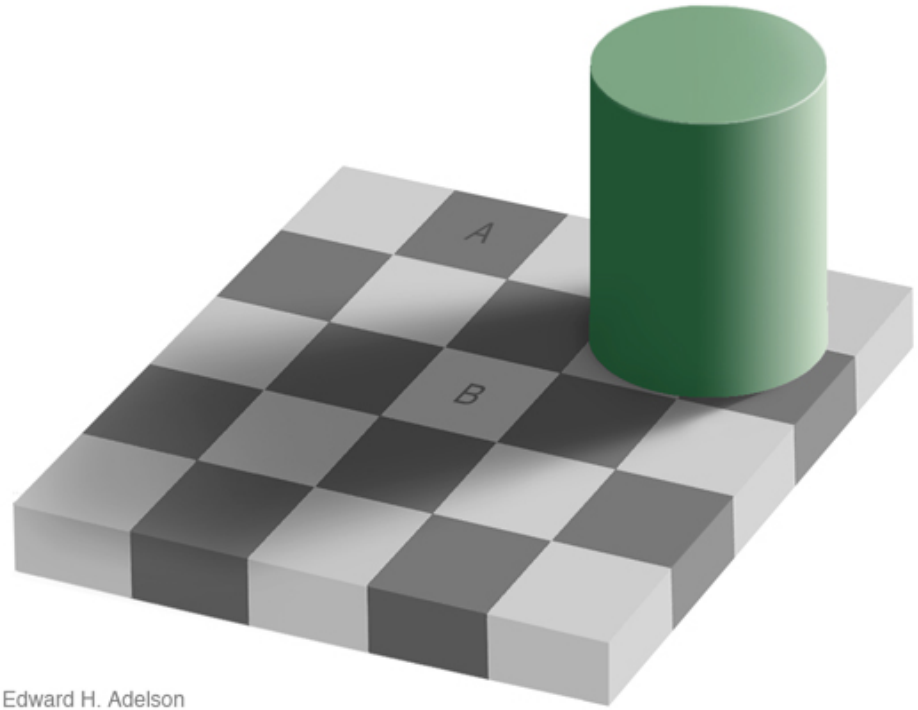
Eyes are smarter than scientists believed

Ulisse Ferrari

ulisse.ferrari@gmail.com

INSTITUT DE LA VISION
PARIS

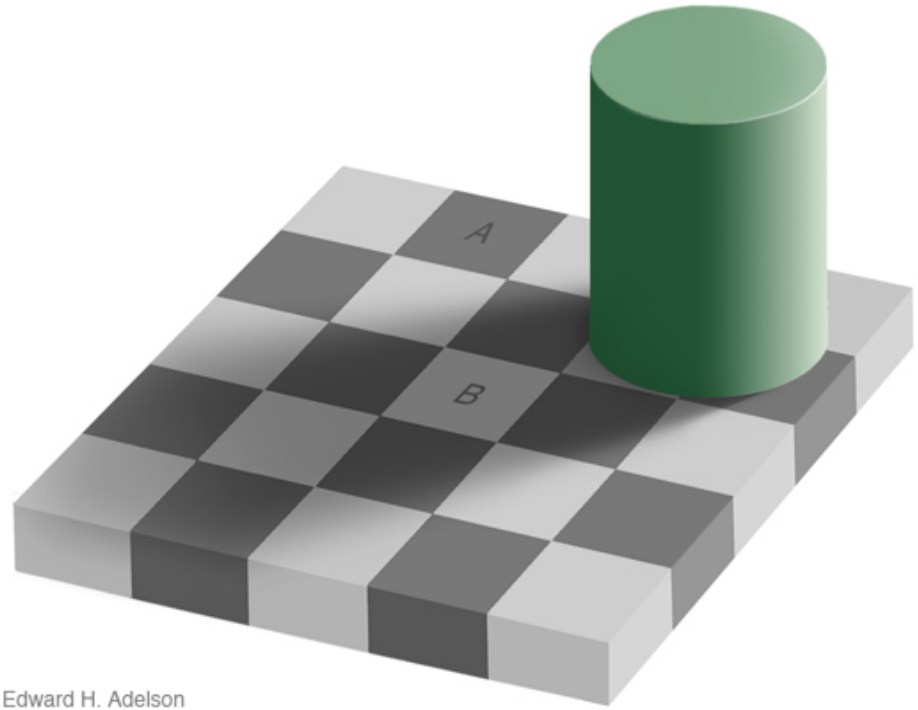
Eyes are smarter than scientists believed

