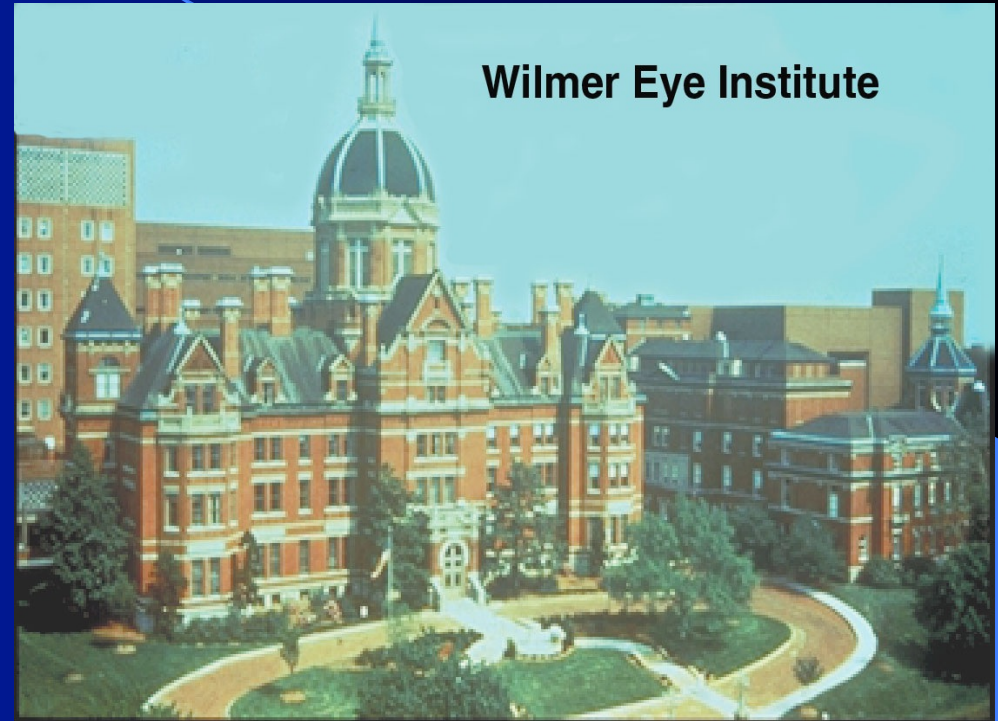


# The Intraocular Retinal Prosthesis Project



Eyal Margalit MD, PhD  
*Department of Ophthalmology and Visual sciences*  
*University of Nebraska Medical Center*

