Retinal implants

Restore vision to patients blinded by retinal degeneration

MICRO-568

Clémence Rey

References

PhysiologyPathology

Retinal implants

Market

Alternative therapies

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- Conclusion
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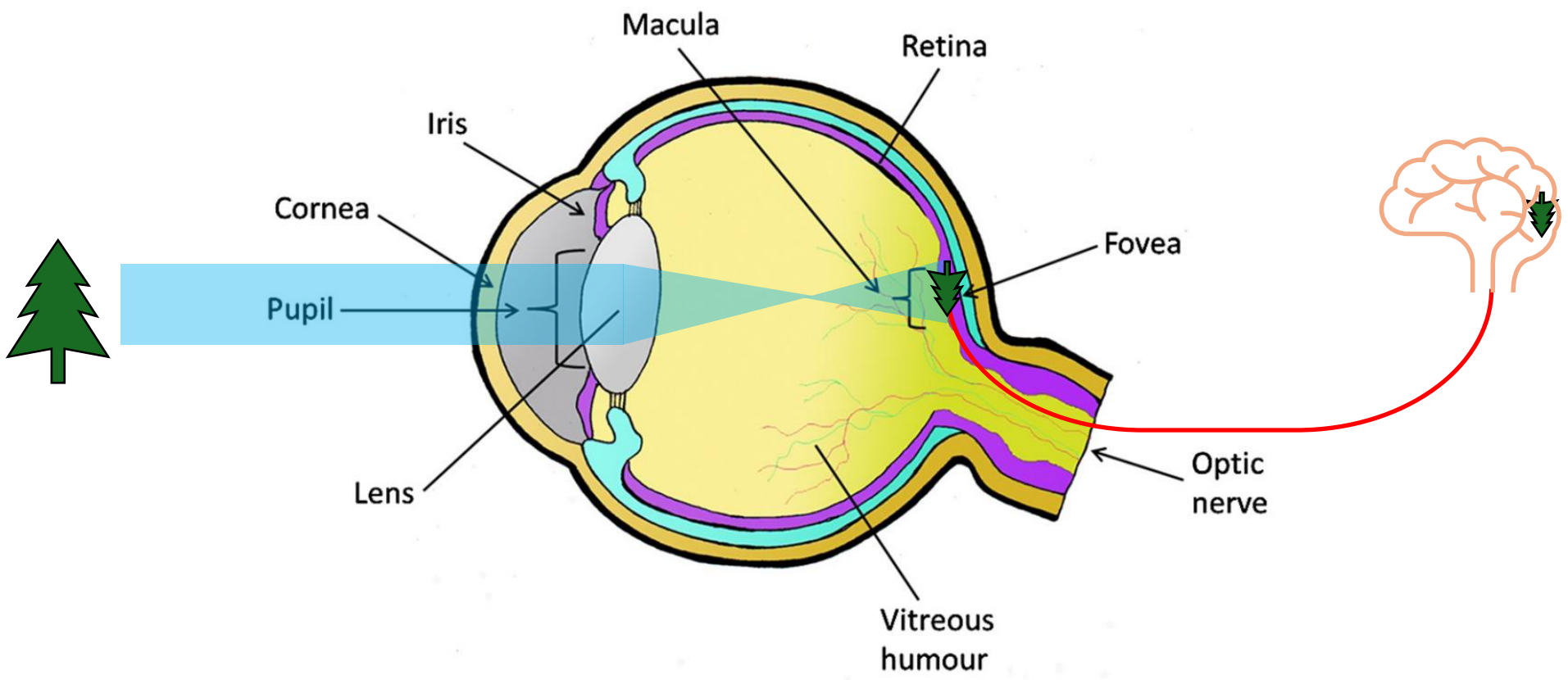
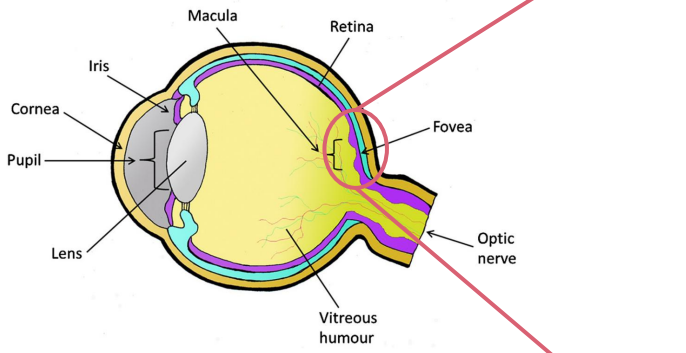
Background : the biology of vision