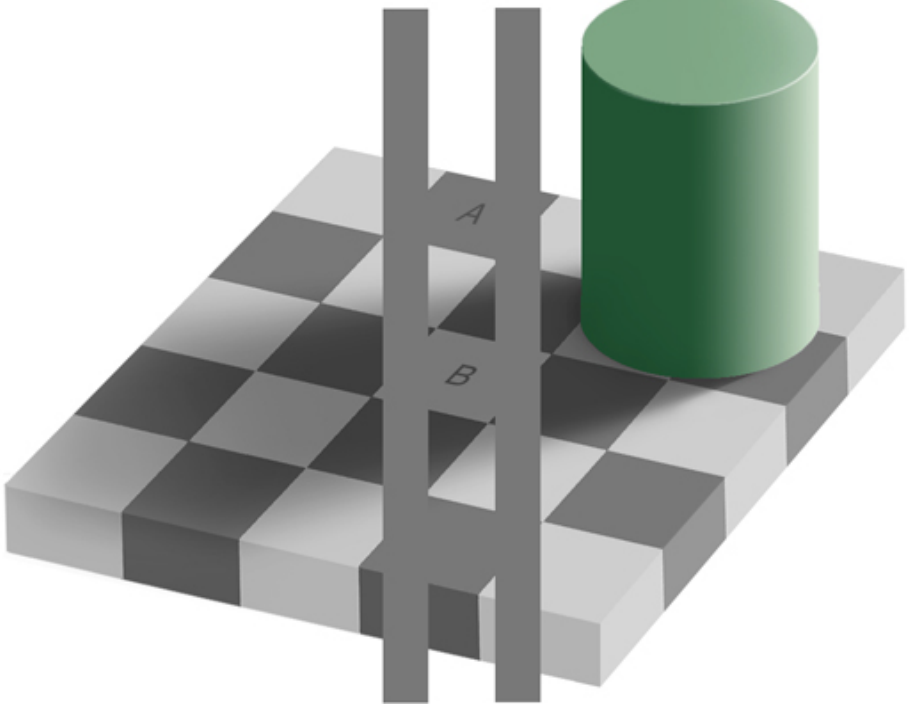


Edward H. Adelson

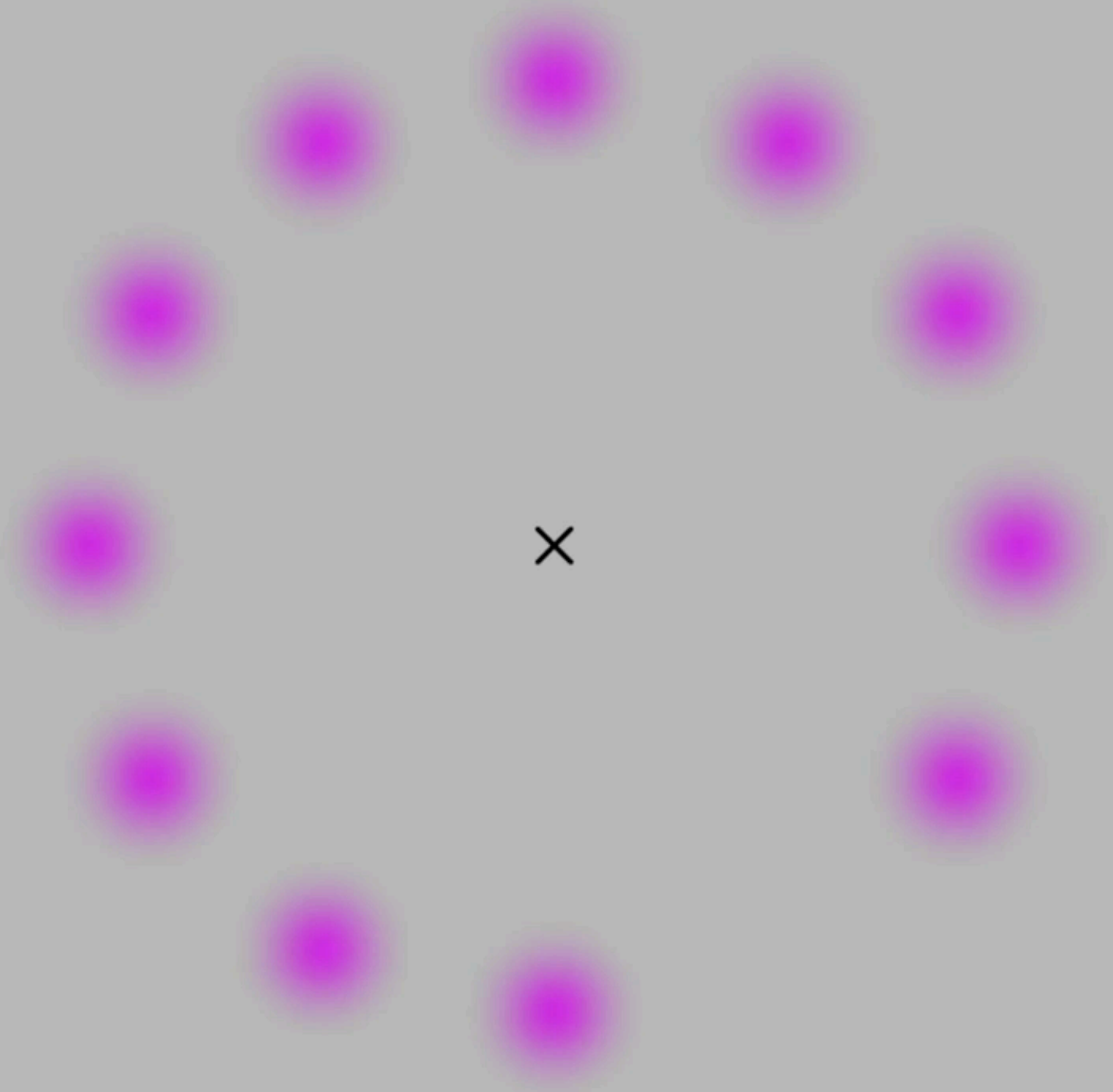
07/11/2022

Eyes are smarter than scientists believed



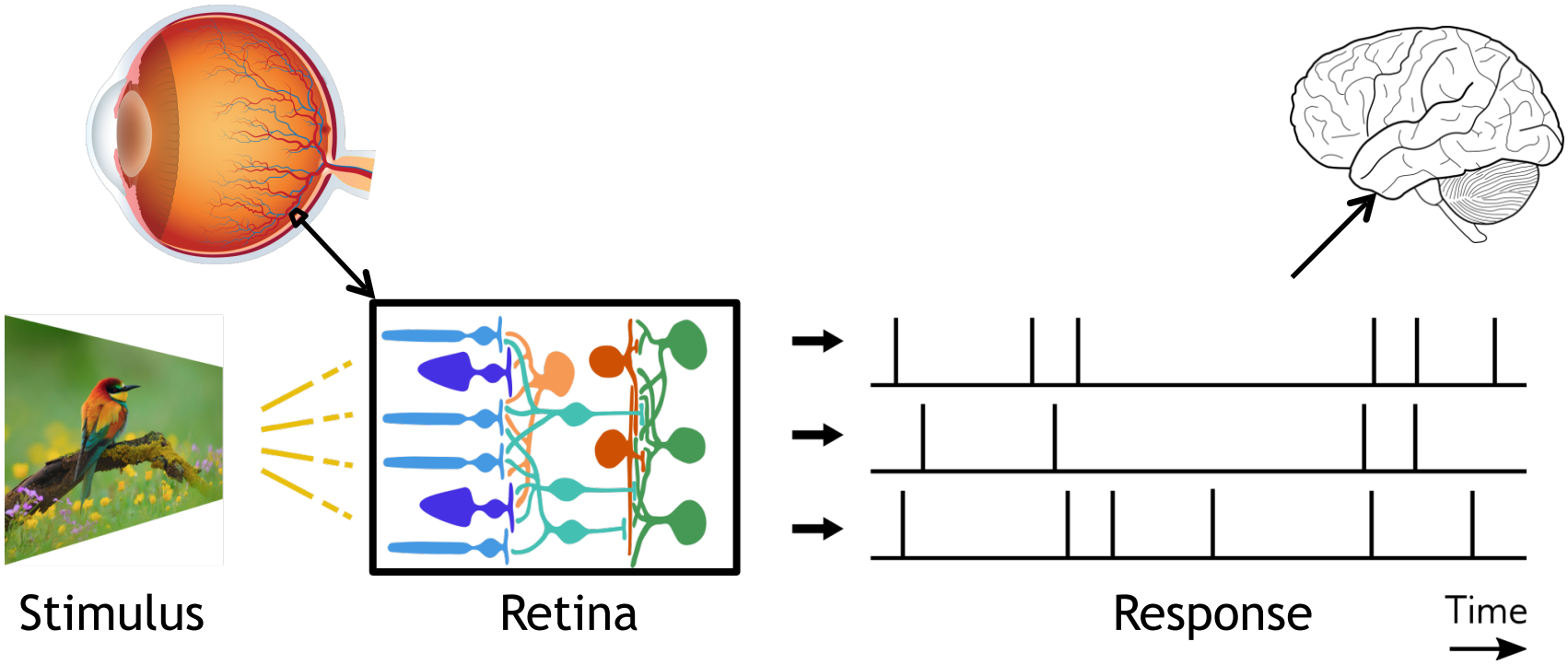


Edward H. Adelson



ch

The retina



- Retina: a thin, light sensitive, layer of tissue
- **Ganglion cells** spikes encode all the visual information accessible by the brain