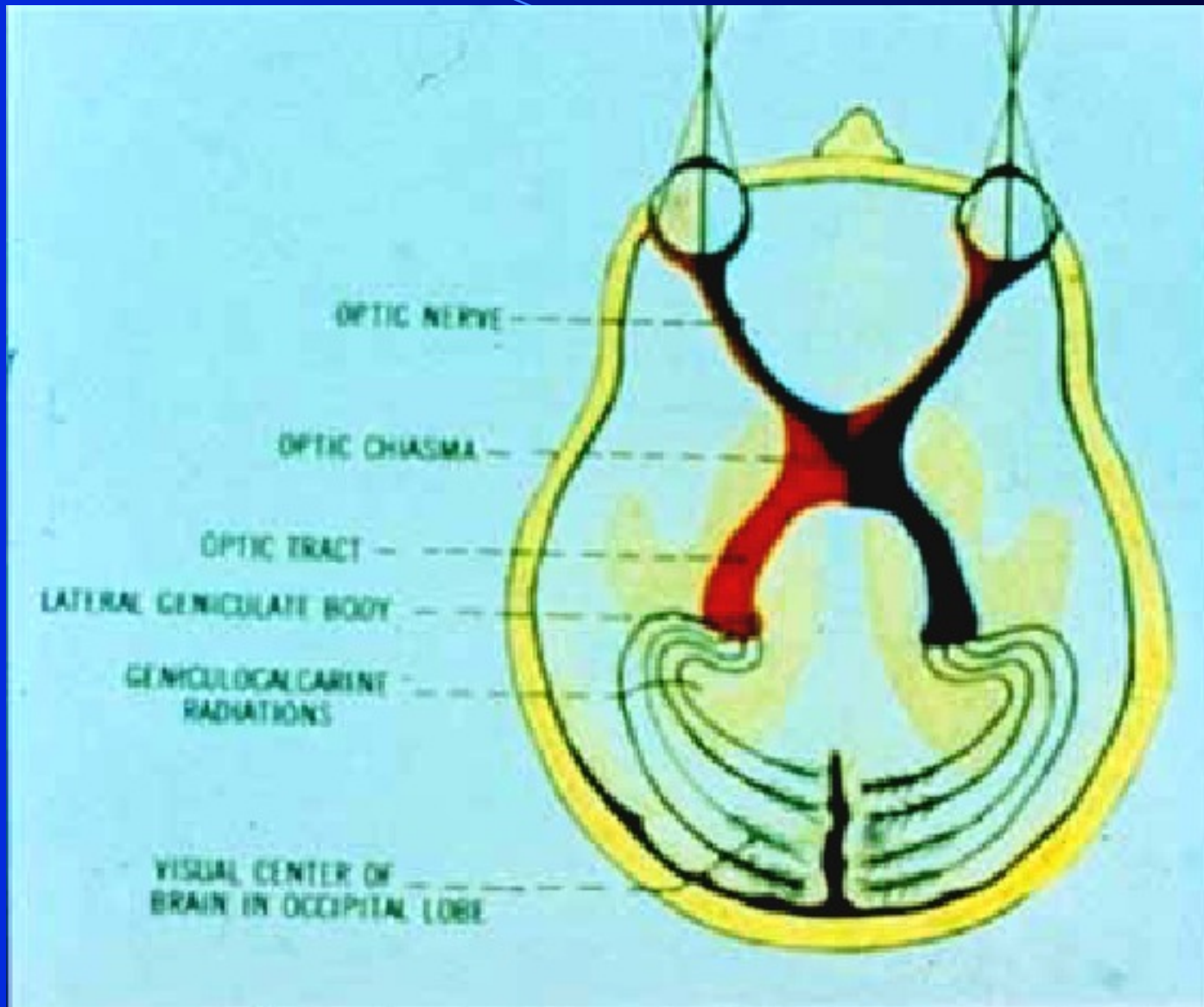


# Developing an Implantable Prosthesis

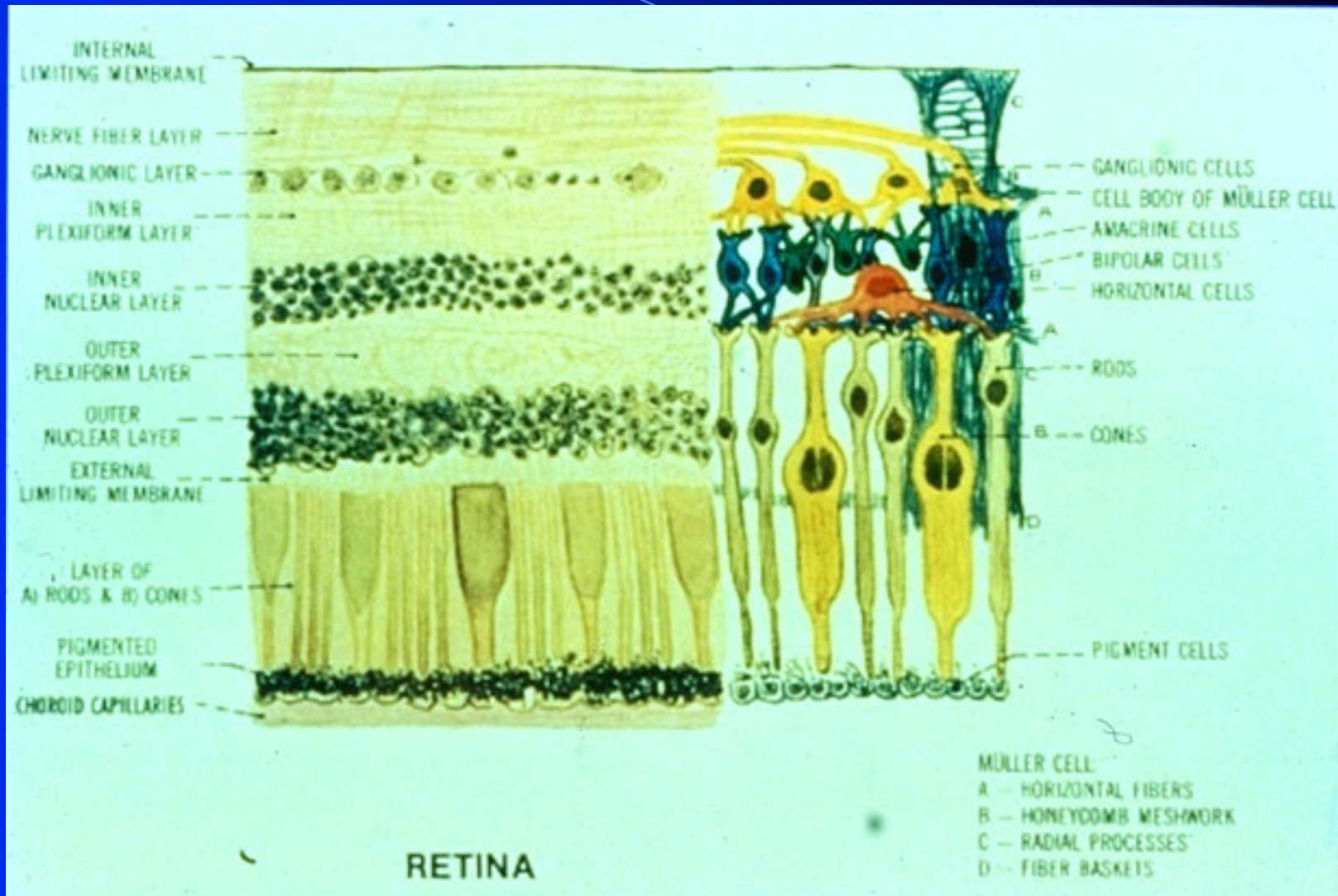
- Anatomy of the visual system in normal and RP individuals.
- Concept of the retinal prosthesis.
- Understanding how electric current drives the retina in blind RP and AMD individuals.
- Prosthesis technology development.
- Assess the efficacy and safety of the prosthetic device in animals.
- Human experiments.