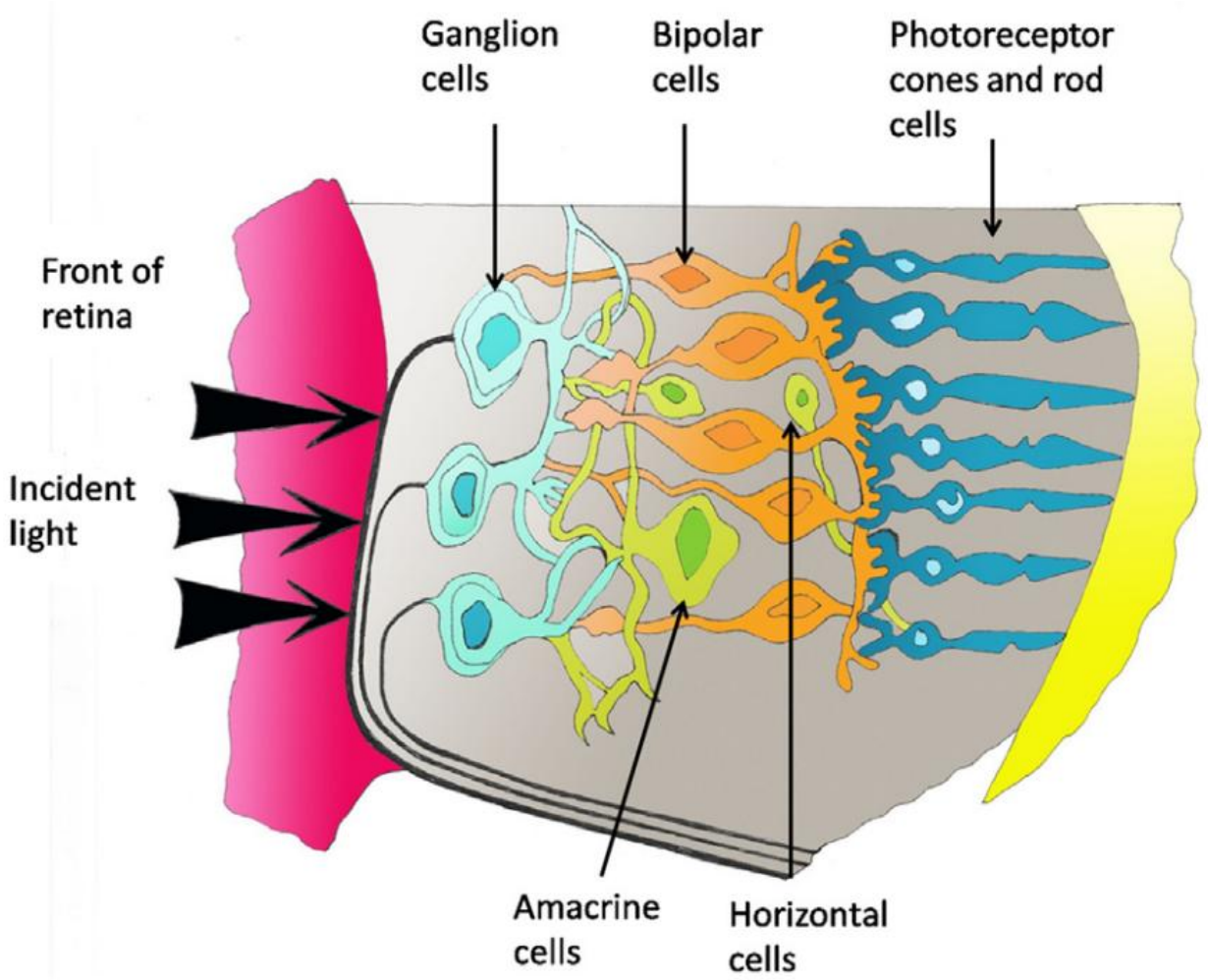
The human eye’s anatomy



Background : the biology of vision

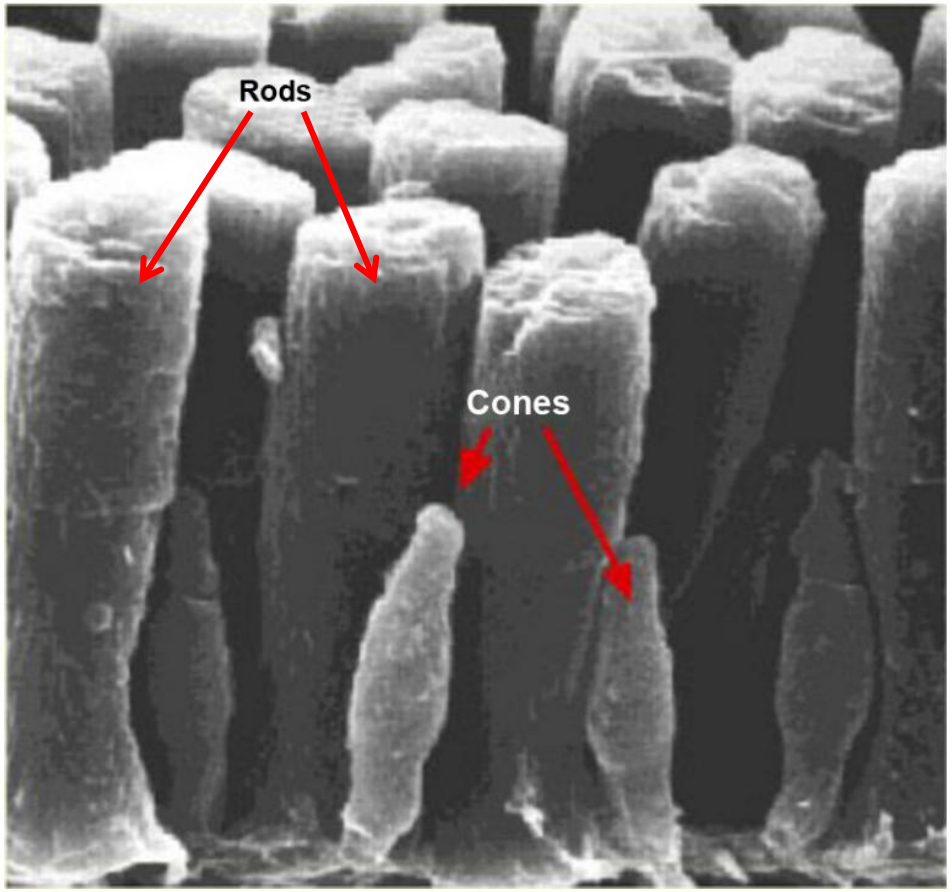
The retina’s anatomy

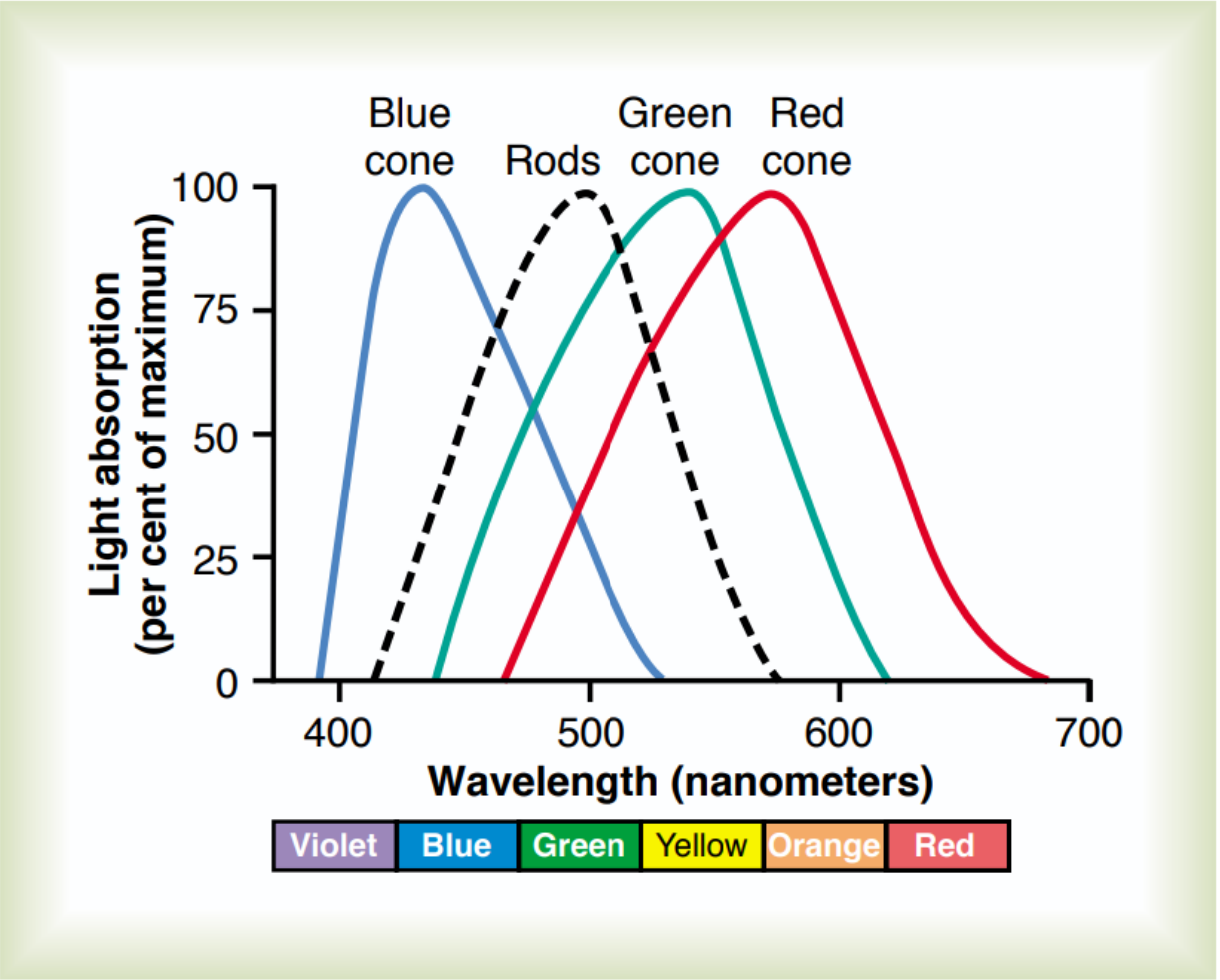




Background : the biology of vision

The photoreceptors : cones and rods cell





Background : the biology of vision

Retinal degenerative diseases

Retinitis pigmentosa (RP)

- Genetic (> 100 genes)
- Loss of photoreceptors function
- Loss of peripheral vision
- 2 millions

Age-related macular degeneration (AMD)

- Damage to the macula
- “Dry” and “wet” types
- Loss of central vision
- 200 millions

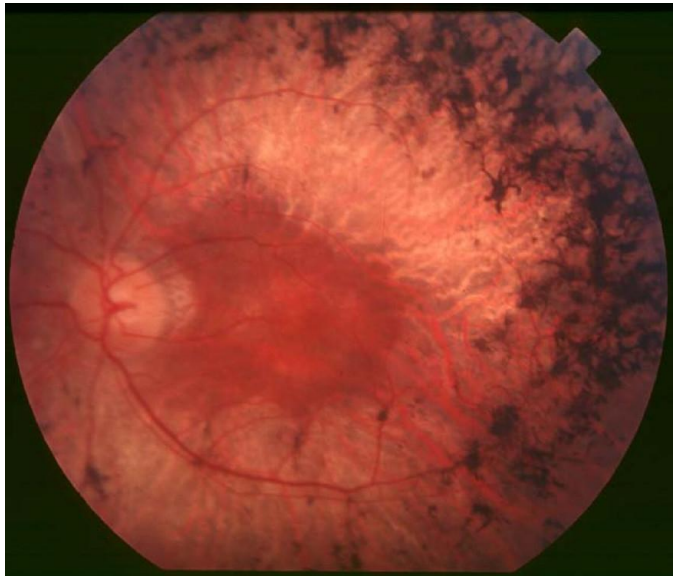
➡ Dysfunctional photoreceptor cells

➡ But intact bipolar and ganglion cells

Background : the biology of vision

Retinal degenerative diseases

Retinitis pigmentosa (RP)