Eyes are smarter than scientists believed

1) The architecture of the retina

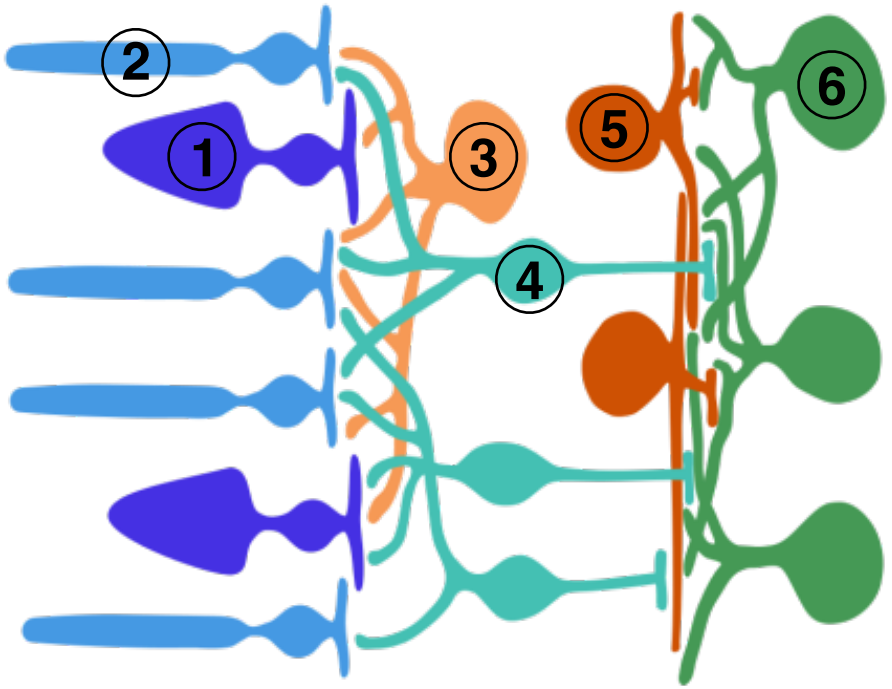
2) Stimulus processing in the retina

3) Predicting retinal light-response

Structure of the retina

Six classes of neurons:

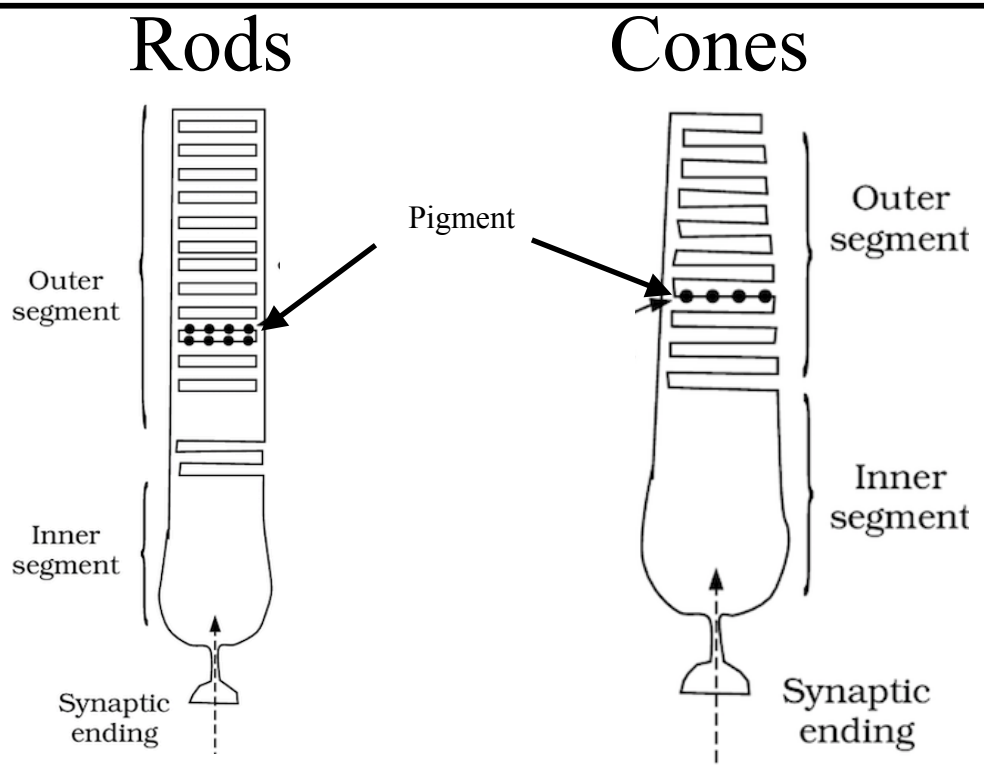
1. Rod photoreceptors
2. Cone photoreceptors
3. Horizontal cells
4. Bipolar cells
5. **Amacrine cells**
6. Retina Ganglion cells



Structure of the retina

Six classes of neurons:

1. Rod photoreceptors
2. Cone photoreceptors
3. Horizontal cells
4. Bipolar cells
5. **Amacrine cells**
6. Retina Ganglion cells



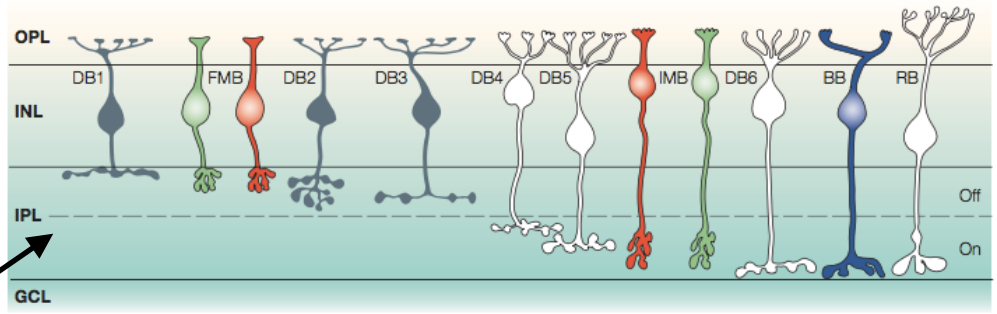
Scotopic vision	Photopic vision
very sensitive	weakly sensitive
Slow response	Fast response
Colour un-sensitive	Colour sensitive

Both are **hyperpolarized** by light

Structure of the retina

Six classes of neurons:

1. Rod photoreceptors
2. Cone photoreceptors
3. Horizontal cells
4. Bipolar cells
5. **Amacrine cells**
6. Retina Ganglion cells