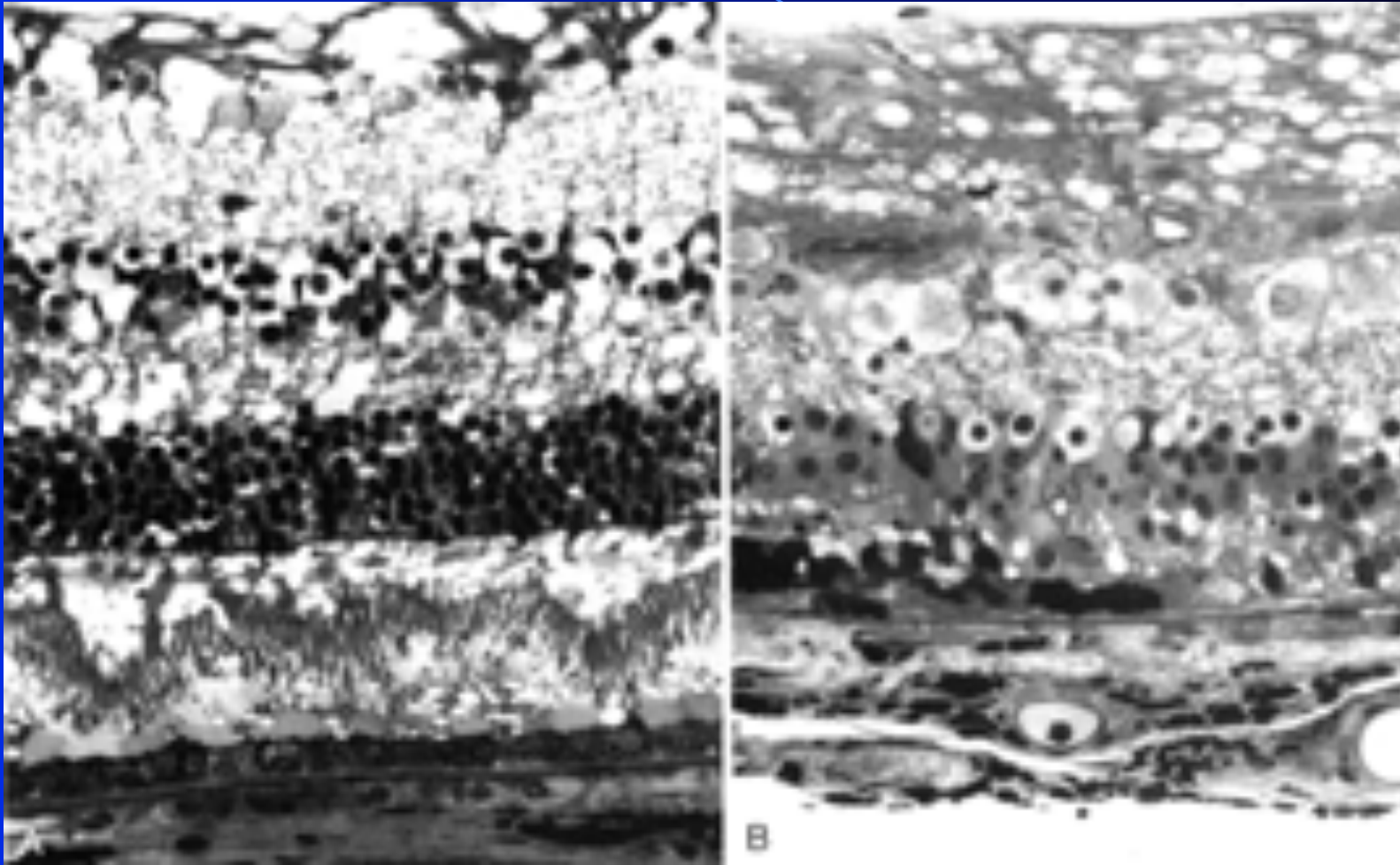
# Diagram of the Human Visual System



# Diagram of the Retinal Layers



# Morphometric Analysis of RP patients' Retina



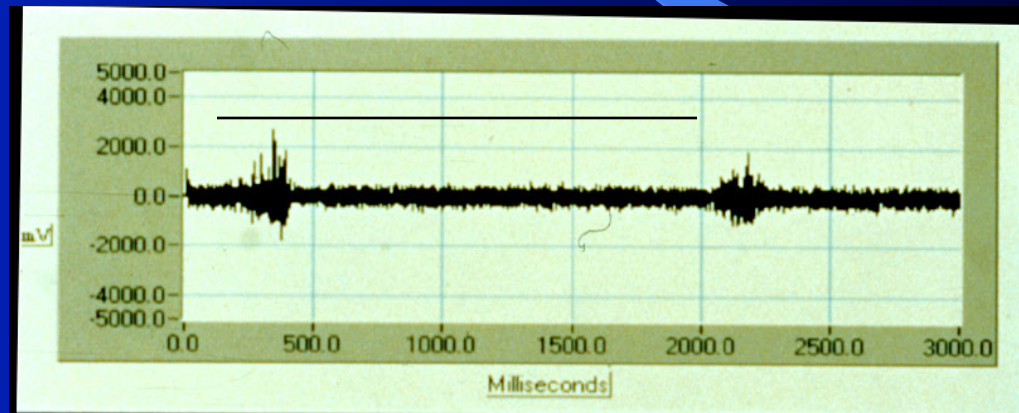
# How The Idea of an Electronic Retinal Prosthesis Came About

- During the 18<sup>th</sup> century scientists began to understand that electricity could elicit a response in biological tissues (*Galvani 1791*).
- The era of electronic implants was ushered in by both cardiac pacemakers (*Glenn 1959*) and cochlear implants (*Djourno 1957*).
- Electrically evoked response (EER) is recordable in some RP patients (*Potts 1969*).
- Short-term tests of retinal electrical stimulation in humans blind from RP & AMD hold promise (*Humayun et al 1996, 1999*).

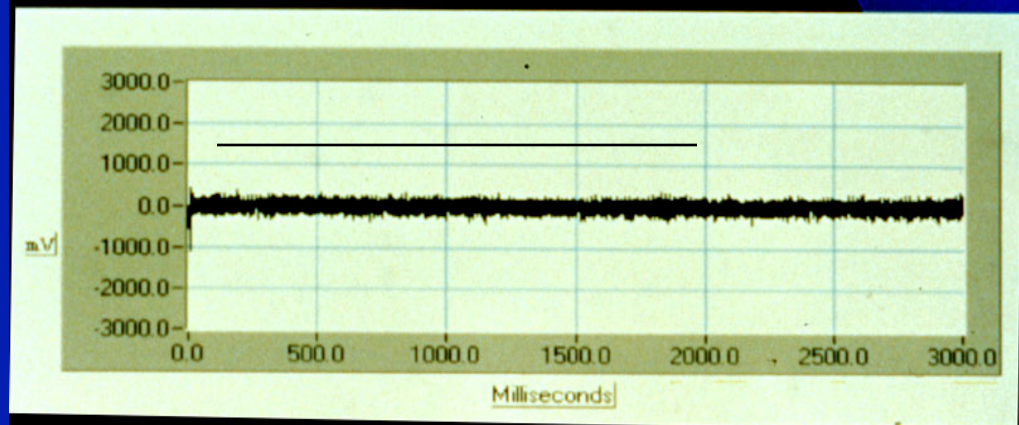
# Recording of ganglion cells from normal and RD mice