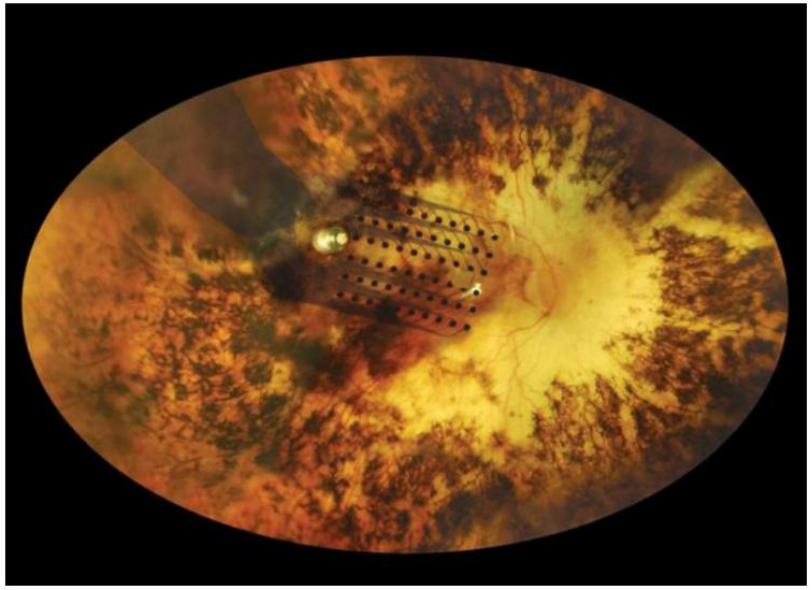
Age-related macular degeneration (AMD)