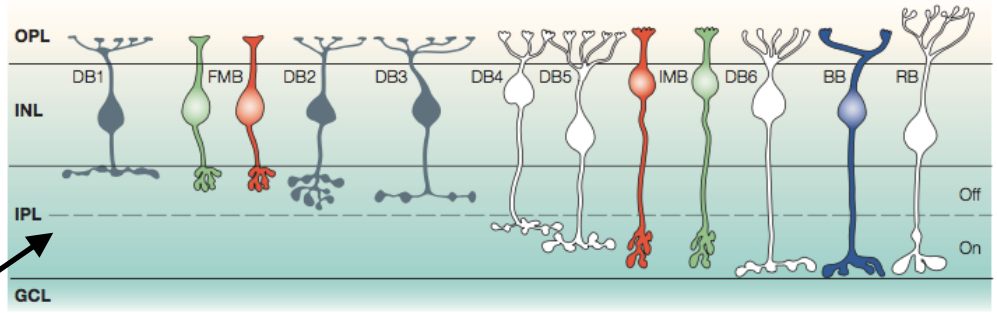


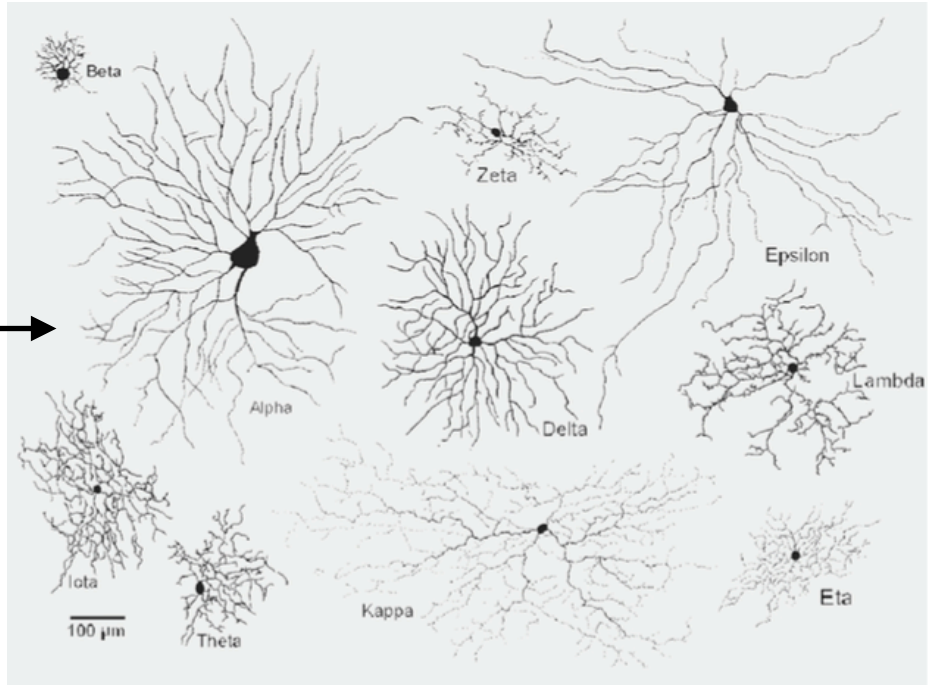
~80 **different** cell types

Structure of the retina

Six classes of neurons:

1. Rod photoreceptors
2. Cone photoreceptors
3. Horizontal cells
4. Bipolar cells
5. **Amacrine cells**
6. Retina Ganglion cells



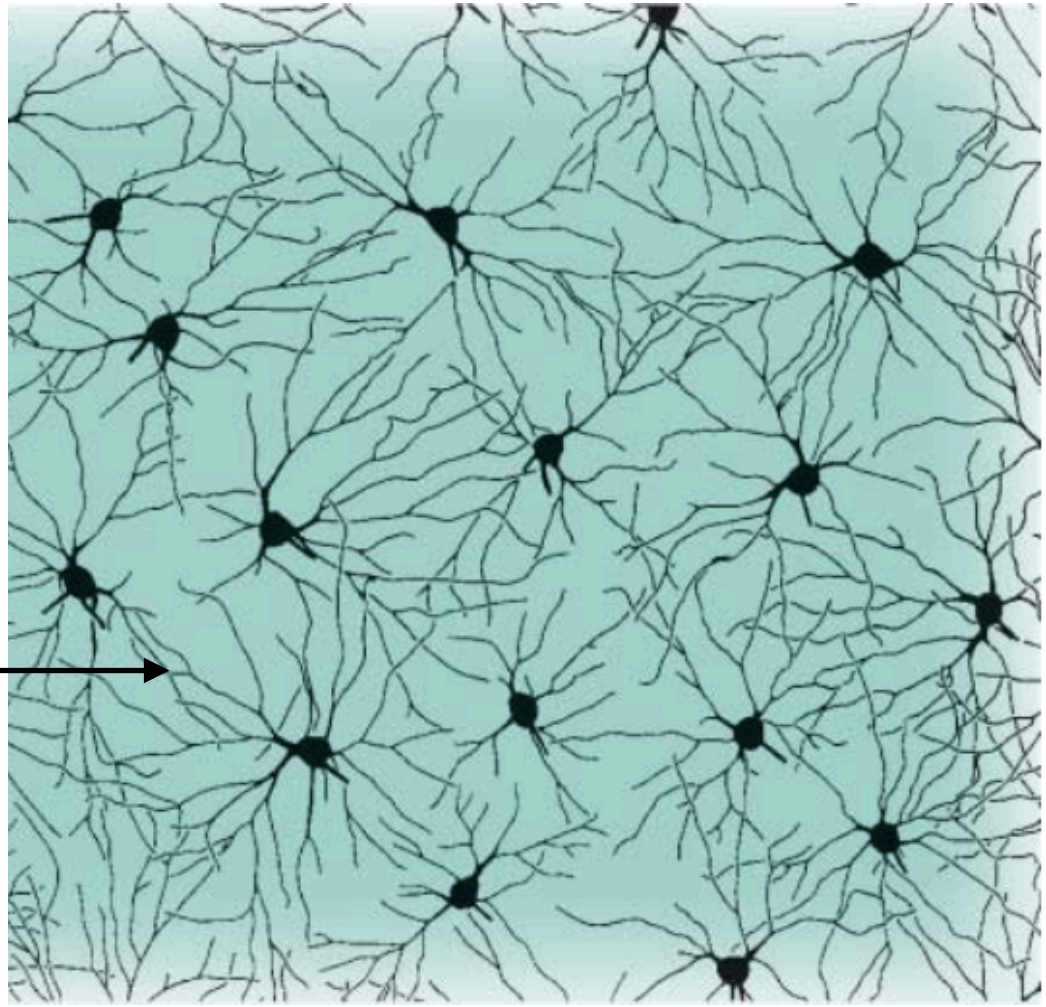


~80 **different** cell types

Structure of the retina

Six classes of neurons:

1. Rod photoreceptors
2. Cone photoreceptors
3. Horizontal cells
4. Bipolar cells
5. **Amacrine cells**
6. Retina Ganglion cells