## Light stimulation

Normal mouse



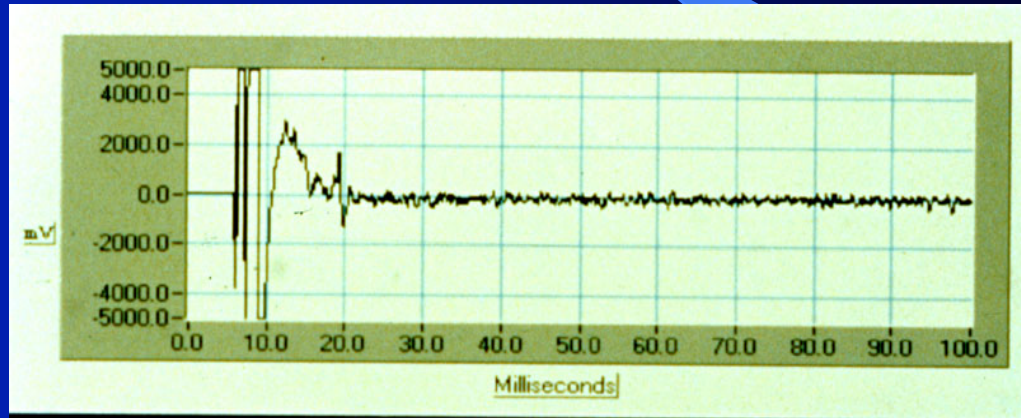
RD mouse



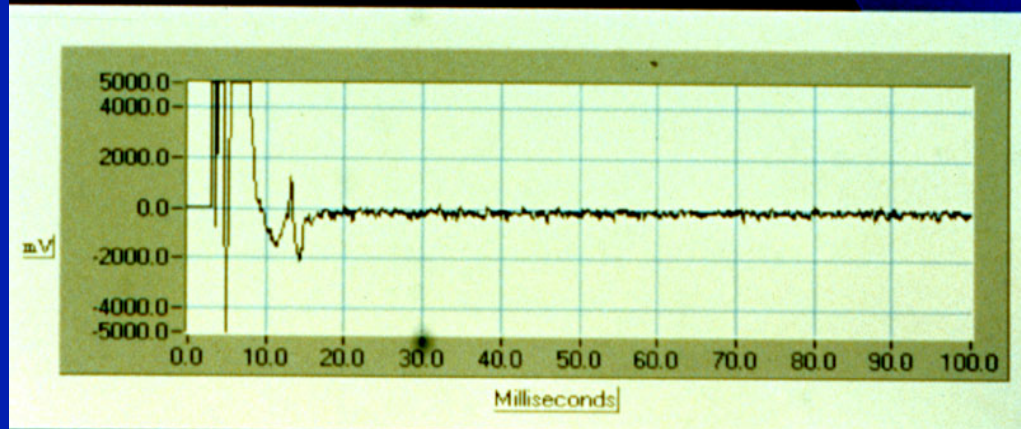
# Recording of ganglion cells from normal and RD mice