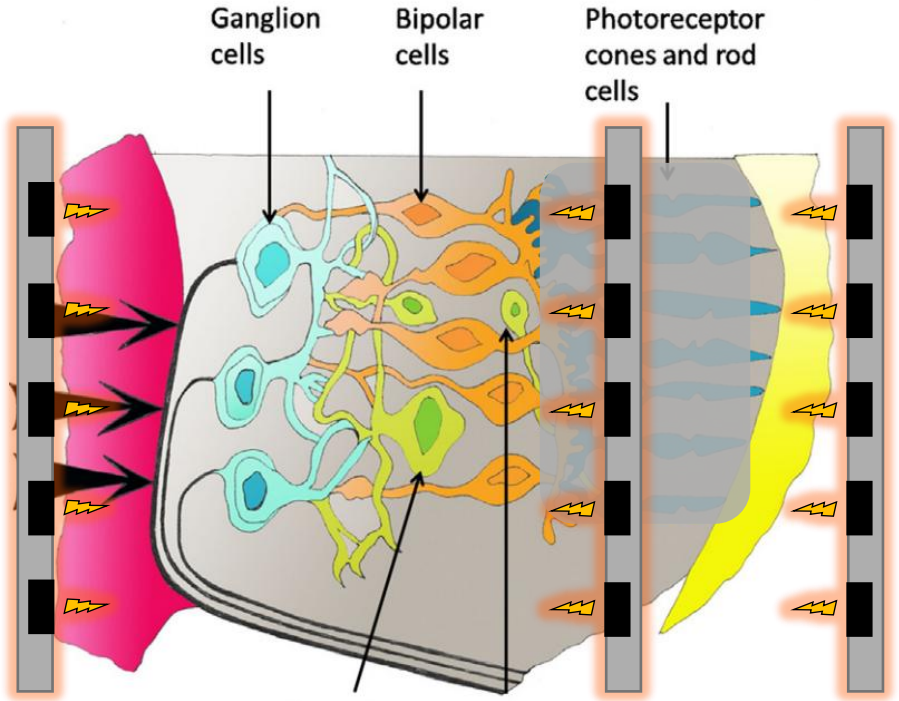
Healthy eye

How retinal implants work

Basic mechanism

➡ Bypass the damaged photoreceptors





Epiretinal

Subretinal

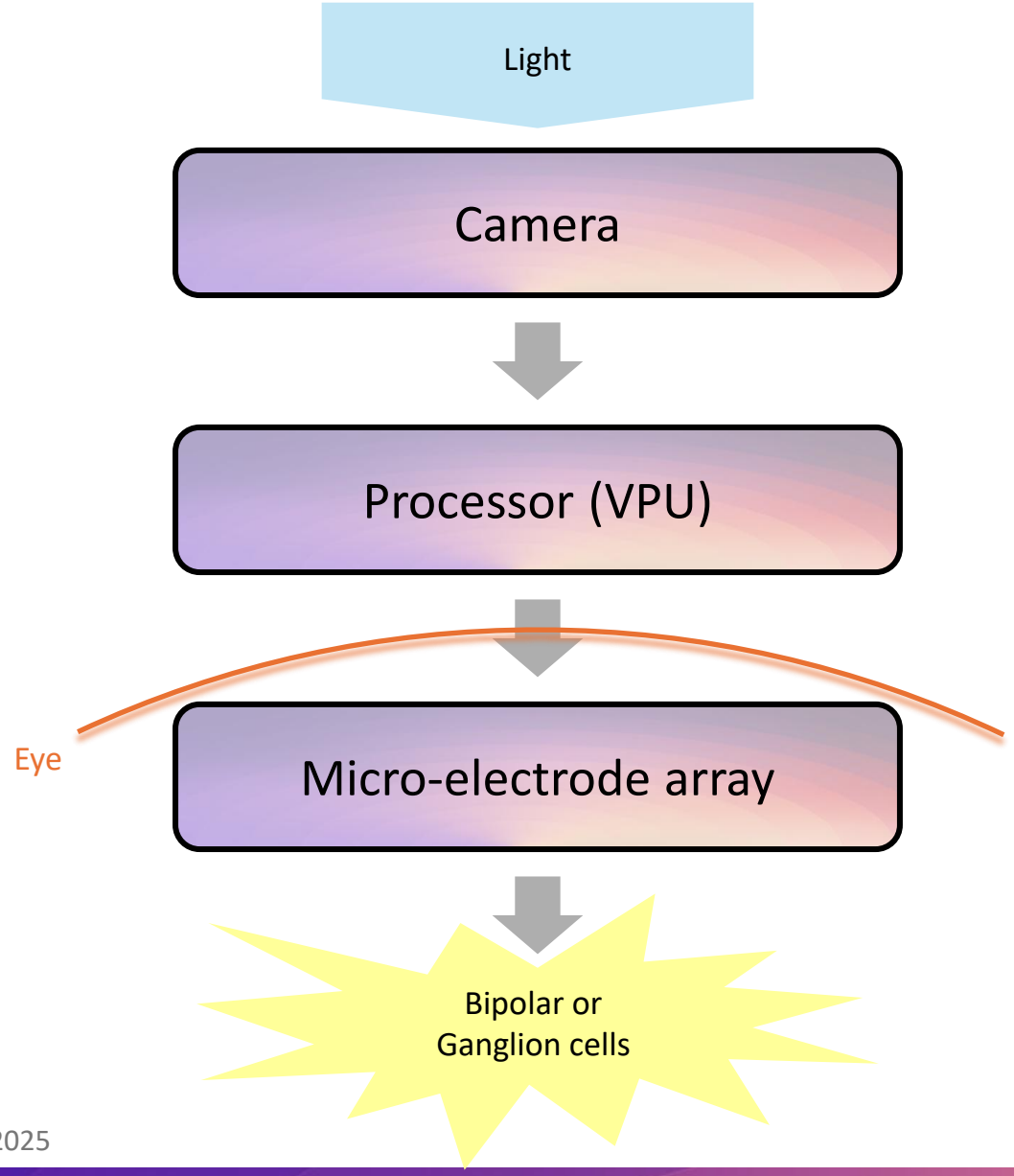
Suprachoroidal

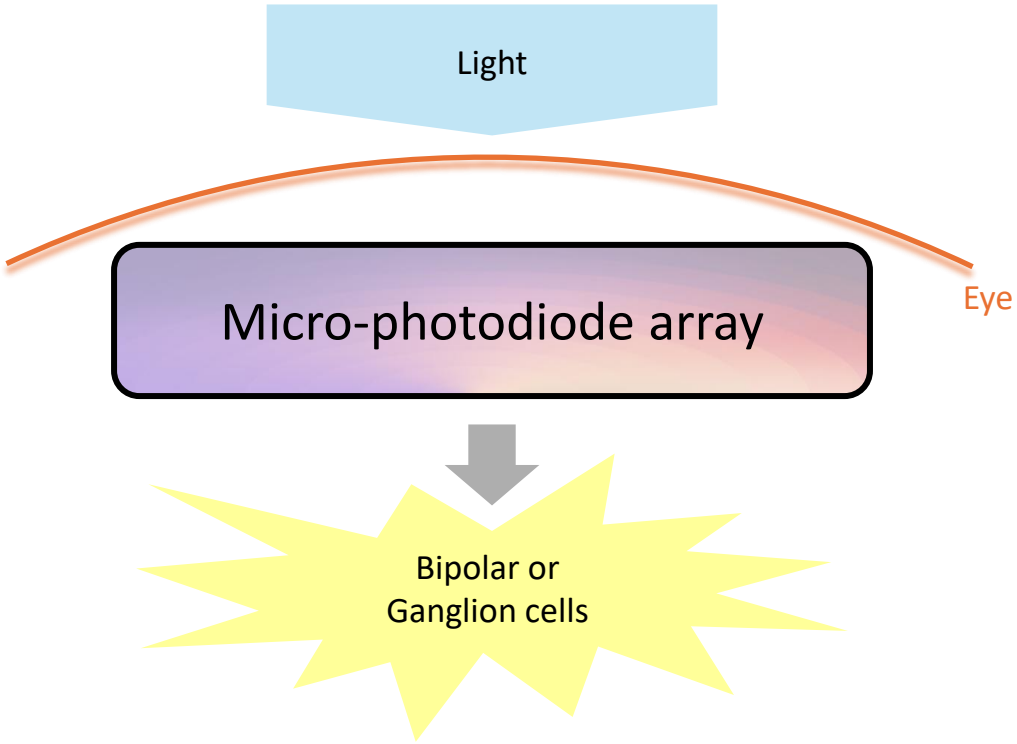
How retinal implants work

Comparison of type of implants

	Epiretinal	Subretinal	Suprachoroidal
Surgical Complexity	Medium	High	Low
Image Resolution	Medium	High	Low
Safety	High risk of retina damage		Minimal risk

How retinal implants work

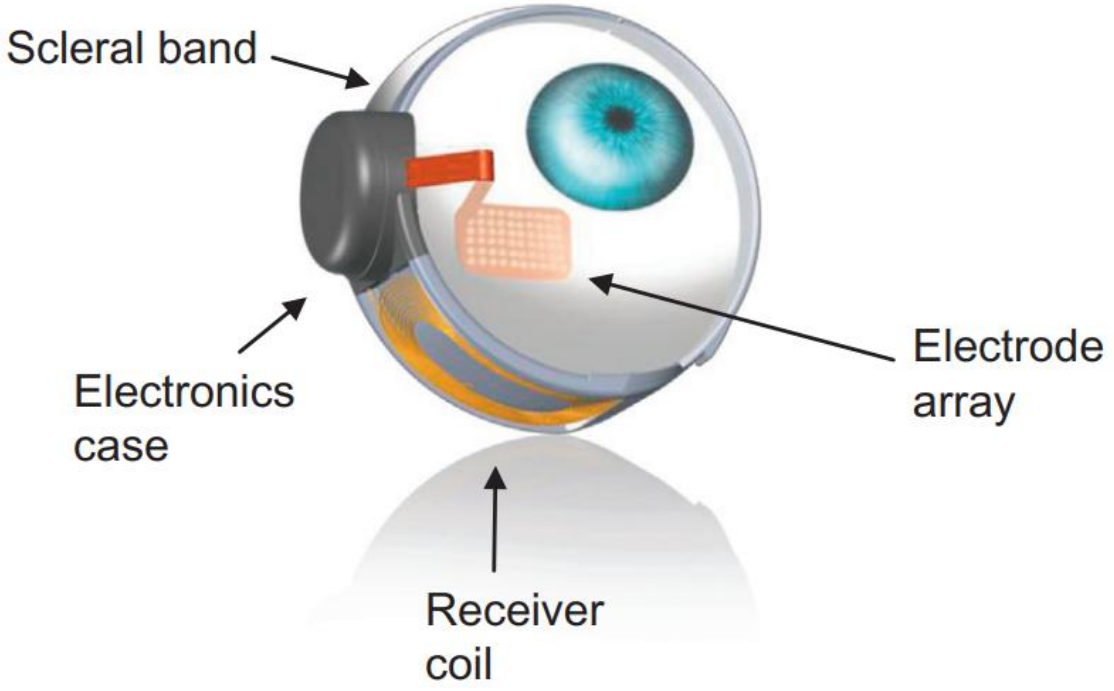




Current technologies and clinical trials

*Argus II (*Second sight, US)