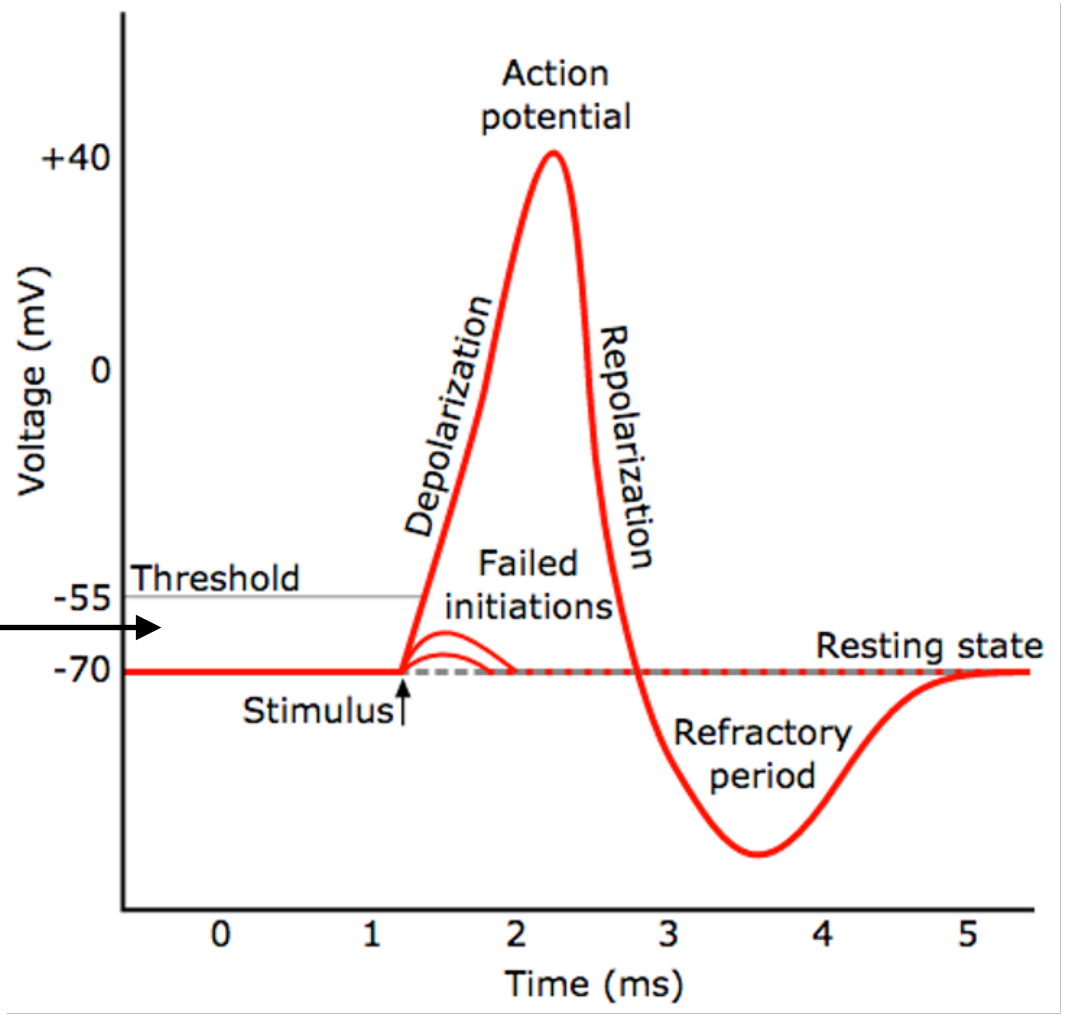


~80 **different** cell types, each **tiling** the 2D space

Structure of the retina

Six classes of neurons:

1. Rod photoreceptors
2. Cone photoreceptors
3. Horizontal cells
4. Bipolar cells
5. **Amacrine cells**
6. Retina Ganglion cells