## Electrical stimulation

Normal mouse



RD mouse

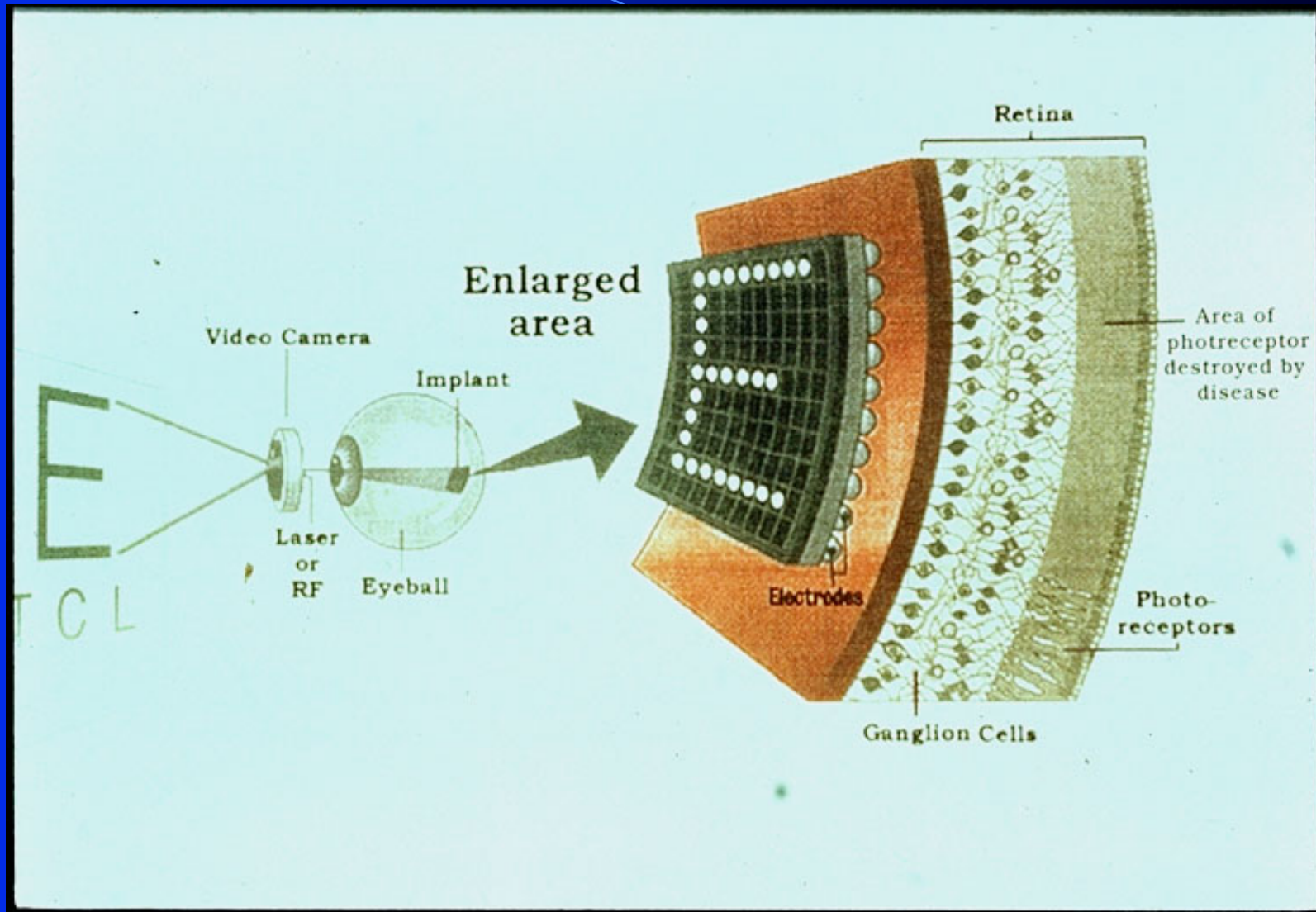




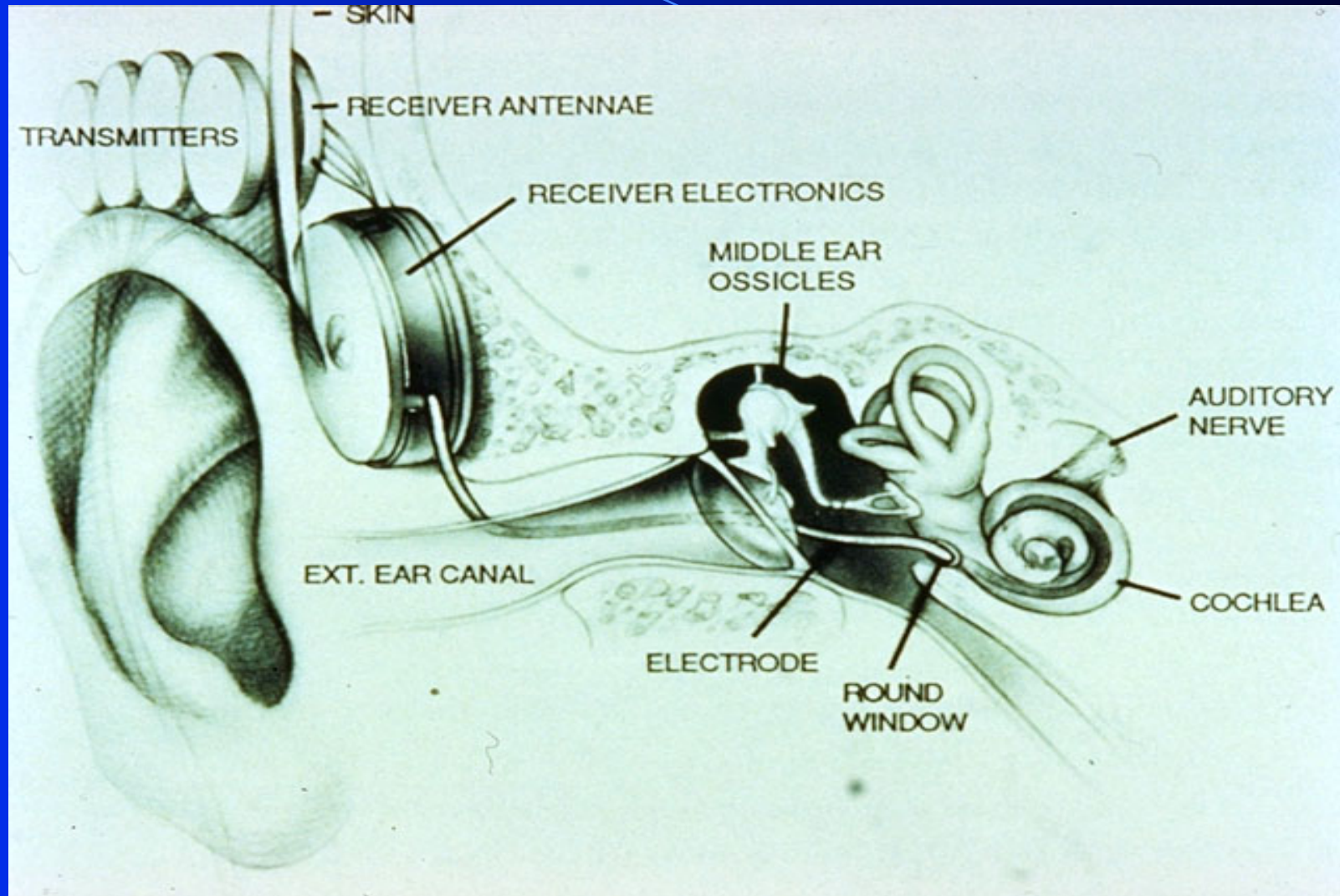