Epiretinal



20/20 Normal

20/200 Blind

20/1262

2010

CE mark 2011

FDA Approval 2013

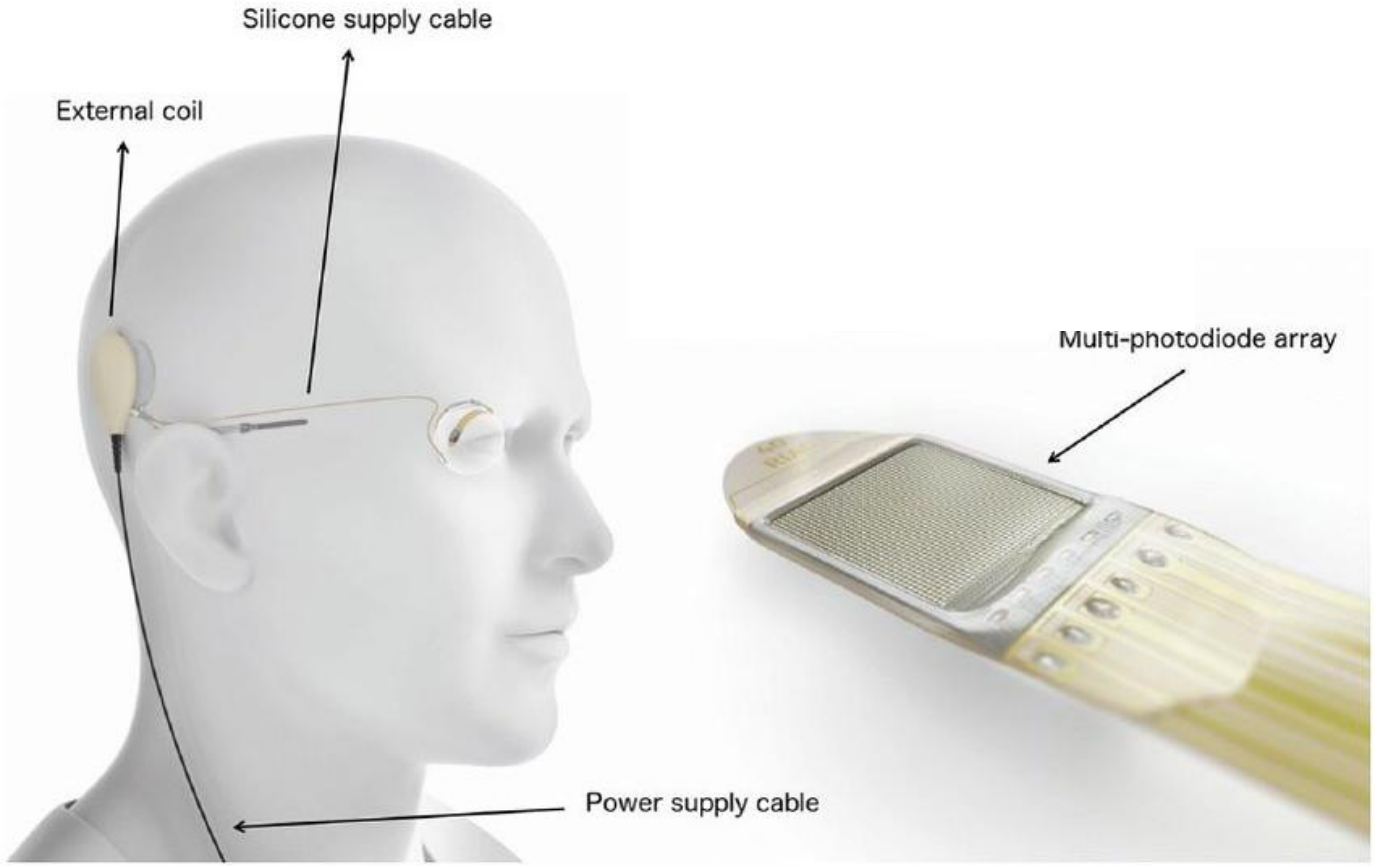
End of production 2019

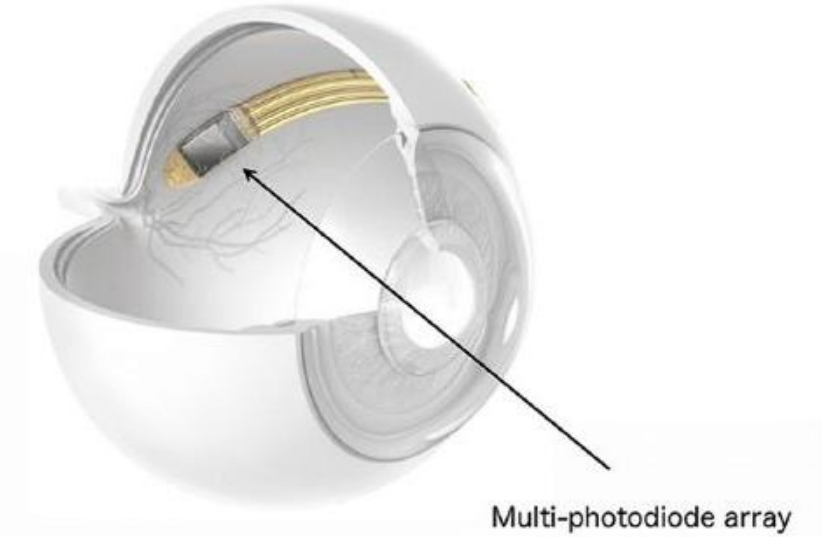
Today

Current technologies and clinical trials

*Alpha-AMS (*Retina Implant AG, DE)

Subretinal





20/20
Normal

20/200
Blind

20/546

20/1262

2010

1st implantee
2015

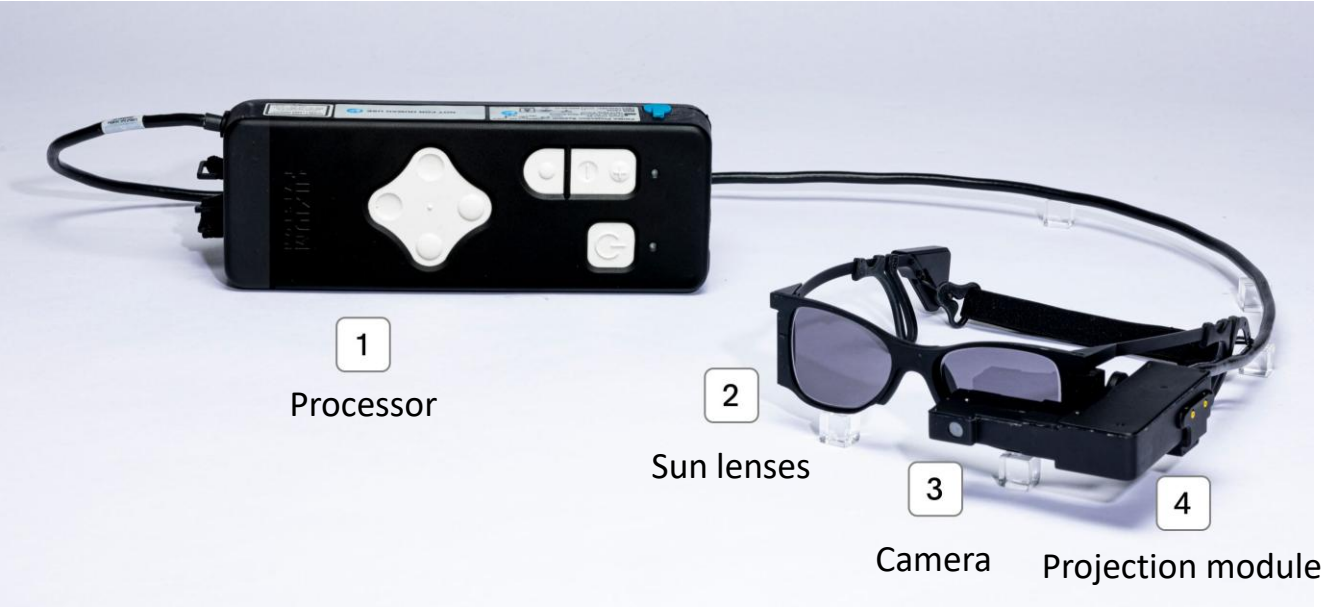
CE mark
2016

End of production
2019

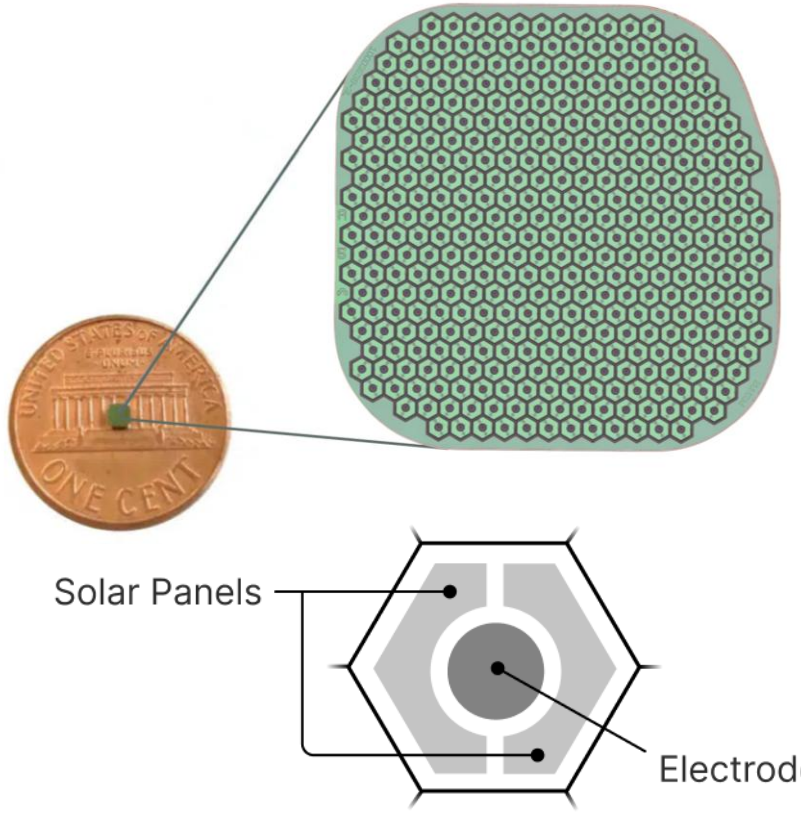
Today

Current technologies and clinical trials

*PRIMA (*Pixium Vision, FR)