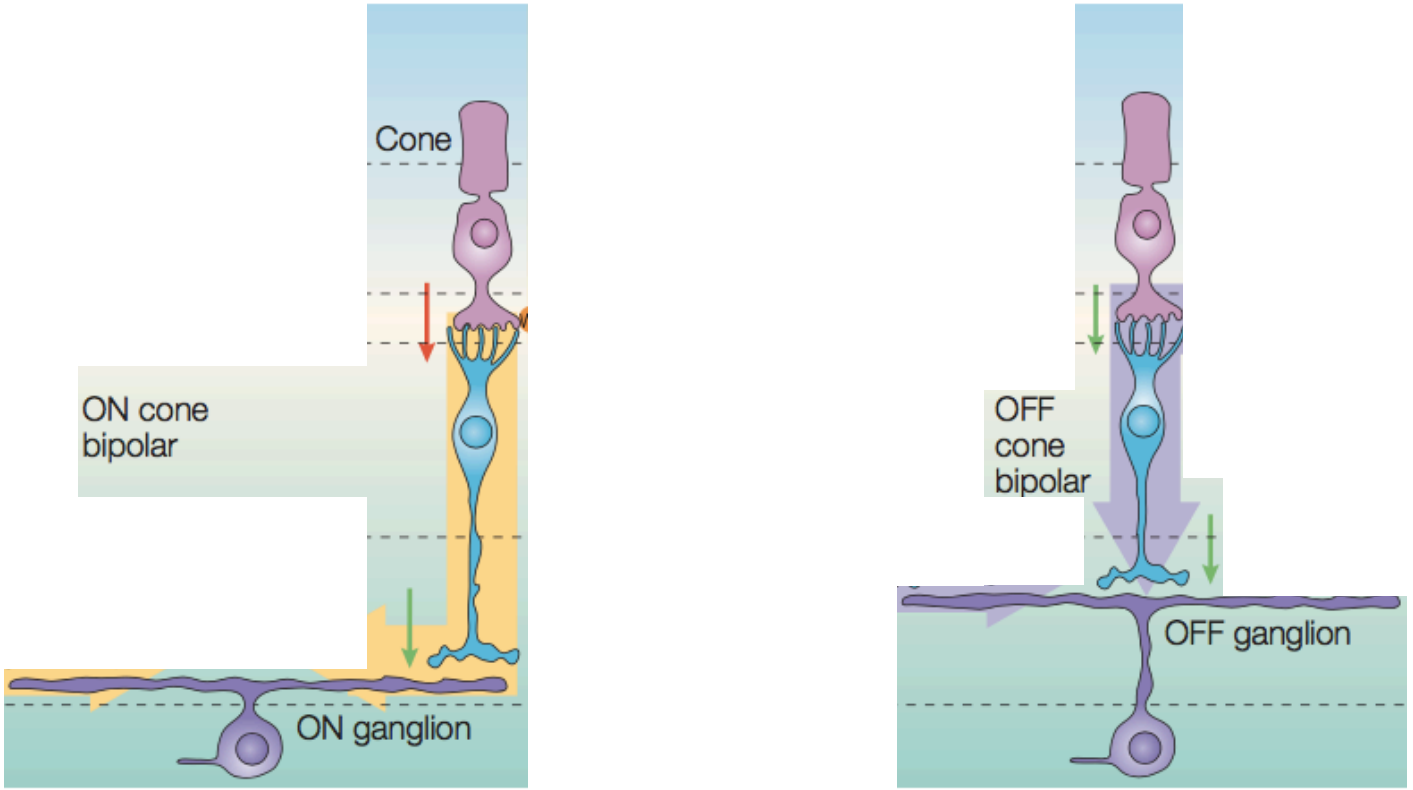


~80 **different** cell types, each **tiling** the 2D space

Structure of the retina

The cone visual pathway

see: Wässle 2004

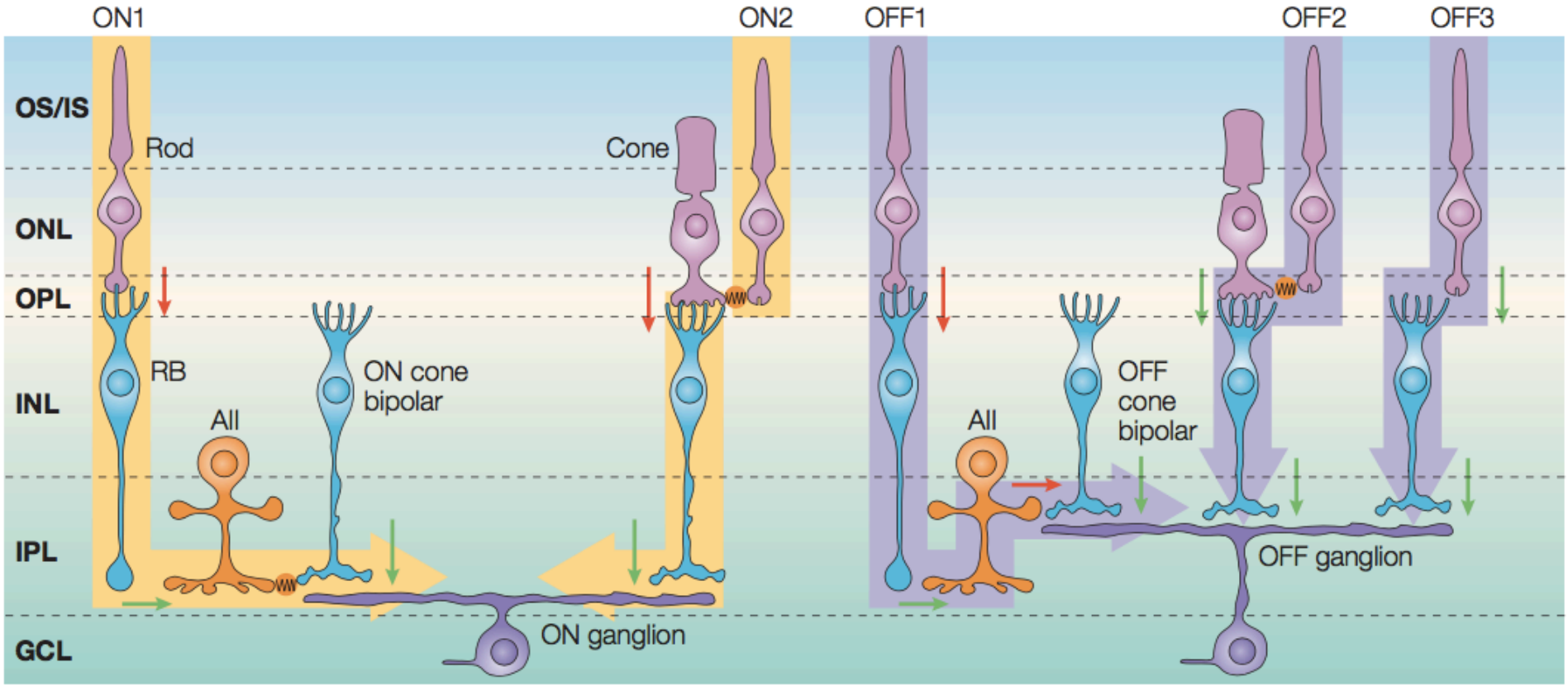


Synapse Inverting Synapse Gap junction

Structure of the retina

The rod visual pathway

see: Wässle 2004



Synapse Inverting Synapse Gap junction

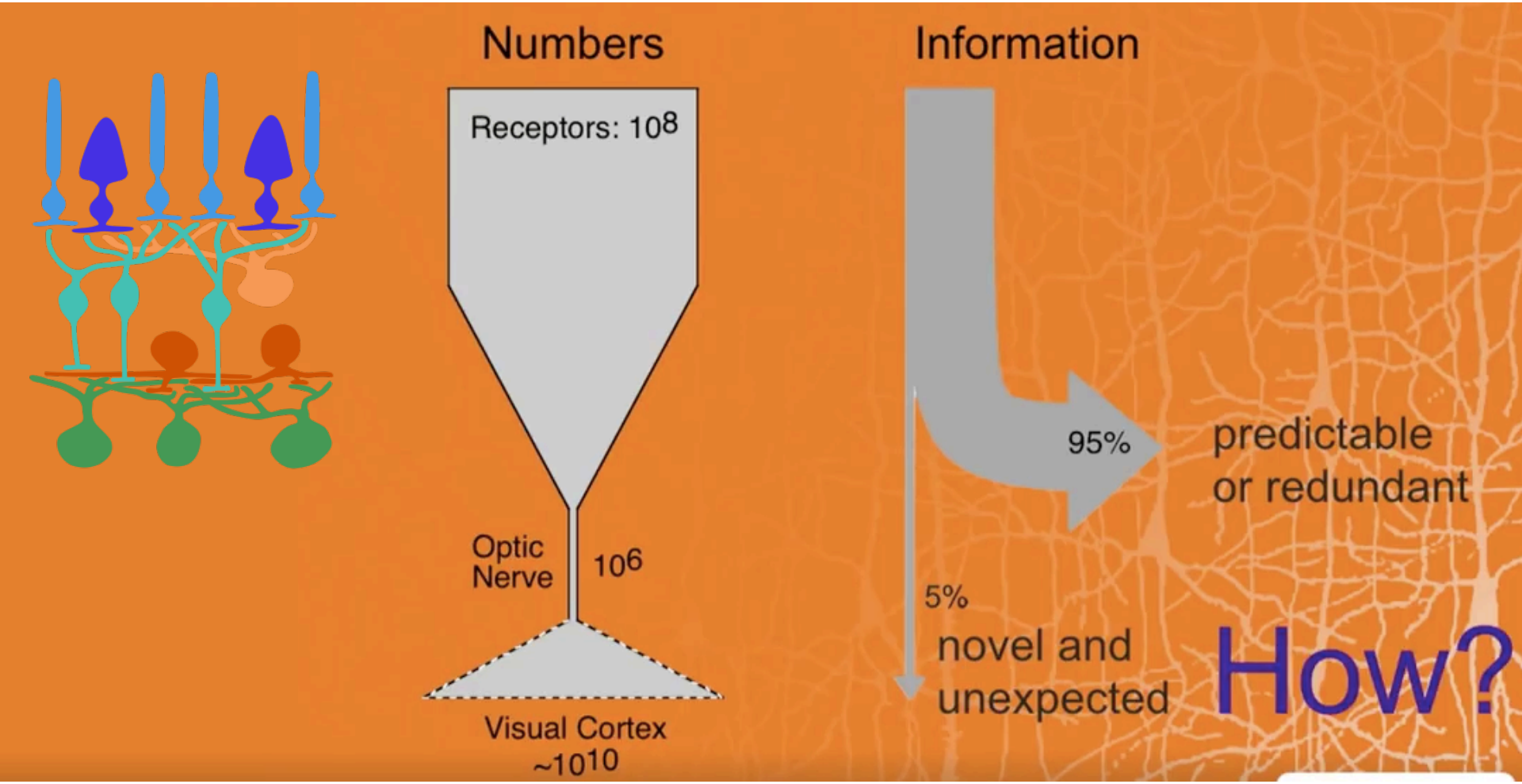
Eyes are smarter than scientists believed