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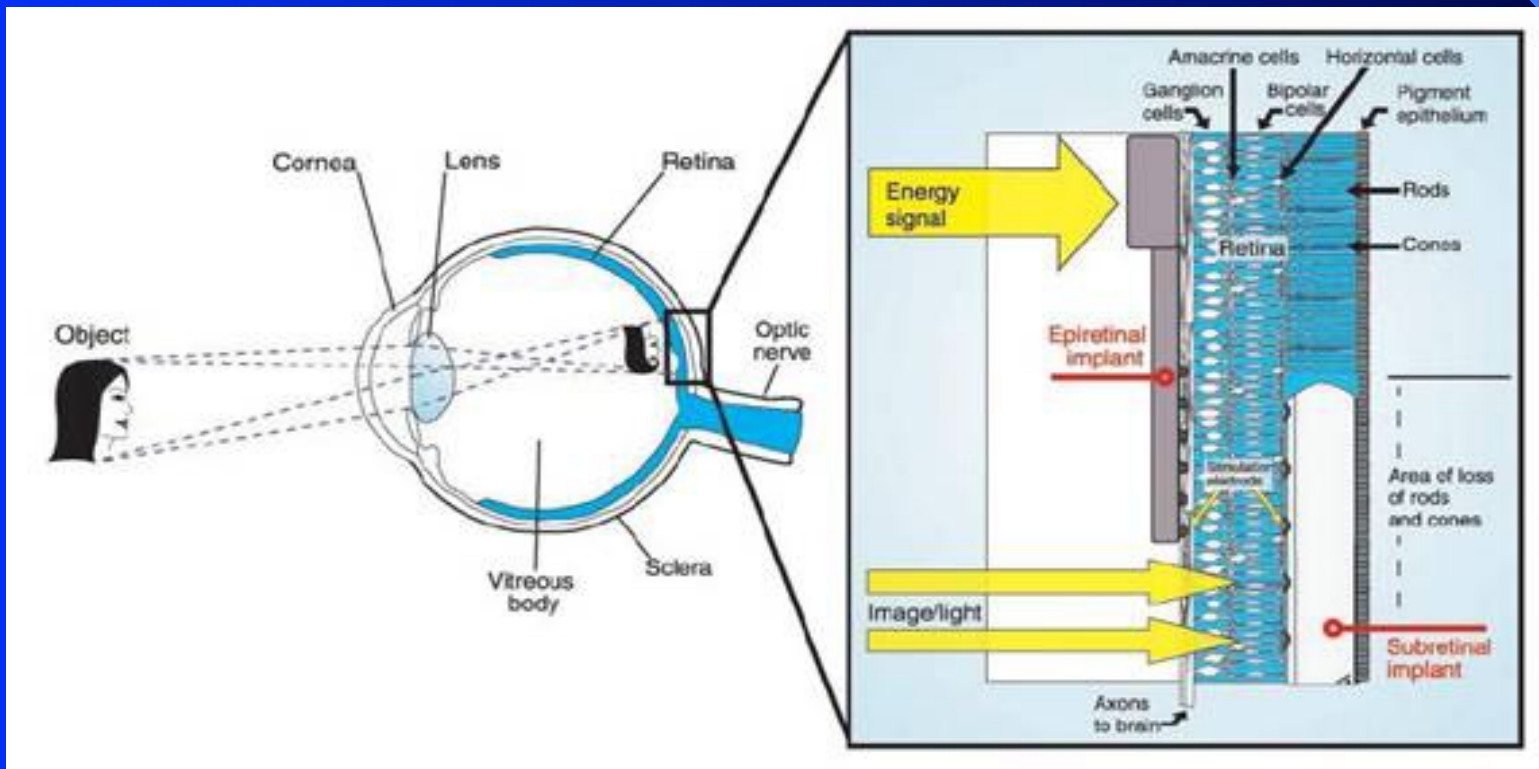
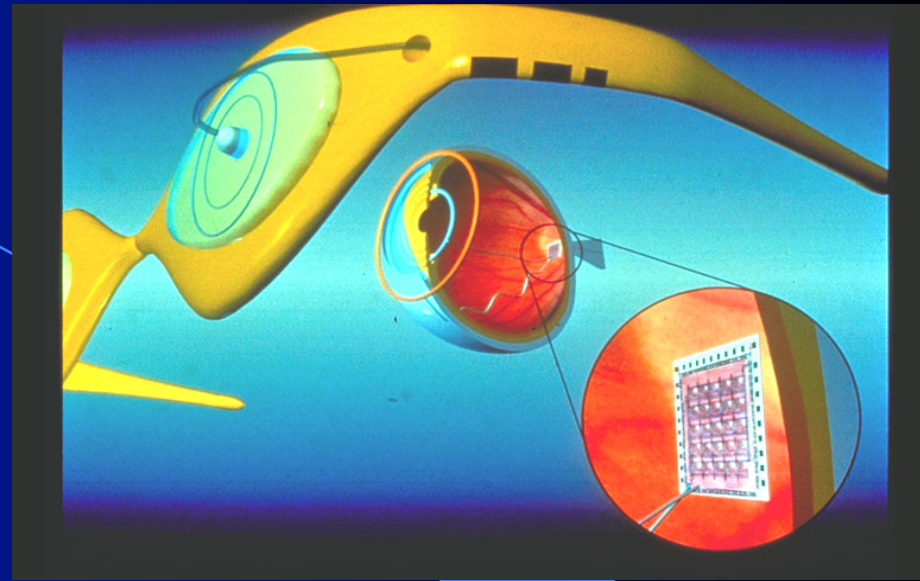
# Retinal Prosthesis Concept