Subretinal



20/20 Normal

20/42

20/200 Blind

20/546

20/1262

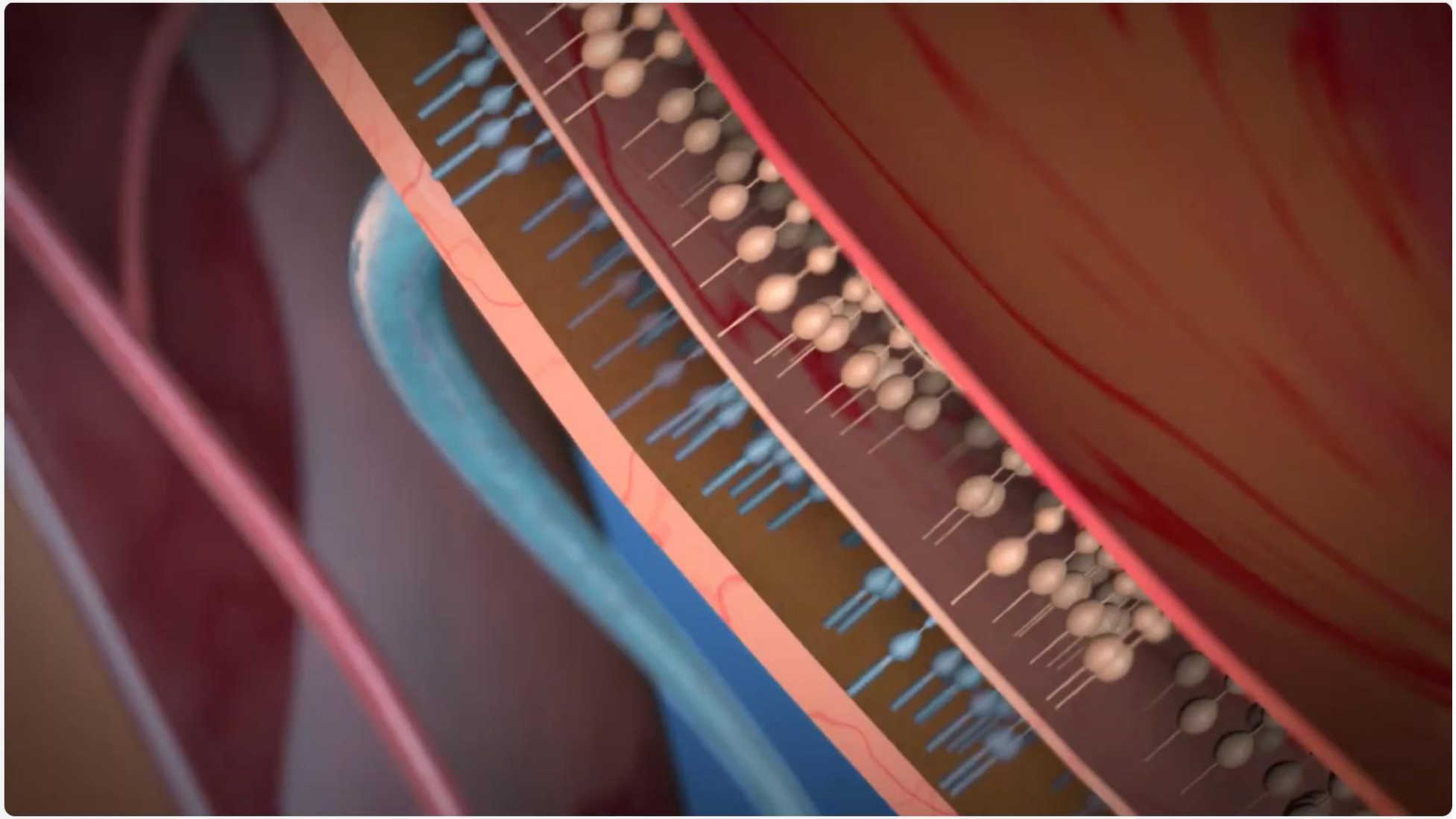
2010

1st Implantee 2018

Regulatory review Today

Current technologies and clinical trials

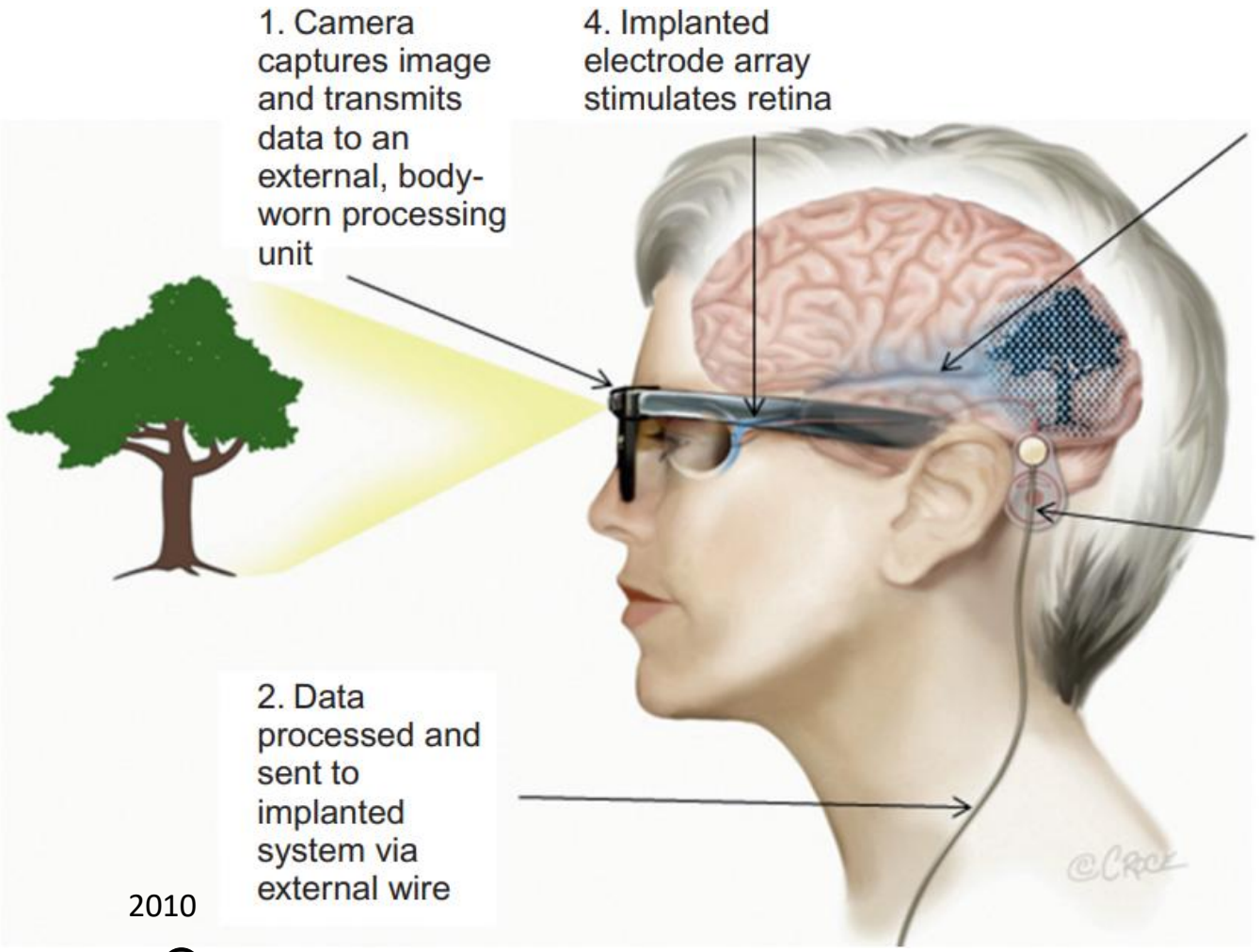
*PRIMA (*Pixium Vision, FR)