1) The architecture of the retina

2) Stimulus processing in the retina

3) Predicting retinal light response

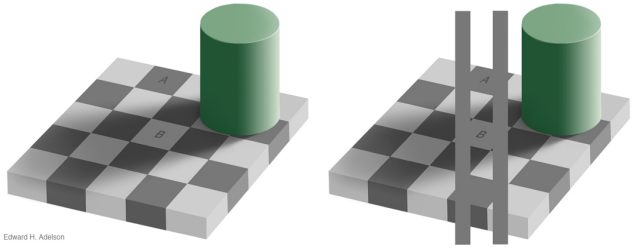
Stimulus processing in the retina

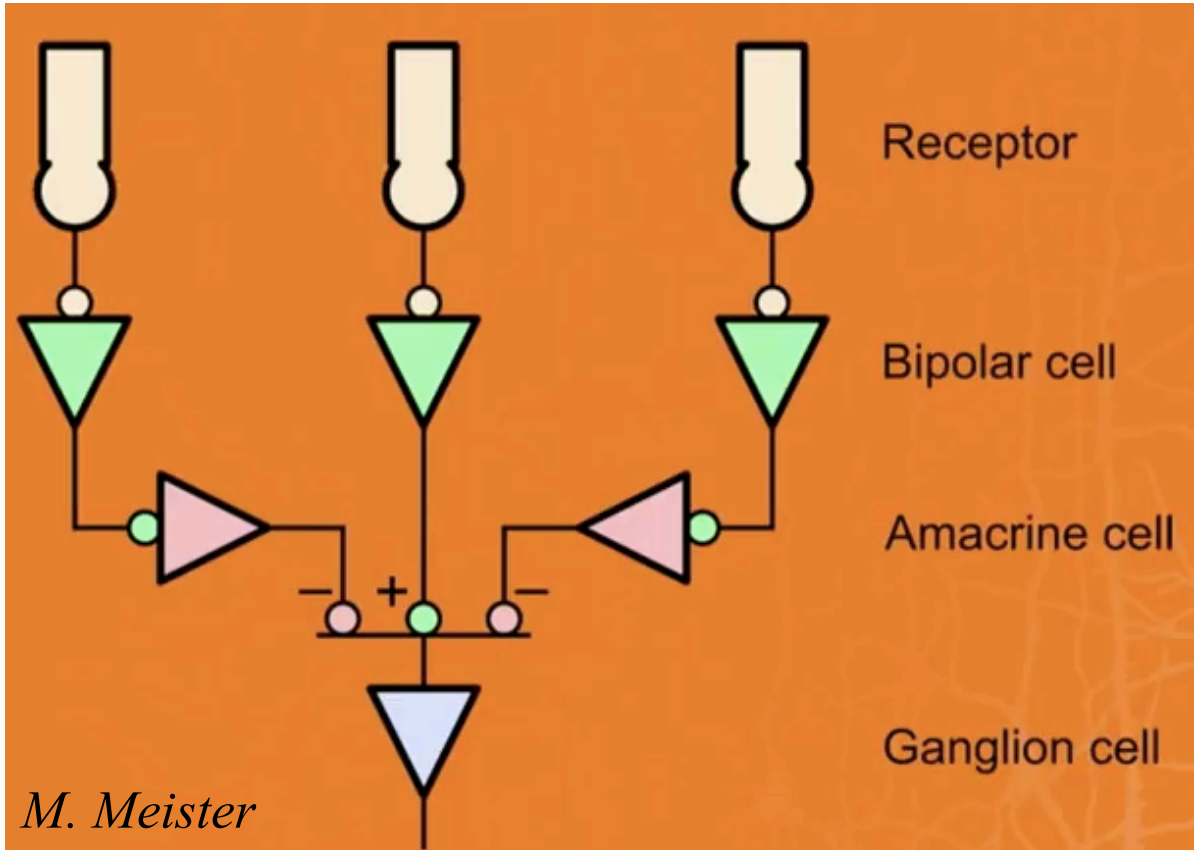


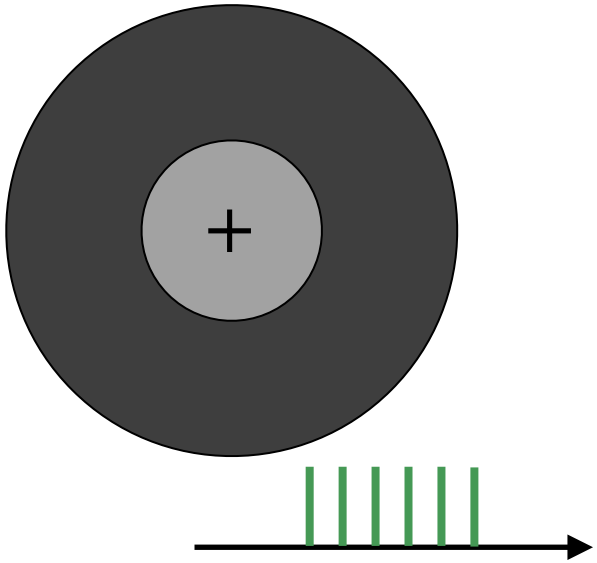
M. Meister

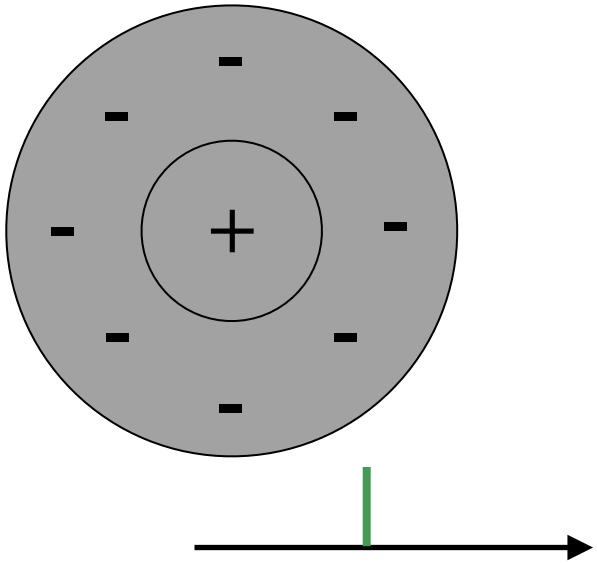
Stimulus processing in the retina