# Cochlear Prosthesis Concept



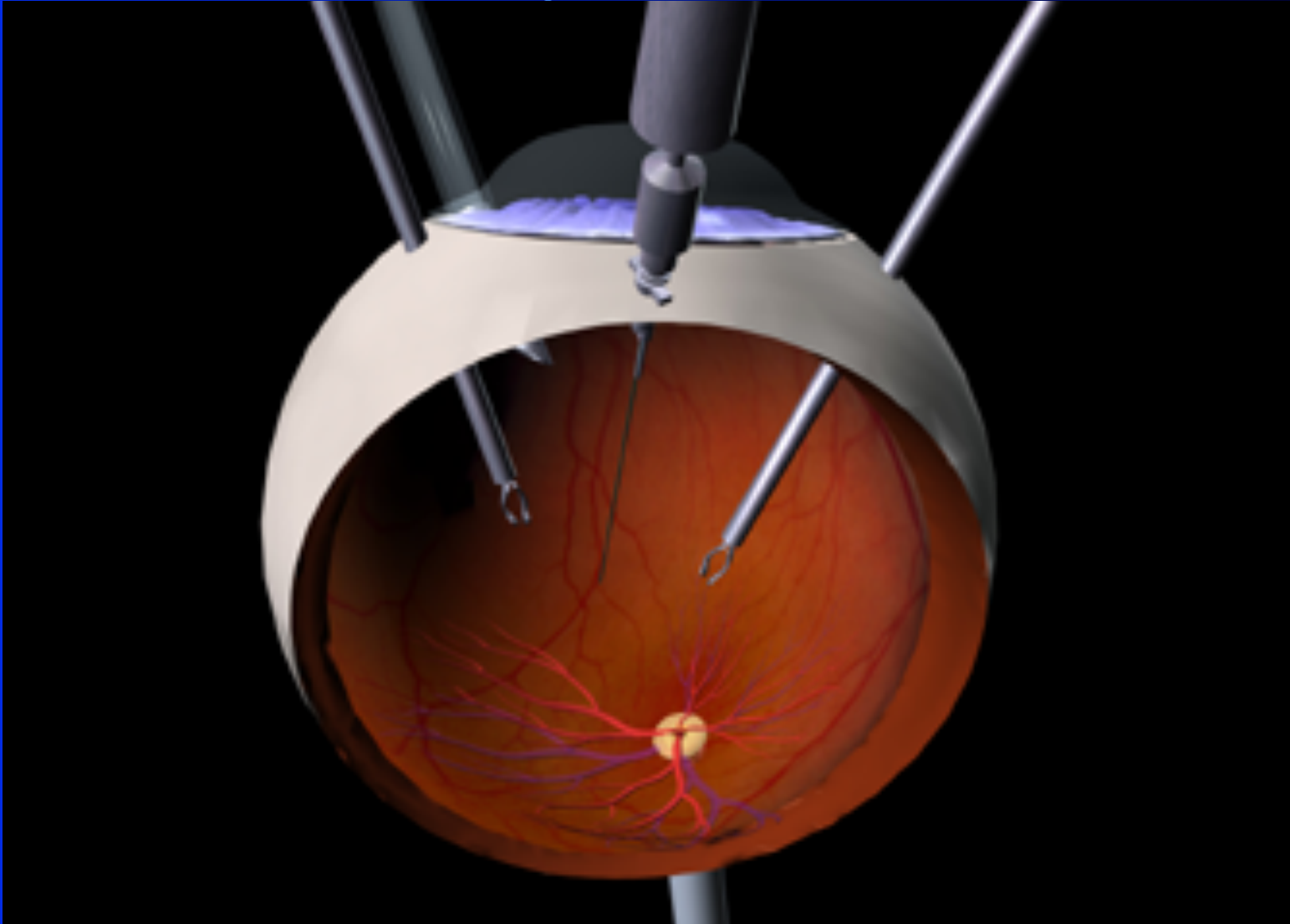
# Retinal Prosthesis Concept



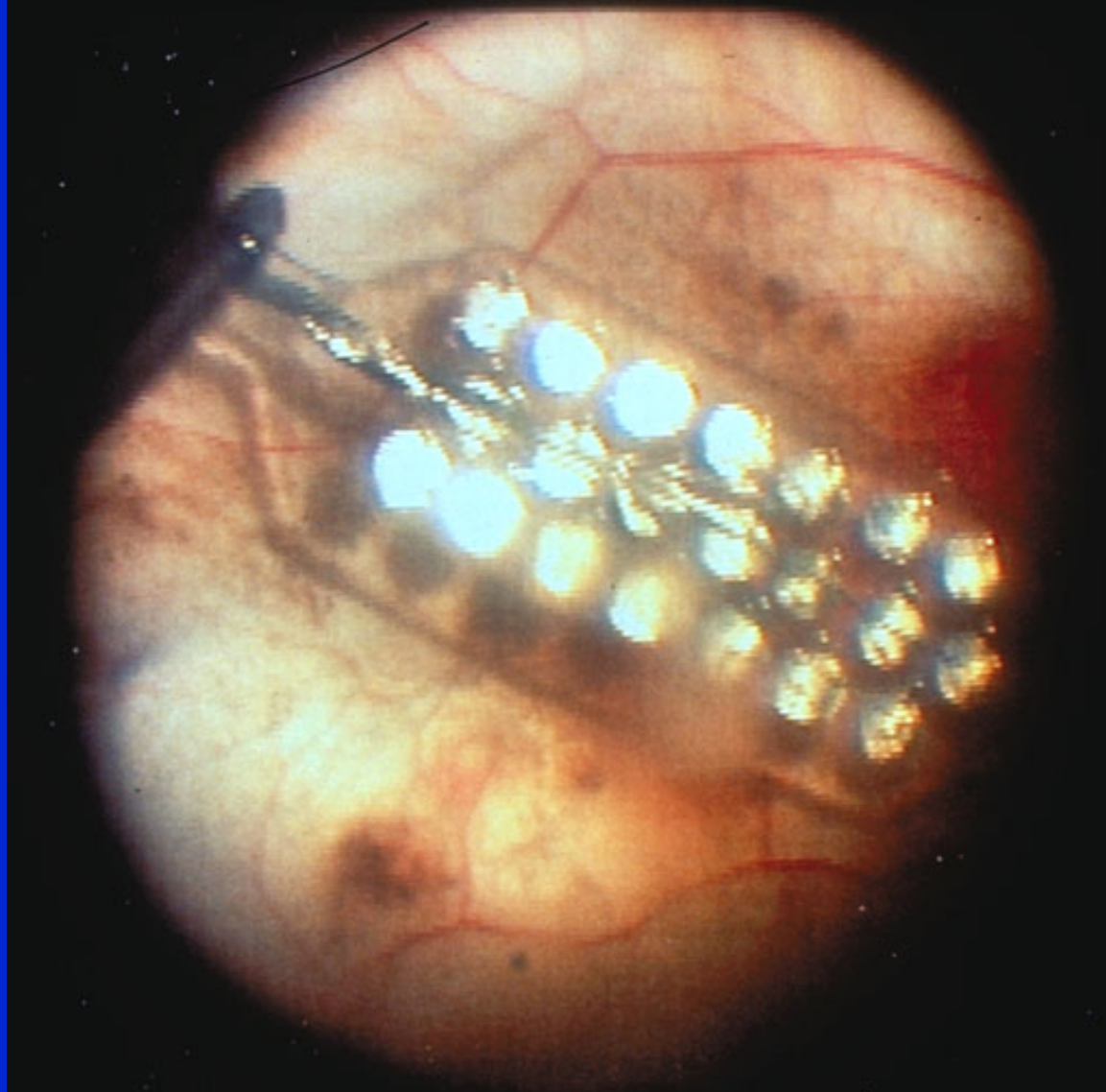
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# Animation of Electrode Insertion



# Twenty-One Electrodes Used in Human Experiments



# Summary of Results in the Human Experiments

Subject	Diagnosis	Preop-Visual Acuity	Percept shape	Percept color	Charge ( $\mu\text{C}$ )
HC	RP	NLP	LETTER	YELLOW-GREEN	0.4
AD	RET -DEGEN	LP	?	?	0.95
CC	RP	NLP	MATCH HEAD	YELLOW	0.16
RS	RP	LP	PIN	YELLOW	3.2
WG	AMD	NLP	PENCIL	WHITE	6.0
PS	RP	LP	PEA	YELLOW	2.8
BC	RP	LP	PIN	YELLOW	1.6
RJ	RP	LP	PIN	YELLOW	1.8
BH	RP	NLP	PIN	WHITE	1.1
AB	AMD	20/400	PIN	WHITE	0.3
CS	RP	LP	PIN	BLUE	2.4
VO	RP	LP	PIN	YELLOW	1.0
HW	RP	LP	PIN	WHITE	1.2
JT	RP	LP	BOX	WHITE	1.4
JL	RP	LP	FIREFLY	WHITE	0.2