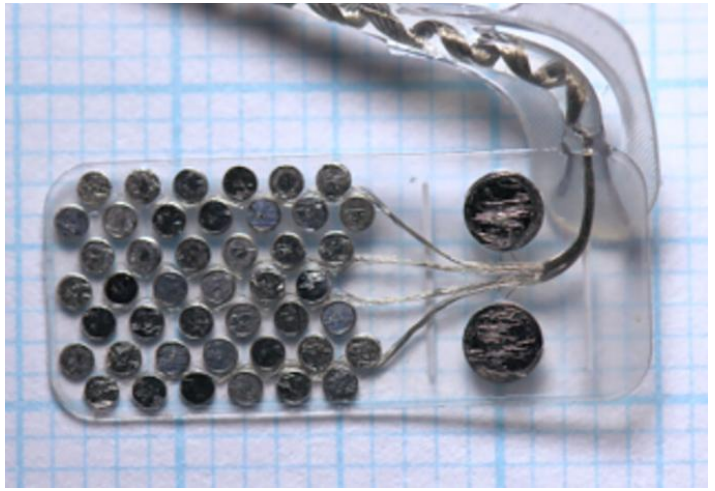


Current technologies and clinical trials

Bionic Eye System *(*Bionic Vision Technologies)

Suprachoroidal





2010

1st Implantee

2018

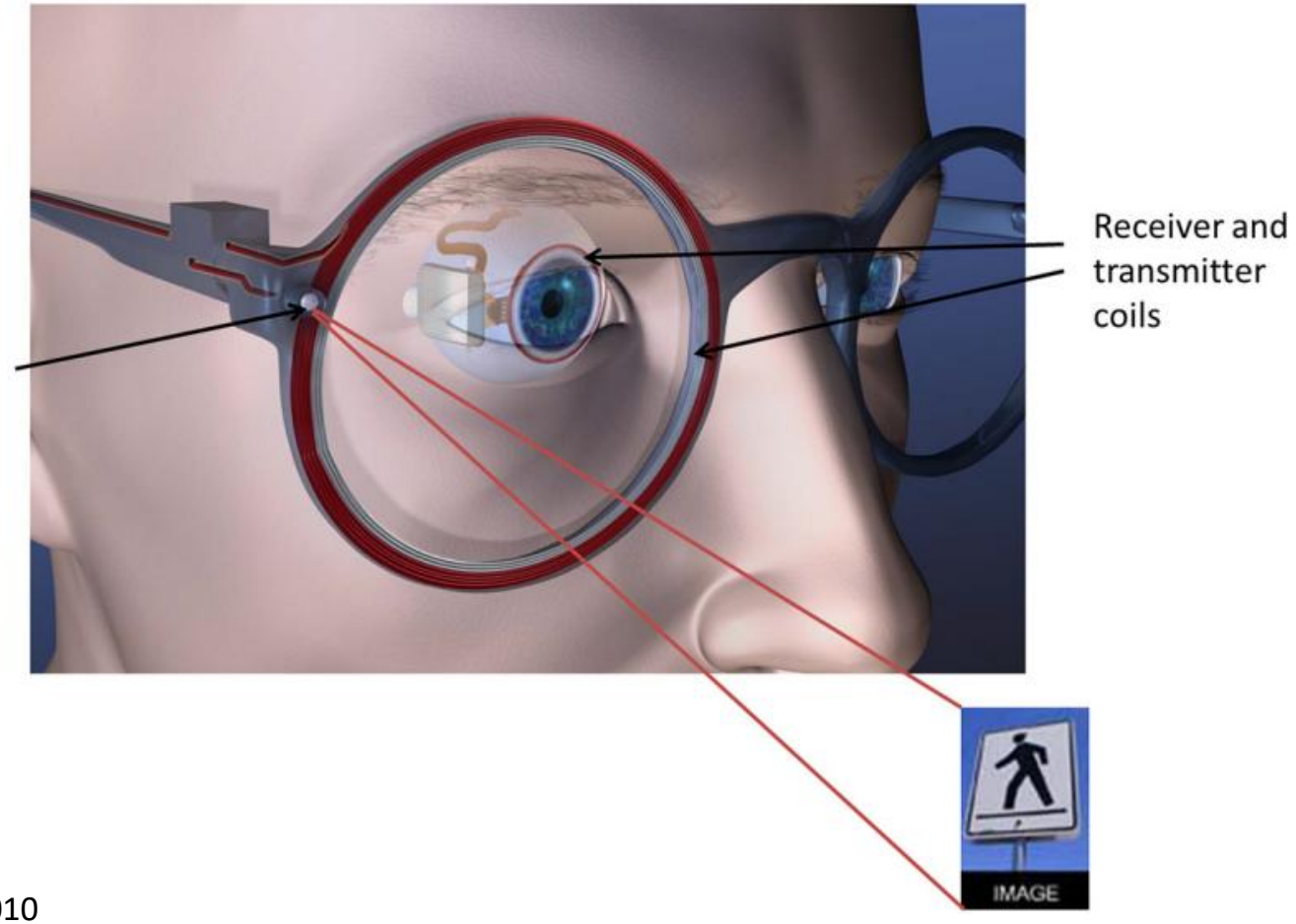
In development

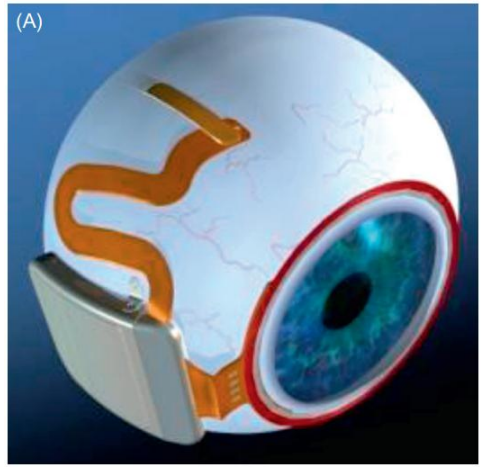
Today

Current technologies and clinical trials

Boston Retinal Implant Project

Subretinal





2010

In development

Today

Future perspectives

Limitation and challenges

- Incomplete understanding of retinal degeneration
- Unknown long-term effects of chronic retinal stimulation
- Miniaturization of electrodes
- Limited eligible patient population

Future perspectives
Economic impact

AMD prevalence growing
(200 mil. Now → 288 mil. in 2040)

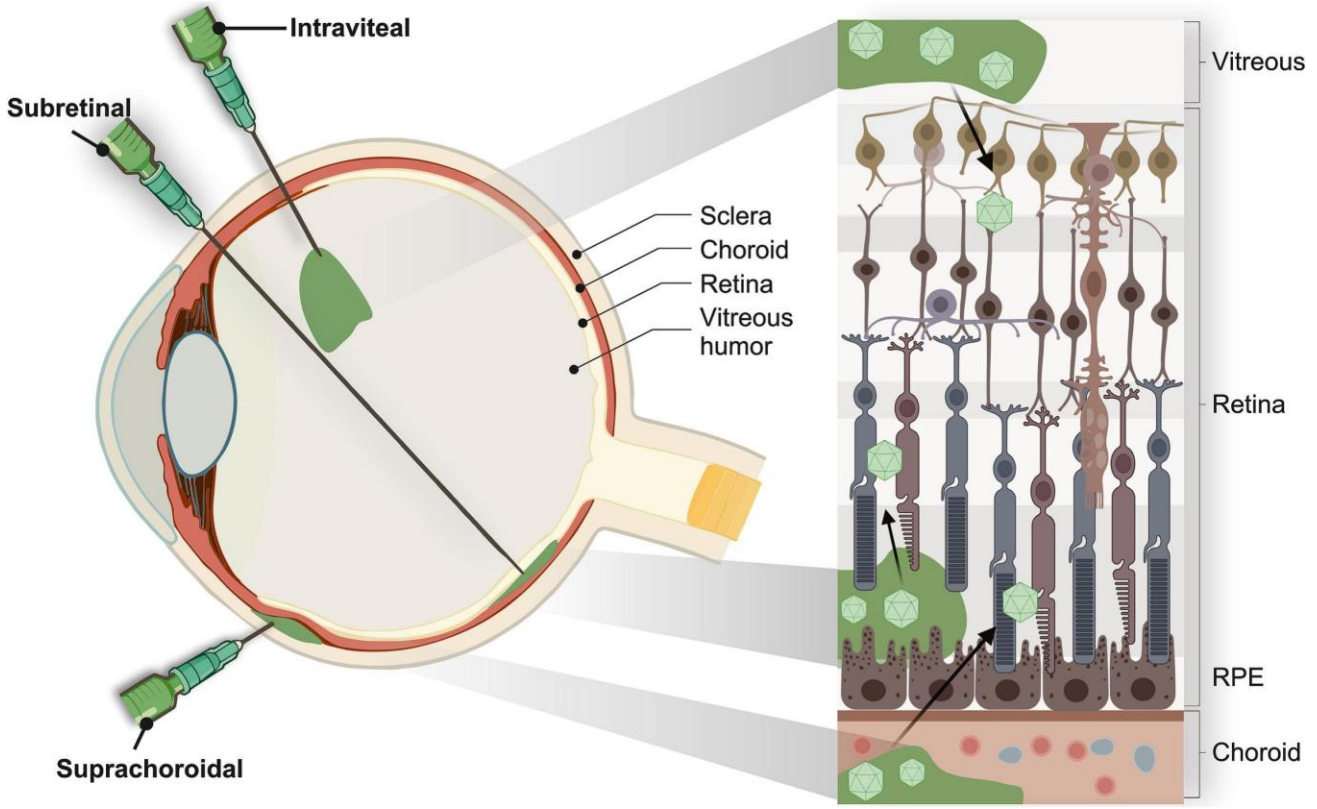
High costs (Argus II ~ 200’000USD)
Disappointing results
Promising emerging therapies