Center/surround response



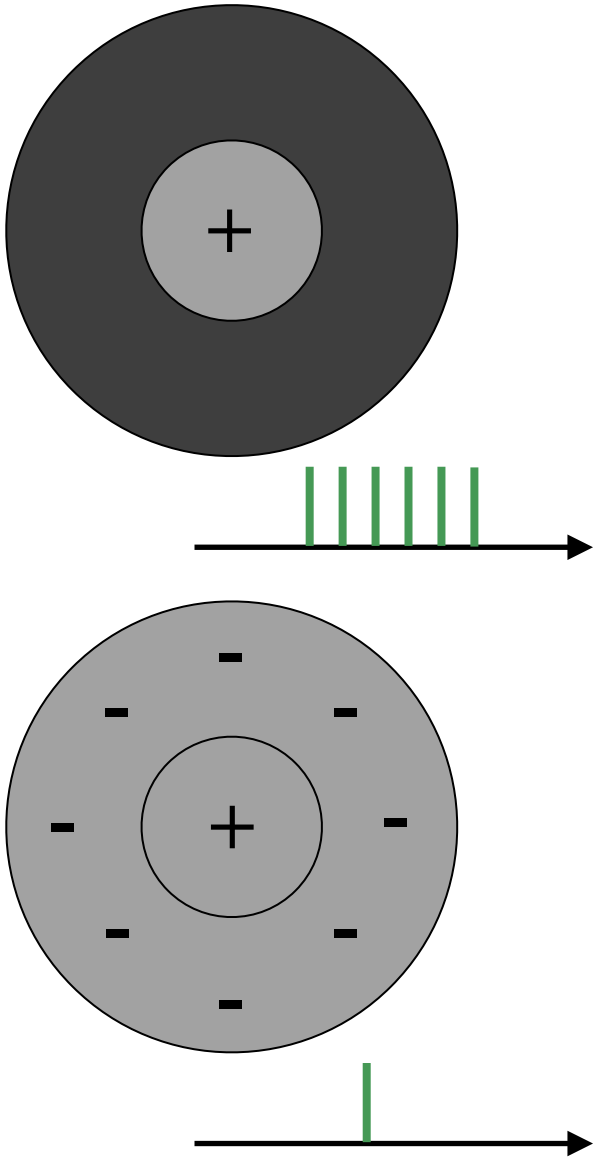






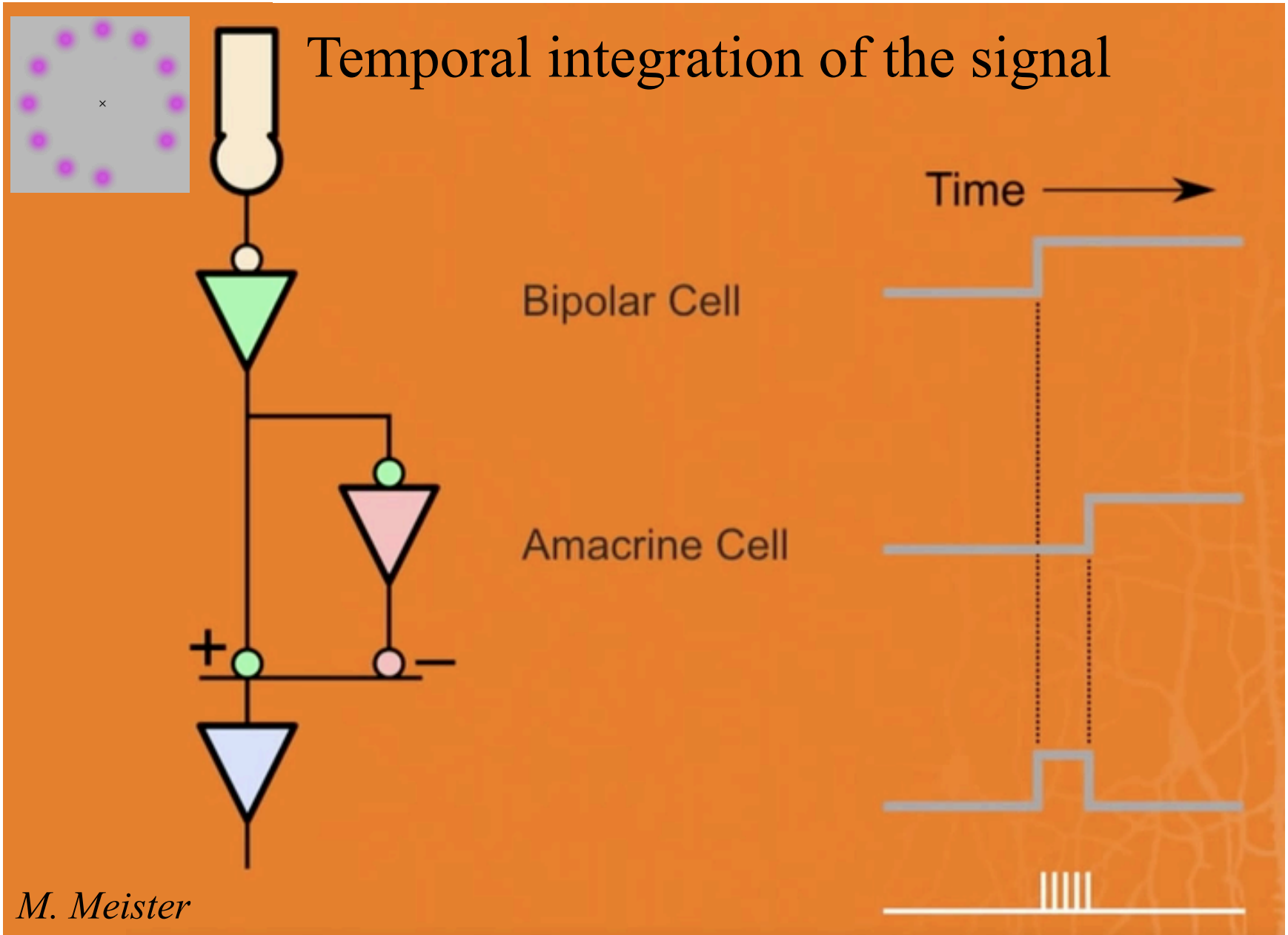
Stimulus processing in the retina

Center/surround response

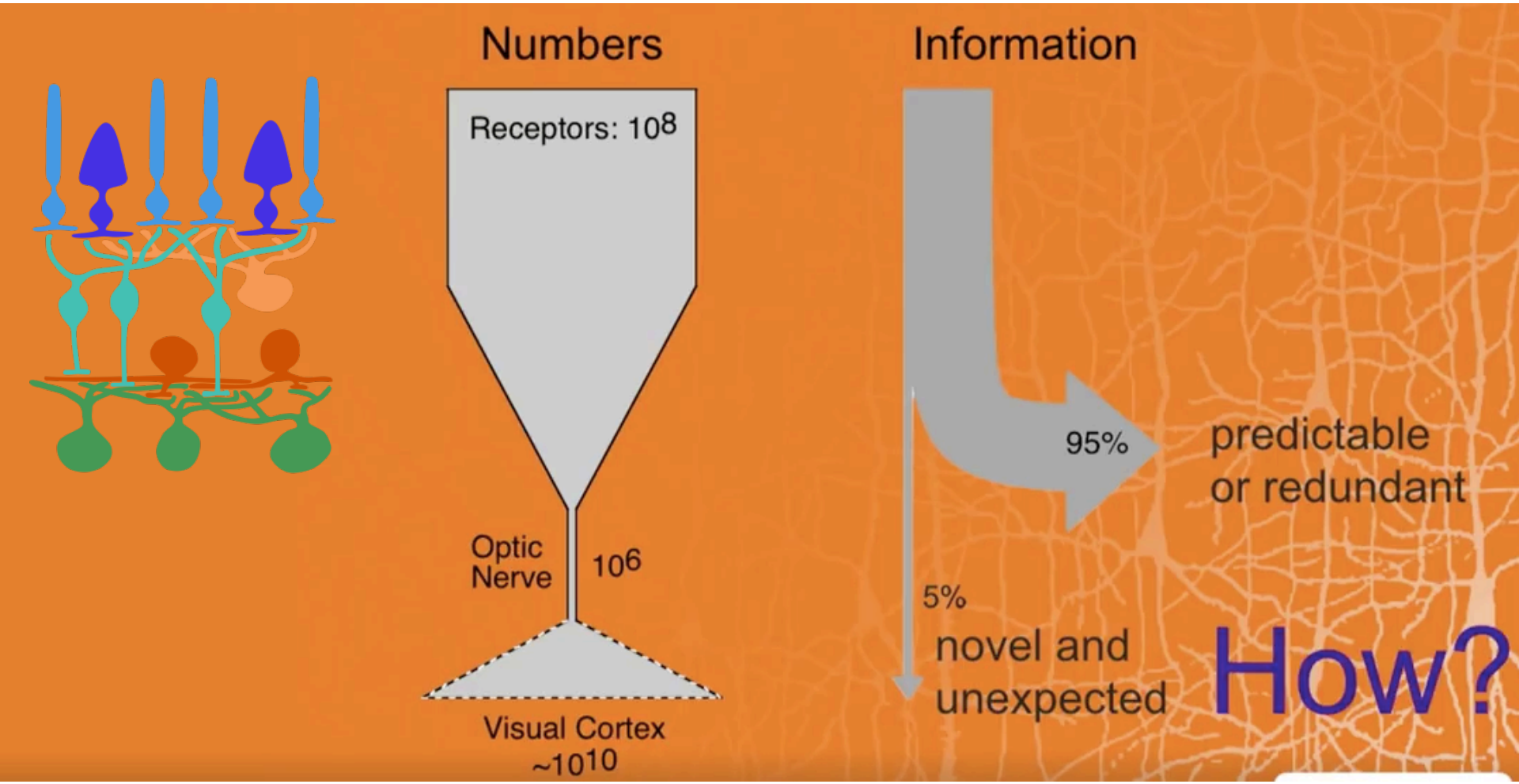


M. Meister

Stimulus processing in the retina



Stimulus processing in the retina



By processing visual information thanks to the retinal architecture

M. Meister