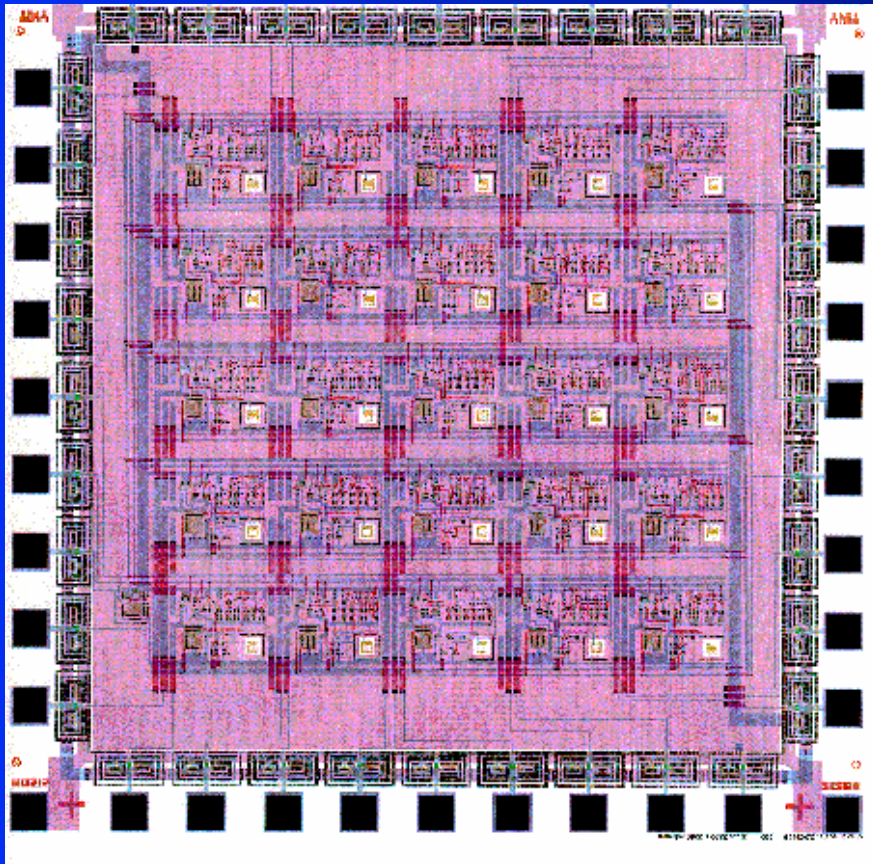


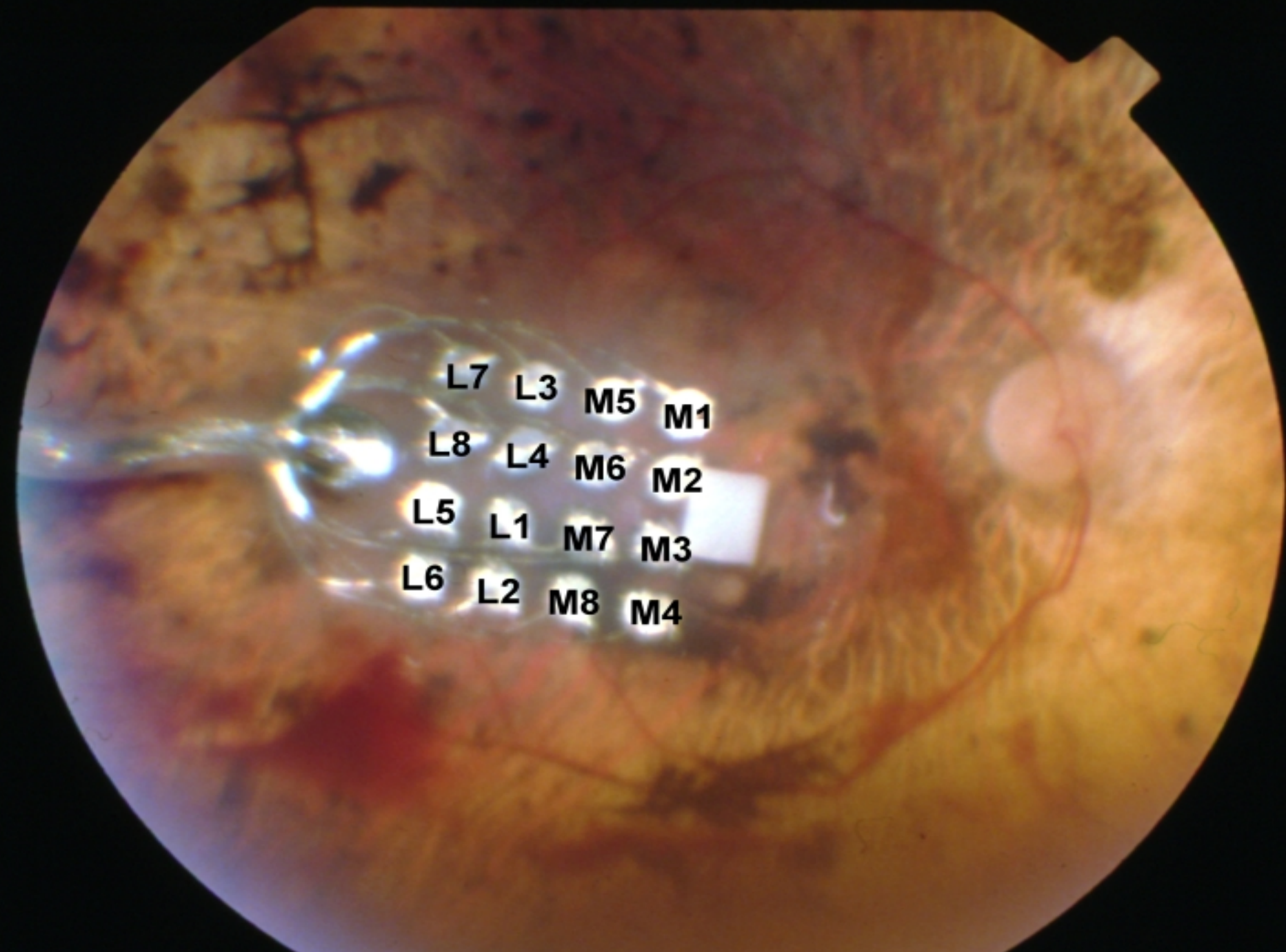


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# Electronic Chip





L7 L3 M5 M1  
L8 L4 M6 M2  
L5 L1 M7 M3  
L6 L2 M8 M4