Future perspectives
Alternative emerging therapies

Gene therapy

- Using a viral vector to deliver a functional copy of the faulty gene

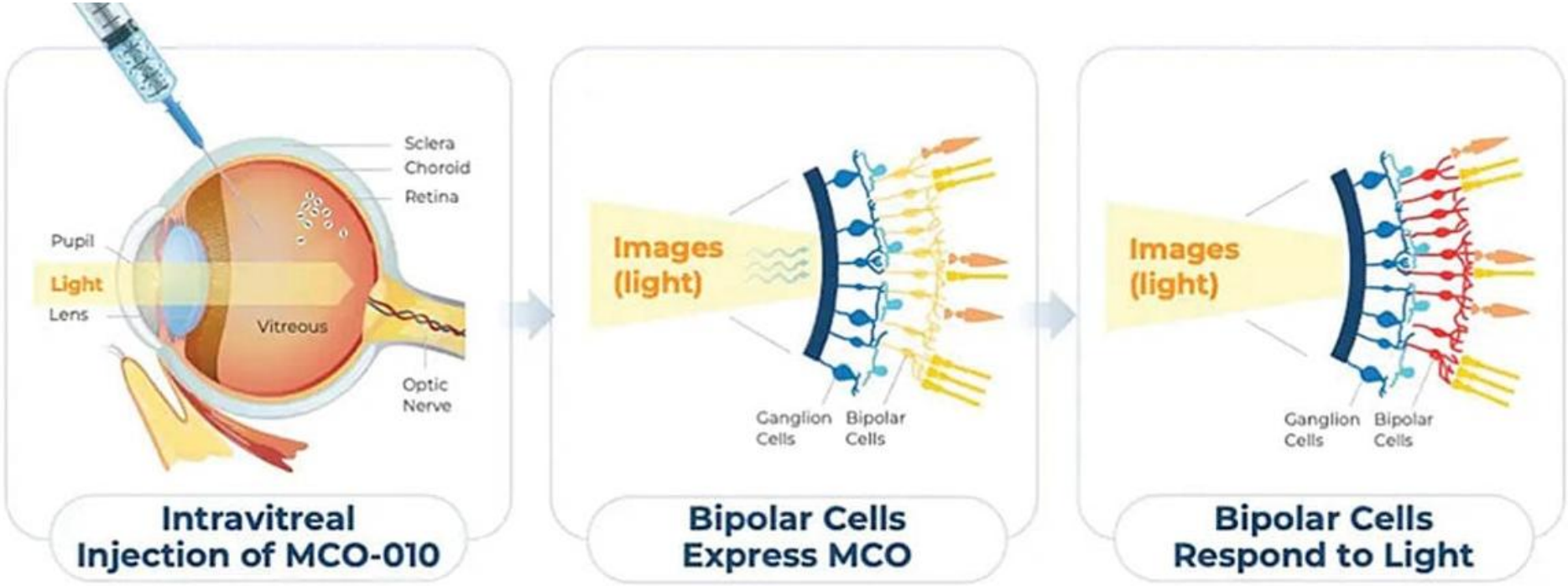
- FDA approved 2017
  for RPE65



Future perspectives
Alternative emerging therapies

Optogenetics

- Turn non-light-sensitive cells into photoreceptors with optic proteins (opsins)
- Clinical trial

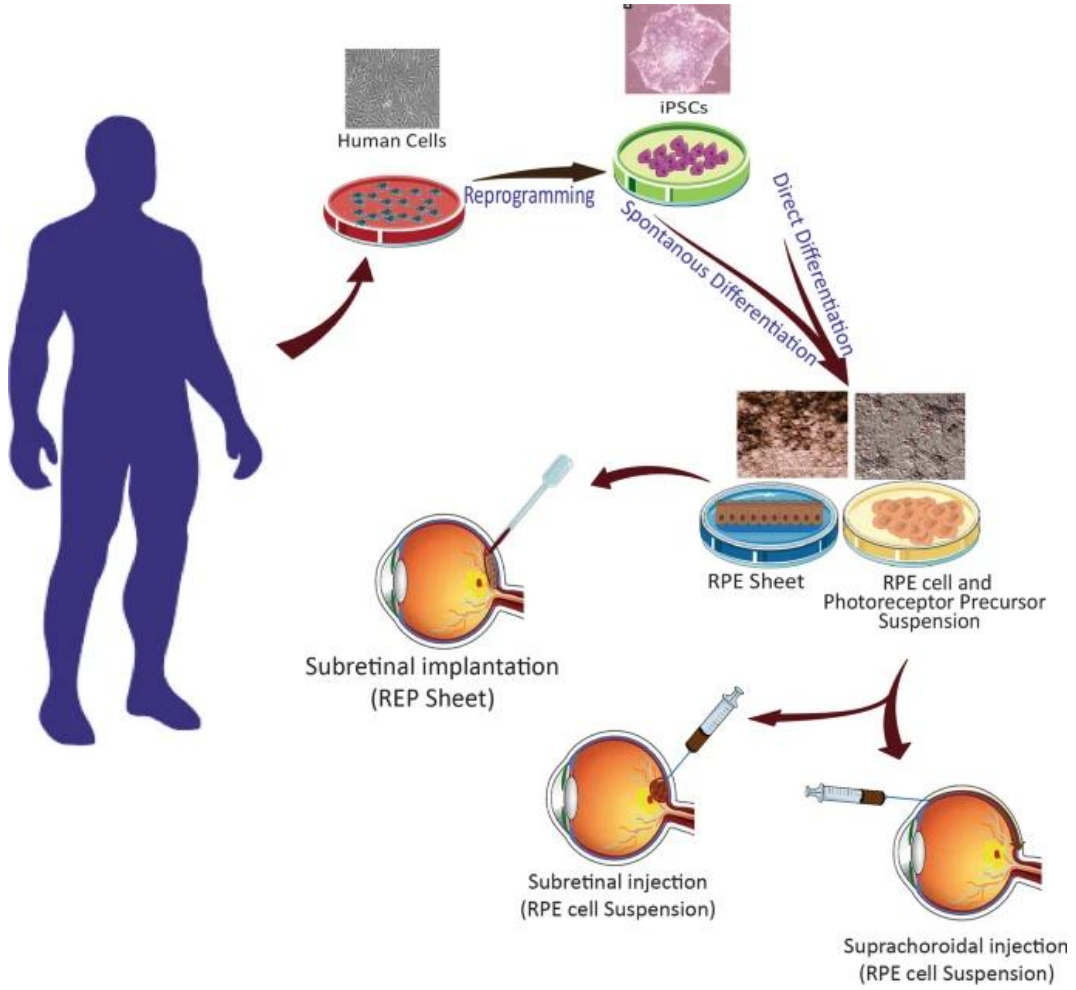


Future perspectives

Alternative emerging therapies

Stem cell therapy

- Use stem cells to replace damaged retinal cells
- Clinical trial



Conclusion

- Multiple technologies achieved regulatory approval and clinical use
- Technical limitations in electrode density and image resolution
- Economic pressures from emerging alternative therapies

Thank you for your attention